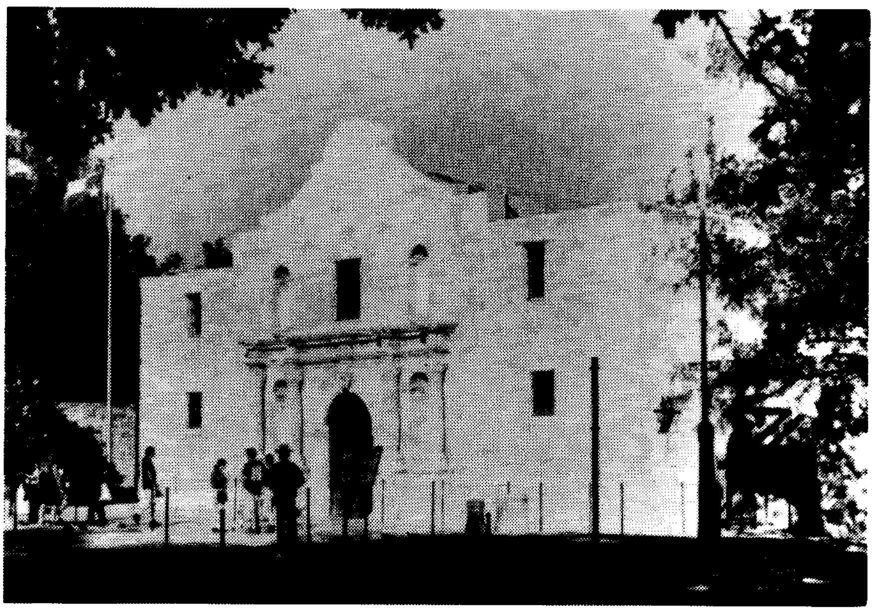
ISECON '98

Information Systems Education - Where Teaching Takes Center Stage



Information Systems Education Conference
San Antonio, Texas
October 15-18, 1998

PROCEEDINGS

I S E C O N ' 9 8

INFORMATION SYSTEMS EDUCATION CONFERENCE

INFORMATION SYSTEMS EDUCATION – WHERE TEACHING TAKES CENTER STAGE

San Antonio, Texas
October 15-18, 1998

Marvin Albin, Editor
Dakota State University

ISECON '98

WELCOME TO ISECON '98

THE FIFTEENTH ANNUAL CONFERENCE FOR IS EDUCATORS

Welcome to San Antonio "Where Computing Takes Center Stage." We are here together as information systems educators to share our ideas and experiences so that we can continue to improve the educational experience of our students. What an exciting time to be in this dynamic field where change is the only constant. In organizing this year's conference we have tried to include different formats and events so that there will be something of value for everyone.

We have 136 authors presenting 51 papers, 12 works in progress, 9 seminars, 4 workshops and 3 panels providing a rich environment from which to choose. A special part of the program is the Distinguished Speaker Forum with six out standing professionals from industry and academe. There is also a track designated for vendors' presentations allowing specific time to view their newest technology and publications.

San Antonio is the ideal convention city. Be sure to enjoy the activities on the Riverwalk and the rich history of the Alamo. Join your colleagues for breakfast on Friday, lunch on Saturday and our Southwest reception on Friday night. Help us make this the biggest and best ISECON ever!

David Feinstein
ISECON '98 Conference Chair

ISECON '98

Welcome to ISECON 1998

Alan Strong
President-Education Foundation

Well the time is finally arriving for the 1998 version of ISECON. At this time I would like to thank the individuals who played a major part in making this conference a success.

First I would like to thank Dr. Jack Russell who went above and beyond the call of duty to insure that both EDSIG and The Education Foundation worked well as a team. Never before have both our organizations been more in sync in our thinking, and more cooperative than this year. Dr Russell made it his goal that we would work together to accomplish common goals, and he succeeded.

One of Dr. Russell's first endeavors was to choose Dr. David Feinstein to assume the responsibilities of putting the ISECON event on successfully. Through Dr. Feinstein's tireless effort, I believe that this will be the beginning of a new era of unification of both our organizations to truly lay the foundation of better ISECON conferences for years to come.

The Education Foundation chose Mr. Al Jones to be in charge of insuring that ISECON remain a financial success, so that the Ed Foundation can continue to fund ISECON for years to come. Mr. Jones has done an outstanding job. He has managed to watch the purse strings and yet maintain a friendly and constructive relationship with EDSIG. We of the Education Foundation are extremely appreciative of his endeavors.

As a representative of the Association of Information Technology Professionals (AITP) we were fortunate to have them send us Mr. Kevin Jetton, their current Executive Vice President. Words enough cannot describe how this one person spends so much time on everything that he does, and still have some time left to pursue his career and devote time to his growing family. He is truly an inspiration to all of us for his continued pursuit of excellence.

Putting on a conference of this magnitude is not an easy endeavor, and requires much more help than the people that I have mentioned above. At the conference, I feel certain that we will go out of our way to personally thank each and everyone of the people behind the scenes, who have helped to make this conference a stepping stone to future endeavors between our collective groups.

ISECON '98
INFORMATION SYSTEMS EDUCATION – WHERE TEACHING TAKES CENTER STAGE

THE PROGRAM COMMITTEE

CONFERENCE CHAIR
Dr. David Feinstein
University of South Alabama
Mobile, Alabama

CONFERENCE CO-CHAIR
Sharon Vest
University of South Alabama
Mobile, Alabama

PROGRAM CHAIR
Dr. Roy Daigle
University of South Alabama
Mobile, Alabama

PROCEEDINGS
Dr. Marvin Albin
Dakota State University
Sioux Falls, South Dakota

FACILITIES
Kathy Ford and Sharon Jones
University of South Alabama
Mobile, Alabama

AWARDS
Mark "Buzz" Hensel
University of Texas
Arlington, Texas

AITP-Foundation for Information Technology Education
Al Strong
Kevin Jetton

VENDORS
Janet Kemp and William Owen
University of South Alabama
Mobile, Alabama

EXHIBITS
Jack Russell
Tarleton State University
Stephenville, Texas

REGISTRATION AND WEB MASTER
Bruce White
Dakota State University
Madison, South Dakota

ISECON '98
INFORMATION SYSTEMS EDUCATION – WHERE TEACHING TAKES CENTER STAGE

PROGRAM CHAIR

Roy Daigle, University of South Alabama

TRACK CHAIRS

Current IS Issues
Ruth Guthrie, University of Redlands

International IS & IS Education
Eli Cohen, Baruch College, GISE

INTERNET Course & Curricula Delivery
Bruce White, Dakota State University

IS Curriculum
William Tastle, Ithaca College
U. Rex Dumdum, Marywood University

IS-Industry
Marino Niccolai, University of South Alabama

Leading Edge/Emerging Technology
Kevin Elder, Angelo State University

Women and Minorities in Computing
R. J. Daigle, University of South Alabama

Workshops/Seminars/Panels/ Works-In-Progress
Michael Doran, Unversity of South Alabama

ISECON '98
INFORMATION SYSTEMS EDUCATION – WHERE TEACHING TAKES CENTER STAGE

REFEREES

Joe Adams, United States Military Academy
Beverly Amer, Northern Arizona University
Neelima Bhatnagar, University of Pittsburgh at Johnstown
Nathan Buchheit, United States Military Academy
Lisa Burnell, Texas Wesleyan University
Netiva Caftori, Northeaster Illinois University
Carol Young Carver, Georgia State University
Doris Duncan, California State University at Hayward
Irv Englander, Bentley College
Tom Farrell, Dakota State University
John Finnegan, Purdue University at South Bend
Jeffrey Griffin, Purdue University at South Bend
Dale Gust, Central Michigan University
Forrest W. Harlow, Angelo State University
Albert Harris, Appalachian State University
Carolyn Harris, Midwestern State University
Martha Harvey, Midwestern State University
Susan Helms, Metropolitan State College of Denver
Don Kalmey, University of Southeast Indiana
Mark (Buzz) Hensel, University of Texas, Arlington
Herman "Hoppy" Hoplin, Syracuse University
Kevin Hufford, Ithaca College
Marcy Kittner, The University of Tampa
Ronald Kizior, Loyola University Chicago
Jeff Landry, Florida State University
H. E. Longenecker, University of South Alabama
Paul Leidig, Grand Valley State University
Susan Lisack, Purdue University
Kathryn O. McCubbin, Christopher Newport University
Jeanine Meyer, Pace University
George Morgan, Southwest Texas State University
Mayur Mehta, Southwest Texas State University
Nilo Niccolai, University of California, Fullerton
James Novitzki, Johns Hopkins University
Pat Olson, University of Redlands
Jo Ann Oravec, University of Wisconsin-Whitewater
William Owen, University of South Alabama
Harold Pardue, University of Minnesota, Duluth
Gary Randolf, Purdue University School of Technology at Anderson
Robert Ryder, University of South Alabama
Donna Schaeffer, University of Redlands
William T. Schiano, Bentley College
Todd Smith, United States Military Academy
Wayne Summers, New Mexico Highlands University
Mike Stachelczyk, University of South Alabama
Mary Sumner, Southern Illinois University at Edwardsville
Ward Testerman, California State Polytechnic University at Pomona
Nancy Thomson, Northwest Missouri State University
Craig Van Lengen, Northern Arizona University
Gerald Wagner, California State Polytechnic University at Pomona
Liang Chee Wee, Luther College
Steve Walczak, University of South Alabama
Garry White, Southwest Texas State University
Pat Woodworth, Ithaca College

ISECON '98
INFORMATION SYSTEMS EDUCATION – WHERE TEACHING TAKES CENTER STAGE

DISTINGUISHED SPEAKERS

Gordon B. Davis, Honeywell Professor of Management Information Systems, Carlson School of Management, University of Minnesota, is one of the principal founders and intellectual architects of the academic field of information systems. In 1968, he and two colleagues began the MIS program and the Management Information Systems Research Center (MISRC) at the University of Minnesota. He has also been ranked as the most important academic pioneer in the subfield of information systems audit and control. Fellow of the ACM, and the DPMA Educator of the Year Award (1992).

Jimmie E. Haines, an experienced and nationally recognized Information Science and Technology professional, is currently serving as a loaned executive to the University of Nebraska at Omaha as an Industry Expert. Mr. Haines has been with the Boeing Company over 44 years serving in technical, professional, management and executive assignments. Mr. Haines also serves the National Science Foundation (NSF) as an industry adviser and is a member of the National Visitor Committee for one of NSF's flagship projects in Information Systems and Technology.

Doris Lidtke, Professor, Department of Computer and Information Sciences, Towson University, is serving as ACM SIG Board Chair. She has numerous publications and over $1,000,000 in grant awards to her credit. Dr. Lidtke's honors include the ACM Distinguished Service Award, IEEE Computer Society Golden Core Member, and the Association for Educational Data Systems' Outstanding Computer Educator Award. She has been a vital member of the Computing Sciences Accreditation Board, serving in the capacities of President, Vice-president, and currently, ACM Representative Director. Currently, Dr. Lidtke is also working on projects on information science accreditation and mutual recognition of computer science accreditation between the European Union and the USA.

Mike Michalski, IT Manager for BELMARK, Inc, established a consulting/software division within BELMARK called "Web-to-Web"TM. Mike has been very active in AITP for over 15 years, serving in the capacities of director for several local chapter committees, vice-president, president and now past-president of the Northeastern Wisconsin Chapter, and chairperson of the National Electronic Communications Committee(ECC),

Blair Stephenson, Principal of MarketLink -Dallas, a marketing consultancy based in Dallas, Texas, is a graduate of the U. S. Air Force Academy and received his Ph. D. in Management and Information Systems from the University of Oklahoma. Formerly, Blair was the Senior Director of Market Analysis and Design for Avon Products, Inc., and the Director of Strategic Market Development for Mary Kay Cosmetics, Inc. During his tenure at Graduate School of Management, Blair was one of the principal architects of the MBA in Information Systems program which has become one of the largest and most successful specialty degree programs at the University of Dallas.

Linda T. Taylor, Certified Computing Professional (CCP) and Quality Analyst (CQA), is president of Taylor and Zeno, Inc., Los Angeles, California. Ms. Taylor has over 30 years of diversified experience in project, administrative, technical, and systems management; and in EDP and quality auditing for various industries. This is in addition to her work in security for systems, data and facilities, configuration management; total quality management for hardware and software; process management and process improvement; systems requirements analysis; communications (LAN) systems; and technical, management and end user training.

ISECON '98
PROCEEDINGS

TABLE OF CONTENTS

Thursday October 15, 1998

8:00 to 10:00 .... Seminar

Using Web Technology to Reduce Administrative Load and Increase Learning Opportunities in Classes 1
Thomas Janicki and Geoffrey Steinberg, Kent State University

8:00 to 10:00 .... Workshop

Understanding TCP/IP: An Introduction for Educators 3
Daniel Farkas, Pace University

10:00 to 12:00 .... Seminars

Workshop on Publishing and Managing Course Information on the Web 4
Chrys de Almeida, St. Francis Xavier University

Creating an Information Systems Educator Friendly Video-teleconferencing Classroom: Planning and Implementation Issues 5
Glenda Anderson and Dennis Jones, Tarleton State University

1:30 - 5:30 .... Seminars

An Introduction to Internet Applications Development 6
Mayur Mehta and George Morgan, Southwest Texas State University

Launching New Academic Programs to Address the IT Labor Shortage 8
Kathy Schwalbe and Nora Braun, Augsburg College

1:30 - 5:30 .... Seminars

Current State of Computer-Based Testing Systems 9
Forrest Harlow, Angelo State University

Creating Simple Multimedia Presentations Using ScreenCam© 10
B. Dawn Medlin and Albert L. Harris, Appalachian State University

1:30 - 5:30 .... Workshops

The Next Generation of Web Publishing 12
Wayne C. Summers, New Mexico Highlands University

Java Scripts: A Pre-Conference Workshop Designed for Educators 13
Narayan Murthy and Stuart A. Varden, Pace University

Friday, October 16, 1998

7:30 – 9:30 .... Featured Speaker

Address by Jimmie E. Haines 15

9:45 - 12:00 .... Paper Presentations

Track 1: Current Issues 1

The Shape of Futurist Things to Come: Critical Perspectives toward Futuristic Approaches 16
Jo Ann Oravec, University of Wisconsin-Whitewater

A Design Methodology for Teaching Event-Driven Languages to Novice Programmers 22
Peter Shackleton, Victoria University of Technology

Towards a Broader Competency-Based IS Education: A Proposed Improvement Package for Analysis of Case Studies 28
U. Rex Dumdum, Marywood University, and William J. Tastle, Ithaca College

Attracting Non-Majors to the IS Department: Challenges and Strategies 34
Irv Englander and William T. Schiano, Bentley College

Critical Success Factors in Large-Scale Integrated Information Systems Projects 40
Mary Sumner, Southern Illinois University at Edwardsville

Track 2: IS Curriculum 1

Student Computer Clubs Fill Curriculum Void and Facilitate Student Careers 42
Gerald E. Wagner, California State Polytechnic University, Pomona, and Doris G. Duncan, California State University, Hayward

Proficiency Exams: An Aid to Student Retention 48
Martha M. Harvey and Carolyn R. Harris, Midwestern State University

Paradigm for a Master's Program in Information Systems Management 51
Ronald J. Kizior, Loyola University of Chicago

Evaluating Understanding in an Information Systems Course 56
Todd L. Smith, Nathan A. Buchheit, Joe Adams, United States Military Academy

Coordinating Multi-Section Courses: Using Multimedia and Intranets as Tools of Gentle Persuasion 61
Susan Helms and Gwynne Larsen, Metropolitan State College of Denver

Track 3: Issues in Computing 1

Why Math and Science? A Rationale for Inclusion in Information Technology Curriculum 63
Marcia Williams, Bellevue Community College

Investigating How Female Computing Students Differ from Other Students – Phase I 69
Carol Chrisman and Thomas P. Schamback, Illinois State University

Retention of Women in the Technological Sciences .... Panel Discussion

Issues Impacting Education and Career Advancement 75
Janet Kemp and Sharon Vest, University of South Alabama, Don Caputo, Robert Morris College, Suzanne E. Gladfelter, Penn State University, Jeanine Meyer and Stuart Varden, Pace University, Ann Gates, University of Texas, El Paso, Magid Igbaria, Claremont Graduate University, and Pam Specht, University of Nebraska

2:00 to 3:00 .... Featured Speaker

Address by Blair Stephenson 78

3:30 to 5:30 .... Paper Presentations

Track 1: IS-Industry 1

"Real Word" Experience for Is Students: Using Non-Profit Organization and Faculty Collaborations 79
Chad Grabow and Denise R. McGinnis, Mesa State College

An Exploratory Analysis of Information Systems Education and Training for Air Force Officers 85
Donald A. Schmidt, Luke Air Force Base and Michael G. Morris, Air Force Institute of Technology

Partnering with ORACLE An Example of an Academic and Industry Partnership 91
Gregory Neal, James N. Morgan, Alden C. Lorents, Northern Arizona University

Promoting Careers in Computing: A Multimedia Approach 97
Sally K. Scott and Carol Chrisman, Illinois State University

Track 2: IS Curriculum 2

Design of a Novel CIS Curriculum for Educating the Information Systems Developers of the 21st Century 103
Andrew L. Wright, S. Srinivasan, and Jian Guan, University of Louisville

Introduction to Computer Course Large Class Size Small Class Atmosphere 109
Beverly E. Amer, William B. Cone, and Craig A. VanLengen, Northern Arizona University

Articulated Programs of Study: A Modular Information Systems Curriculum 112
Paul M. Leidig, Grand Valley State University

The MIS Core Course: Focus on Managerial Needs Not Technology 116
James E. Novitzki, Johns Hopkins University

Track 3: Internet Courses 1

Teaching and Learning MIS Using IS Tools 122
Nancy S. Thomson, Northwest Missouri State University

Using Groupware to Facilitate Group Learning 128
Judy Caouette, Pace University

Benchmarking the Use of the Web for Teaching Information Systems Courses 134
Kregg Aytes, Idaho State University

Enriching the Learning Experience: Creating A Virtual Community 136
Carol Young Carver, Georgia State University

Saturday, October 17, 1998

7:30 – 9:30 .... Featured Speaker

Address by Gordon B. Davis 138

10:00 – 11:00 .... Featured Speaker

Address by Mike Michalski 139

2:00 - 3:15 .... Paper Presentations

Track 1: Professional Issues 1

On-line Distance Learning for Introductory Computing 140
Kris D. Powers, Bradley University

Information Systems-Centric Curriculum (ISCC '98) .... Panel Discussion

.... 142
Jimmie Haines, Boeing Corp., Doris K. Lidtke, Towson University, and Michael C. Mulder, University of Nebraska at Omaha

Track 2: IS Curriculum 3

Incorporating Integrative Learning Experiences in a College-Wide Environment 143
Dale D. Gust, Patrick A. Okonkwo, Central Michigan University

Facilitating Bloom's Level One through Active Learning and Collaboration 149
Roy J. Daigle and Michael V. Doran, University of South Alabama

Building a Bachelor of Science with a Major in Computer Information Systems Based on IS '97 and within the Framework of ACBSP Guidelines 154
John H. Reynolds, Richard W. McCullum, and E. Ray Walden, Jr., Missouri Baptist College

Track 3: IS Curriculum 4

Integrating Real World Case Projects with Traditional Textbook Case Instruction in Systems Analysis and Design 156
Steven Walczak, University of South Alabama

Developing an Electronic Commerce Focus within the IS Curriculum 162
William T. Schiano and Irv Englander, Bentley College

Four Computer Disciplines 168
Garry White, Southwest Texas State University

Track 4: International IS 1

Information Systems Curricula in a Global Environment: The Need for Change 170
Sanjeev Phukan, Bemidji State University

They Wrote the Book: Students Seize Control of an International Information Systems Seminar 176
Elia Chepaitis, Fairfield University

Distance Learning – Courseware Development 181
Netiva Caftori, Northeastern Illinois University

3:45 - 5:30 .... Paper presentations

Track 1 Current Issues 2

A Profile of First Computing Course Students: New Insights and Their Implications for the Curriculum 183
Jeanine Meyer and Stuart A. Varden, Pace University

Improving Communications Skills in IS Majors: An Innovative Method of Teaching Traditional Content 189
Brian D. Janz and Steven M. Zeltmann, University of Memphis

Implementation of the Communication Skills Program in an Upper-level Computer and Information Systems Course at Robert Morris College 194
Charles R. Woratschek, Robert Morris College

Delivery of a K-12 Network Planning and Management Course on a State Wide Basis 200
Tom Farrell, Dakota State University

Track 2: IS Curriculum 5

Teaching Telecommunications in the College of Business 202
Ward Testerman, California State Polytechnic University, Pomona

Experimenting with Teaching Resources in Upper-level MIS Courses: Are They Helping? 205
Liang Chee Wee, Luther College

Computer Networks – A Hands on Approach 209
Wayne C. Summers, New Mexico Highlands University

The Database Course in Information Systems Education: A Microcosm of the Dichotomy of Academic Curriculum and Industry Training 212
William I. Bullers, Jr., University of New Mexico

Track 3: IS Curriculum 6

Too many topics, too little time: Integrating Computer Science Topics in an Undergraduate Intelligent Robotics Course 214
Lisa J. Burnell, Texas Wesleyan University

Introducing Team Programming Projects in a Controlled Lab Setting 220
Susan Lisack, Purdue University

Connecting IS Majors with Small Business: A Case Study 226
John M. Anderson, University of North Carolina at Wilmington

Managing and Maintaining Personal Computers: A Hands-on Class Designed to Build on IS' 97.1 and IS '97.4 231
John H. Reynolds and Cynthia A. Martyn, Missouri Baptist College

6:15 – 7:00 .... Featured Speaker

Address by Doris Lidtke 233

Sunday, October 18, 1998

8:30 – 9:30 .... Featured Speaker

Address by Linda Taylor 234

10:00 – 12:30 .... Paper Presentations

Track 1: Internet Courses 2

A Framework for Planning Distance Education 235
Marcy Kittner, University of Tampa, Craig Van Slyke, Ohio University, and Kenneth Trimmer, University of South Florida

Managing the Paperless Classroom 241
Gerald F. Braun and Elaine Crable, Xavier University

Web-based Support for Cooperative Learning Teams: Report and Results from a National Science Foundation Grant Project 246
Catherine M. Beise, Merle King, Martha E. Myers, and Diane L. Willey, Kennesaw State University

Using Web Technology to Reduce Administrative Load and Increase Learning Opportunities in Classes 251
Thomas Janicki and Geoffrey Steinberg, Kent State University

The K-12 Web – Using Student Consultants to Teach the Teachers 253
Ronald W. Chorba, Clarkson University

Track 2: IS Curriculum 7

Incorporating Visual Design into Programming Courses: A Beginning 258
Jeffrey A. Griffin and John Campbell Finnegan, Purdue University

Curricular Infrastructure for Internet-Based Applications Development 262
Mayur Mehta and George Morgan, Southwest Texas State University

Using a Teaching Lab Classroom for Active Learning 268
Albert L. Harris and Jacqueline M. Harris, Appalachian State University

Teaching Systems Analysis and Design: A One-Semester Course 272
Neelima Bhatnagar, University of Pittsburgh at Johnstown

Engineering a Better Software Organization 277
Dan Shoemaker and Gregory Ulferts, University of Detroit Mercy

Track 3: Leading Edge 1

Case Study of a Collaborative IT Project: Siemens' Production Computer Information System (ProCIS) 283
Kathryn O. McCubbin and Steve Allen, Christopher Newport University

Constructing Multimedia: Interdisciplinary Collaboration in Cyberspace 288
Christiana Birchak and Herbert Rebhun, University of Houston-Downtown

Factors Associated with Adoption and Use of Technology in Instruction 292
Mary Sumner and Dennis Hostetler, Southern Illinois University at Edwardsville

Emerging IT Issues and Fast-Cycle Curriculum Development 296
Janis L. Gogan, Bentley College

Author, Presenter, and Panelist Index 302

USING WEB TECHNOLOGY TO REDUCE ADMINISTRATIVE LOAD AND INCREASE LEARNING OPPORTUNITIES IN CLASSES

Thomas Janicki & Geoffrey Steinberg
Kent State University, School of Business Administration, Kent OH 44242

INTRODUCTION

The administrative management of classes may comprise a significant portion of an instructor's workweek. The time required for syllabus development, maintaining a current syllabus, grading, posting of grades, creation of homework, tests, and projects, as well as repetitive communications with students may use all available work-time in a week. Potentially this leaves minimal time for the development of new and creative lesson plans. Technology has reduced the time required for repetitive activities in businesses. Information technology may also be used to reduce the repetitive activities for instructors.

Several of the time consuming activities that comprise a significant portion of an instructor's work-week are: 1) grading of projects, homework, and exams; 2) the time to maintain a grade book or roster, and the communication of these grades to students; 3) providing individual feedback on exams; 4) maintaining up to date information on the class syllabus; and 5) communicating changes in requirements for the course to the students.

Creative uses of information technology, can help improve learning. Alavi [1994] reports that no single or unified learning theory exists, but three attributes of effective learning processes can be readily identified. They include active learning and construction of knowledge, cooperation and teamwork in learning, and learning via problem solving. She concludes that Computer Based Technologies (CBT) technologies can enhance all three of these learning keys.

This working paper will discuss the development and implementation of a web based integrated learning and evaluation system that reduces the administrative time for an instructor. In addition, this web-based system has components to enhance learning options for the students. These components are increased evaluation opportunities, increased and rapid feedback, and tutorial modules.

INTEGRATED WEB BASED SYSTEM

The integrated system has two basic focuses. The first is to reduce the chore of maintaining a gradebook, syllabus, and appropriate communications in a class. The second focus is to increase the learning opportunities available to students through increased homeworks, projects, on-line tutorials, and on-line tests that provide increased feedback and evaluations.

The system assumes that the instructor has no knowledge of HTML (HyperText Markup Language), as it has been developed to be menu driven. A class can be thought of one directory on a computer, It contains the information for the syllabus, homeworks, tests, and grades for all students in one unified area. Updates to the syllabus for additional projects or a change in the weight factor of an assignment or test will be reflected immediately on the individual student grade rosters.

Status Report
View Syllabus
Quiz List
Study Guide
Assignment List
Submit Assignments
Graded Assignments
Handouts
Change Personal Data
@email Dr. Steinberg
Close

Figure 1 -Sample options available to a student

ADMINISTRATIVE FEATURES

1. On-line development of a course, from syllabus to handouts, to homeworks, to projects
2. On-line development of tests and exams
3. On-line testing and automated grading, providing comprehensive feedback to the instructor and student
4. Automatic gradebook maintenance
5. On-line individual student progress reports and grade projections
6. Automatic grading of homeworks and projects in a wide variety of common file formats
7. On-line class communications via e-mail, web pages, and live web-based group discussions
8. Comprehensive security system for the instructor and student.

<u>Syllabus Development</u>

A course begins with the development of a syllabus. User friendly screens prompt the instructor for the basic elements of a syllabus. These include office hours, textbooks, basic course requirements, grading scale, etc. Once these basic elements are entered the HTML is generated for the instructor. Included in the development of the syllabus is a list of items that will be required from the student, included are such items as homeworks, quizzes, exams, projects, and extra credit opportunities. As each of these items are added to the course requirements, the instructor will be prompted for grading options, such as percentage of grade, pass/fail, minimal passing, or drop the lowest grade. Figure 2 demonstrates a sample input screen for a graded item.

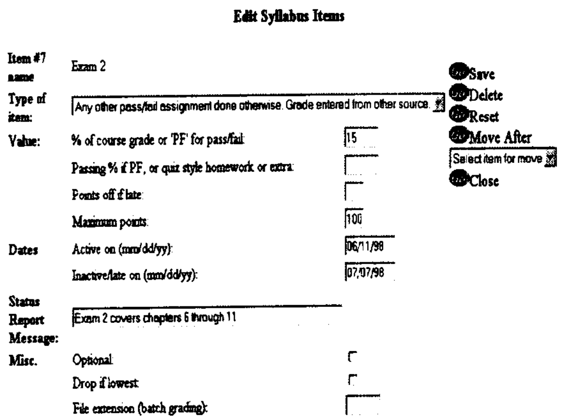


Figure 2 - Adding an item to the Gradebook

On-Line Test Development:

Creation of on-line exams is a simple task. Exams or quizzes can be comprised of multiple choice, true/false, or short answer questions. For the short answer questions, the system looks for certain key words to be in the response of the student. Exams can also be imported from word documents or other popular software packages, or built on-line via a web page as shown in Figure 3.

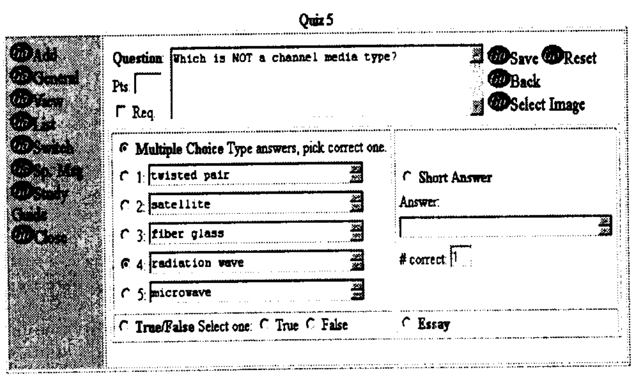


Figure 3 - Creating a question for an exam

Automated Homework Grading:

A feature of the system is to automatically grade homework assignments for Microsoft Office Products. The program can check Access, Excel, PowerPoint, or Word files for certain key attributes. In addition it can check HTML documents and other popular file formats. Each assignment is evaluated and if 'Passed' the gradebook is updated. If the assignment has not been passed, the student is given comments and feedback.

STUDENT FEATURES

1. Personal course status report
2. On-line exams with feedback for every exam and every question
3. On-line study guides with practice exam questions
4. On-line tutorial and comprehensive quizzes
5. Electronic submission of homework from labs, dorm rooms, or home with immediate feedback.

Individual Status Report

An impressive part of the system is the on-line grade roster an individual student receives. They can obtain an up-to-date summary of their progress from any web location once they enter a password. Not only do they see their progress to date, but also comments on homeworks not completed, due dates, and their answers to on-line quizzes. This reduces the number of phone calls and grade corrections at the end of the semester.

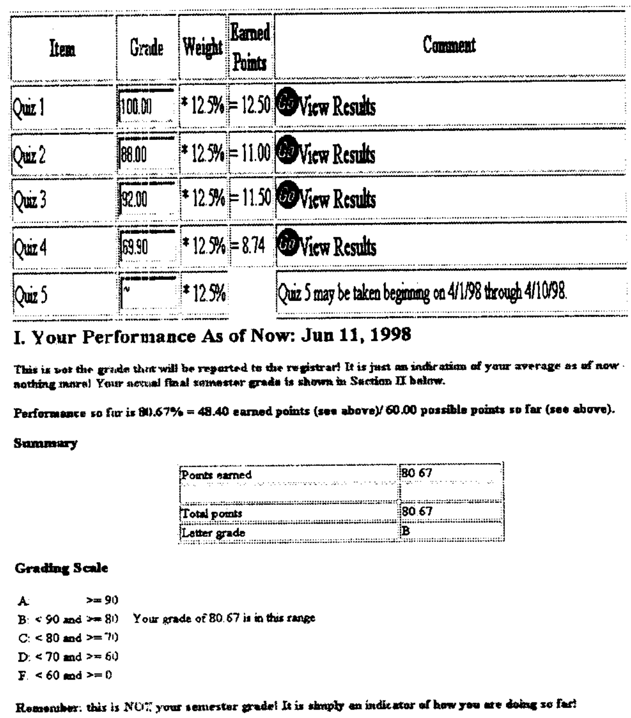


Figure 4 - Sample portions of a student status report

On-Line Tutorials

Course tutorials may be built, for student re-enforcement. Tutorials may be either for material not covered in the classroom or as additional problem solving activities. In addition, sample quizzes may be created to permit the student to gain confidence and feedback before taking an actual graded exam.

REFERENCE

Alavi, M. Computer mediated collaborative learning, an empirical evaluation, *MIS Quarterly*, **18 2**, June 1994, 159-174.

For more information contact: gsteinbe@bsa3.kent.edu or tjanicki@bsa3.kent.edu.

Understanding TCP/IP: An Introduction for Educators

Daniel Farkas
Chair, IS Department, Westchester
Pace University
Bedford Road
Pleasantville, NY 10536
Email:farkas@pace.edu

Description: As electronic commerce, distance education and Internet applications for research, entertainment and communication continue to grow, it becomes important to understand the underlying mechanism which makes it possible. TCP/IP is the protocol suite that provides the infrastructure for the Internet and World Wide Web. This half-day workshop will provide an opportunity for Information Systems professionals and educators to get an understanding of the basic TCP/IP protocols (IP, TCP, UDP) and applications. The seminar will cover Internet addressing, routing and client/server interaction. Internet applications such as ftp, telnet, NFS and the World Wide Web will be presented. The seminar will conclude with a discussion of future trends.

Target Audience: Information Systems educators and professionals.

Presenter: Daniel Farkas has been teaching in the Information Systems department at Pace University for 21 years. He is the author of UNIX for Programmers: an Introduction (John Wiley and Sons, 1988). He has been lecturing on UNIX and telecommunications to major corporations since 1984 and currently delivers 5-day seminars on UNIX, UNIX System Administration, and Unix Networking and Administration.

Topical Outline:

I. Introduction
   A. Data Communications Overview
   B. History of the Internet

II. Basic TCP/IP Protocols
   A. Internet Protocol (IP)
   B. Transmission Control Protocol (TCP)

III. Internet Addressing, Routing and the Domain Name System

IV. Internet Applications
   A. ftp, telnet
   B. NFS, WWW

V. Conclusion: Future Trends, Discussion

Workshop on Publishing and Managing Course Information on the Web

Chrys de Almeida
Department of Information Systems
St. Francis Xavier University
Nova Scotia, Canada

Target Audience:

Those who intend to use the Web for course delivery and management.

Objectives:

- Learn the fundamentals of publishing in the web
- Learn about the tools and techniques for creating web pages
- Learn how to effectively structure and organize information on the web
- Learn about the potential and possibilities of using the Web for course delivery and management

Topical Outline:

1. Why invest on maintaining course information on the Web
2. Determining what content to have on the Web
3. Overview of the Web environment and architecture
4. Essentials of Web authoring and publishing
5. Elements of good design and organizing the content
6. Creating and publishing documents on the Web
7. Managing and maintaining the integrity of documents
8. Advanced applications
9. Issues and concerns

Planned Activities:

- Slide show using PowerPoint
- Demonstration of creating web pages using Netscape Composer

Background of Presenter:

Dr. Chrys de Almeida is an Assistant Professor in Information Systems at St. Francis Xavier University in Nova Scotia, Canada. He obtained his Ph.D. in Decision and Information Sciences and M.B.A. from the University of Florida, and B.Sc. Engineering in Electronics and Telecommunications from the University of Moratuwa, Sri Lanka. He has extensive experience in the broadcasting industry as an engineer and a senior manager. He current interests are emerging technologies and applications including the Internet, intranets, multimedia, and electronic commerce, and the convergence of information and communications technologies.

Resources Needed:

Desktop Computer coupled to an Overhead Projection System
Microsoft Office 97/PowerPoint 97
Netscape Communicator/Navigator/Composer 4.04

Creating an Information Systems Educator Friendly Video-teleconferencing Classroom: Planning and Implementation Issues

Glenda Anderson
Dennis Jones
Tarleton State University

Target Audience

1. Individuals interested in the planning and design of video teleconferencing classrooms.
2. Educators that re interested in teaching via video teleconferencing.

Goals

1. Provide participants with an overview of the planning and design process for establishing video teleconferencing classrooms.
2. Provide participants with an introduction to teaching via video teleconferencing technology.

Planned activities

1. Introduction of presenters and participants
2. Overview of Distance Education Efforts
3. Impact of Distance Education on the Teaching and Learning Process
4. Creating an Environment that Supports Teaching and Learning
   - Room
   - Equipment
   - Instructional Support
5. Creating a Video-teleconferencing Classroom that Supports Teaching and Learning
   - Room
   - Equipment
   - Instructional Support
6. Conclusion

Background of Presenters

Dennis Jones is an Assistant Professor on the Computer Information Systems faculty within the Department of Business Systems at Tarleton State University. Mr. Jones also works as an Instructional Technology Associate in the University's Center for Instructional Technology and Distance Learning. He has experience teaching graduate level CIS courses via video teleconferencing and will be teaching an on-line course during Spring 1999. Additionally, Mr. Jones provides training for faculty developing both video teleconferencing and on-line courses. Finally, Mr. Jones is a doctoral candidate at Texas A&M-Commerce.

An Introduction to Internet Applications Development

Mayur Mehta, Southwest Texas State University, San Marcos, Texas
George Morgan, Southwest Texas State University, San Marcos, Texas

Abstract

In recent years, the Internet, WWW, and Intranets have become very powerful tools for disseminating information. In fact, they have, become an essential set of tools for a modern business. These technologies have empowered businesses to migrate to non-traditional methods of conducting business, including cyber-marketing and electronic commerce. The Internet, Intranets and WWW hold the key to increasing an organization's strategic competitiveness via improved communications and may possibly change the way business information processing applications are designed, developed and deployed. It is, therefore, imperative that students of information systems acquire a good understanding of the concepts for design of IS applications for deployment in the Internet/Intranet environment. More importantly, they should acquire at least an introductory skills set in the use of development tools if they want to succeed in a full-scale Internet-based applications development environment.

This tutorial is designed to introduce novice participants to technologies available for setting up and administering business information processing applications on the Internet, WWW and Intranets. The tutorial will demonstrate how IS faculty may incorporate the use of these development tools in mainstream CIS curriculum.

Introduction[a]

In recent years, perhaps the greatest impact of the changing computing environment is the Internet. There has been a dramatic increase in the use of the World Wide Web (WWW). The number of Internet/WWW users are estimated at anywhere from 8 to 10 million (16,17). The number of Web servers in use has correspondingly increased from 130 to about 120,000 in just over three years (11,16,17). A large number of these web servers are used to conduct day-to-day business and are administered by their respective corporations. These third-generation web sites are much more than just information stores for hyperlinked documents. These web sites are actually being used to conduct commercial transactions. Companies like Dell Computers, Federal Express, UPS, and American Airlines have harnessed the power of the Internet to conduct significant amounts of their business on the Internet. In recent years, Dell Computers has earned revenues of $3 million a day from business transactions conducted over the Internet.

As can be ascertained from the previous discussion, the primary impact of this changing computing environment has been a gradual shift from host-based processing to client-server and now to the more distributed environments of Internet/Intranet computing. In most cases, this second-generation "Paradigm Shift" has forced developers to turn to alternative ways to develop and deploy information systems utilizing methodologies and tools that are better suited for the distributed, inter-organization and object-oriented computing environment.

Developers must gain proficiency in a different set of tools as an increasing number of IS applications migrate to the distributed computing environment of the Internet and Intranets. They will need tools that are substantially more powerful than standard HTML text editors and web-design tools such as Microsoft FrontPage. While these tools are sufficient for a corporation to create web presence, IT professionals will come to rely on powerful visual tools. They will need to work with tools, such as Microsoft's Visual InterDev and Borland's JBuilder, that are based on Java and Java-like object oriented programming languages as they move into the world of "real" Internet programming and electronic commerce.

It is, therefore, imperative that students of information systems acquire a good understanding of the concepts for design of IS applications for deployment in the Internet environment. More importantly, students should acquire at least an introductory skills set in the use of development tools if they want to succeed in a full-scale Internet-based applications development environment.

[a] The authors would like to refer readers to unpublished material "Curricular Infrastructure for Internet-Based Applications Development" accepted for ISECON 98 as part one of this tutorial.

The proposed tutorial will introduce novice participants to a systematic process of building a robust Internet - based application. The tutorial will demonstrate the entire process, including the design, implementation, and deployment of an application using Visual InterDev and Visual Basic by way of a simple case study. This tutorial will strive to achieve the following objectives:

1. Provide novice participants an understanding of the Internet-based application development process.
2. Introduce the participant to the features in Visual InterDev and Visual Basic that permit building and deploying an Internet-based application.
3. Demonstrate the use of these visual tools in developing an Internet-enabled application.
4. Introduce participants to the use of CGI, Java, and VbScript to create applets for business information processing.
5. Demonstrate how Visual InterDev and Visual Basic may be successfully incorporated into the CIS curriculum to teach distributed processing and Client-Server concepts in the Internet/Intranet computing environment.

A resource scheduling application will be created during the session to demonstrate the use of visual tools in developing Internet-based business information processing application. The session will follow the topical outline shown below.

An Introduction to Internet Applications Development Environment

1. Planning Applications for the WWW and Intranets
   1.1. Fundamentals of creating Web Documents
   1.2. Components of web documents: Text, Graphics, Animation, Multimedia - Audio and Video
   1.3. Designing and Creating web documents using Microsoft InterDev and Visual Basic
2. Designing User Interface Screens
   2.1. Developing user interface Screen using Microsoft InterDev
   2.2. Building user interface screens using Microsoft InterDev
   2.3. Introduction to web forms
3. Building and Providing Connections to Web Database
   3.1. Database locations
   3.2. Selecting database connection
   3.3. Database access methods
   3.4. Programming Database Connection using VbScript
4. Programming the Applications
   4.1. Linking web documents/screens
   4.2. Using Java and VB scripts to create applets for business processing.
   4.3. ActiveX Servers (OLE Automation objects and Remote OLE Automation Servers)
      4.3.1. Building ActiveX (OLE Automation) Servers
      4.3.2. Using ActiveX (OLE Automation) servers
      4.3.3. Application Process Partitioning
   4.4. Programming Web forms for data capture (using VbScript, Java, CGI)
   4.5. Designing Reports for Web Display
      4.5.1. Report layout for display in web browser
      4.5.2. setting up queries and Preparing reports
5. Packaging the application for Internet/Intranet Deployment
6. Additional Features
   6.1. Use of Multimedia Technologies

Launching New Academic Programs to Address the IT Labor Shortage

Kathy Schwalbe, Ph.D., Assistant Professor and MIS Area Coordinator and
Nora Braun, Assistant Professor Business/MIS
Augsburg College, Minneapolis, MN

Target Audience

Faculty, administrators, and industry representatives who have created or are interested in offering new programs in IT education.

Workshop Goals

The main goal of this workshop is to share information on what colleges/universities are doing or would like to do to provide more programs in IT education. Everyone knows the number of traditional computer science graduates has decreased while the demand for IT professionals continues to increase. It's not easy starting any new academic program in colleges/universities, and the labor shortage in IT applies to finding qualified faculty, also. In this workshop we would like to share our experiences at Augsburg College with our MIS programs and especially the new Information Technology Certificate program. We'll share some of the typical problems of dealing with the politics, incentives, staffing, curriculum development, etc. in starting a new program. We'd also plan for participants to share their experiences and advice.

Topical Outline

1) Brief background information on
   a) the IT labor shortage and groups addressing the issue
   b) traditional 4-year programs and master's degrees in computer science, MIS, and related disciplines
   c) other programs in academia and the commercial sector
2) Starting the IT Certificate Program at Augsburg or any other academic institution
   a) Administrative push to increase enrollments, demand pull from IT industry and potential students
   b) Curriculum for Augsburg's new program (started in January 1997)
   c) Academic resistance to new ideas and perceived "technical" focus of IT programs
   d) Industry's unfamiliarity with non-traditional academic programs
   e) Difference between academic programs and "training" programs
   f) Understanding and dealing with the politics on campus
   g) Providing incentives to start and manage a new program
   h) Staffing a new program
   i) Student response to the new program and adjustments made in the second year
   j) Issues
3) Future contacts/resources related to this topic

Planned Activities

1) Brief introduction of speakers and workshop participants
2) Brief "presentation" using handouts and computer projection or overheads (whichever is available – we'll bring laptop and overheads)
3) Discussion on key topics mentioned above (small group, large group, depending on number of participants)
4) Participant inputs on topic (collect written information, summarize later via the Web)

Background of Presenters

Kathy Schwalbe entered academia in 1991 and has been the MIS area coordinator for the past three years. She also led the development of the IT Certificate program. Prior to entering academia, Kathy was an Air Force officer at Electronic Systems Division, an engineer and IT consultant at McDonnell Aircraft Company, and an independent IT consultant. Kathy has a B.S. in mathematics from Notre Dame, an MBA in high technology management from Northeastern University, and a Ph.D. in Educational Policy and Administration from the University of Minnesota.

Nora Braun entered academia in 1997 as an Asst. Professor in Business/MIS at Augsburg College. Prior to that she worked at National Car Rental for 18 years in a variety of IT-related positions. Her main interests are in business process reengineering and change management. Nora has a BSBA in accounting from the University of Missouri – Columbia and an MBA with a concentration in MIS from the University of Minnesota.

Current State of Computer-Based Testing Systems

Forrest Harlow, Angelo State University

Target Audience: Instructors interested in computer-based testing, tutoring, and class administration systems.

Goals: Discuss available CBT options; demonstrate IS applications of SBATT and CATTS, two computerized tutoring/testing systems written by the presenter.

Topical Outline:

- Brief Overview of the current state of computer-based testing systems
    - Old: SneakerNet
    - Middle-Aged: LAN
    - Young: Intranet/Internet WWW
- Systems by function
    - Traditional mc/fib/tf systems
    - Macro-driven xls systems for complex quantitative problems
        - Static inputs
        - "Self-mutating" inputs
- Using CATTS: A Simple, Robust, Freeware System
    - Creating test files
    - Logging student performance records
- Using SBATT: A "Quant-Problem" Freeware System
    - Capabilities
    - Creating files
    - Integrating performance records with CATTS
- Web-Based Testing/Class Management Systems
    - MedWeb
    - Anlon Systems

Planned Activities:

Discuss and demonstrate several types of computer-based testing (cbt) and class administration systems. Demonstrate how to use two freeware systems.

Background of the Presenter:

Professor of Finance at Angelo State University; Ph.D. UNT 1976; CPA.
Received 1990 Educom/Ncriptal "Distinguished Software in Accounting" award for a financial simulation program called IFSS.
Software Published:
  Interactive Financial Simulation System (IFSS) ISBN 0-538-82284-8, South-western, 1992.
  Interactive Banking Simulation (IBS) ISBN 0-538-82679-7, South-western, 1992.
Books:
  A Field Guide to Lotus 1-2-3 v 2.4, ISBN 0-877-09812-3, Boyd&Fraser, 1994.
  A Field Guide to Lotus 1-2-3 v 4 for Windows, ISBN 0-877-09863-8, Boyd&Fraser, 1995.
  A Field Guide to Lotus 1-2-3 v5 for Windows, ISBN 0-7895-0034-5, Boyd&Fraser, 1995.

The books included the presenter's automated tutoring system as an on-disk supplement.

SEMINAR:
Creating Simple Multimedia Presentations Using ScreenCam©

B. Dawn Medlin
Albert L. Harris
Department of Information Technology & Operations Management, Appalachian State University, Boone, NC 28608

Introduction

The basic idea behind computer-aided learning is to employ technologies that will provide the professor with enhanced teaching options and offer students increased learning options. More specifically, in the case of instructors, this means greater opportunities to develop and offer a different teaching approach, and for students it offers a means to exercise greater control over the timing, pacing, and sequencing of their own learning. This approach also allows the student to close any gaps in his/her understanding of the material, and to do it in a way that is not humiliating.

Early multimedia products were hard to learn, hard to develop effective presentations with, and hard to use due to the types of equipment needed in the classroom. ScreenCam© is an emerging software product that seems to overcome some of those obstacles. Using ScreenCam©, a professor can develop a multimedia presentation with relative ease. Minimal equipment (computer with sound card, speakers, and a projector) is needed to view the presentation in a classroom. Presentations can be stored on the Web or on an Intranet and can be made available 24 hours a day, 7 days a week. Using this type of technology, the student interacts with the program, making them an active participant in their own learning process.

Multimedia as a Pedagogical Methodology

Compared with students enrolled in conventionally taught courses, students who are provided regular access to well-crafted computer-aided instructional (CAI) materials generally:

- Achieve higher scores on summary examinations (improved learner effectiveness)
- Learn their lessons in less time (increased learner efficiency)
- Like their classes more (greater learner engagement), and
- Develop more positive attitudes toward the discipline under inquiry.

These results hold true for a broad range of students studying across a broad range of disciplines. The findings also are true for students who vary greatly in terms of their prior knowledge, educational experiences, and preferences for particular types of instructional assistance and English language proficiency. The empirical data substantiating these findings can be found in a steady stream of studies published since 1990. The experimental data has been subjected to a range of meta-analytic techniques, specifically designed to enable researchers to contrast and compare research findings across a breadth of instructional environments, implementation models and evaluation methods. In other words, substantial evidence supports the use of multimedia as a pedagogical methodology to enrich classroom presentations.

Despite the effectiveness of computer-aided instruction, software packages that promote this type of interactive instruction are rarely used in mainstream college teaching. Chalk and talk continues to prevail as the predominant teaching method even though it has been shown that multimedia technologies can be viewed as a means to engage the full range of human senses in the learning process. Not even the National Research Council's periodic pleas that greater use be made of technology to meet the learning assistance needs of an increasingly diverse student population, has succeeded in reducing higher education's reliance upon conventional teaching methods. This outcome is not surprising since few instructional development efforts were intended to stimulate transformative thinking on the part of instructors and their students regarding the nature and character of technology-aided teaching and learning.

Any number of possible explanations could account for these nonsystematic efforts.

- First, higher education does not properly reward faculty who are interested in developing comprehensive, instructionally effective technology driven instructional materials.
- Second, the development of computer-aided materials corresponding to a broad range of topics and lessons within a single disciplinary area is technologically and organizationally complex, and, therefore, is beyond the expertise and experiences of most faculty.

- Third, professors need development software and state-of-the-art computer equipment to develop presentations. In addition, professors need classrooms with a computer and projection equipment to show the presentations. But individual colleges and universities cannot afford to shoulder the financial burdens to provide the enabling technologies necessary to support the development and classroom use of instructionally effective computer-aided materials.
- Fourth, state and federal agencies are uninterested in providing large amounts of financial support for efforts intended to transmute promising research results into everyday instructional practices.
- Fifth, it is easier to use traditional teaching environments than to reconceptualize the entire teaching and learning enterprise for a relatively small amount of curriculum materials.
- Sixth, textbook publishers, higher education's traditional supplier of instructional materials have yet to come up with a viable economic model for commercializing the distribution of computer-aided materials.

The chasm between the promise and potential of computer-aided instruction will continue to remain immense as long as nothing is done to radically alter the conditions and circumstances that currently typify campus-based efforts to design, develop and implement computer-aided materials.

ScreenCam© as a Development Tool

The objective of this seminar is to introduce ScreenCam© as an easy and simple way to share information and enrich classroom presentations through the creation, viewing, and sharing of PC movies. The advantages of ScreenCam© technology serve three different populations on a university or college campus:

1. Administrators like it because the course material can actually be taught on a computer without need of an instructor;
2. Faculty like it because once they have created it, they can use it for multiple sections; and
3. Students like it because it is easy to access and they can use it to review the material for class or for a test.

ScreenCam© can literately turn a PC into a VCR that records every click, scroll, and action on the screen. Text, captions, subtitles, and the sound of your voice can also be added. Students and colleagues benefit from your technology development and creativity by you being able to quickly share your PC Movies with them through the Internet, the Web, or by e-mail. Students can play and replay presentations, allowing them plenty of time to understand and grasp the importance of a subject. Thumbnails also can be generated as part of a presentation, making it easy to determine the presentation's content. One of ScreenCam's© many benefits is that you do not have to be a PC expert or a professional movie producer to create interesting and informational presentations.

If students do not have sound cards, for instance in the lab, subtitles or captions can be used to describe what is happening on the screen. They (subtitles and captions) also can be used to re-emphasize a point. Editing, modifying, and improving is simple to do in ScreenCam© through basic editing commands.

Distribution of presentations is easy by using the Web, Intranet or email. The audience does not have to have ScreenCam© installed to view a presentation. ScreenCam© presentations can be saved in Microsoft's .avi format and used in other applications, such as Word documents or PowerPoint presentations.

ScreenCam© can also be used to produce tutorials for students to use in a lab setting. This is especially useful for remedial topics, where the professor does not want to spend classroom time. In a tutorial, students can, at their own pace, view presentations of remedial topics, of topics the professor covered in class, or of a topic that is to be presented in a future class. Another advantage is that ScreenCam© also allows for faculty to share with their colleagues class tutorials, presentations, workshops, or demonstrations. Additionally, it allows questions to be answered through possibly a review of the material on the computer rather than the involvement of the student having to see their professor. Classroom time then could be spent on different and possibly more important issues.

Seminar Content

This seminar will introduce educators to the use of ScreenCam©. Presenters will demonstrate the use of ScreenCam©, a software package that incorporates text, graphics, sound and animation. Also included will be the use of subtitles and captions in multimedia presentations so they can be used by students that do not have sound cards on their PCs (such as in a lab). Basic editing commands that allow presentations to be modified and improved will also be demonstrated. Finally, distribution techniques for finished movies will also be discussed.

The Next Generation of Web Publishing

Dr. Wayne C. Summers
Computer Science and MIS Departments
New Mexico Highlands University
Las Vegas, New Mexico 87701
E-mail: wsummers@nmhu.edu

DHTML, CSS, XML, Perl, JavaScript, CGI, Applets!?!?!?! What does all of this mean? Web publishing has changed tremendously over the last year. Where in the past, we were concerned about HTML and getting the tags correct, there are now word processors and other WYSIWG software like Microsoft FrontPage that take the drudgery out of HTML coding. We now need to look at the next generation of web publishing, which includes using web publishing extensions like dynamic HTML (DHTML) and new languages like Extensible Markup Language (XML). This workshop will provide hands-on experience in extending web documents. Attendees will be expected to be familiar with web pages and HTML.

Home pages have traditionally been written in HTML - HyperText Markup Language. The language is written in plain text and can be written using any editor or word processor and saved as an ASCII file. To enhance the text and provide links to other documents and graphics, the developer includes tags that identify the way the text will look and directions for branching to other documents. These tags can be entered simply along with the text or can be inserted automatically if the developer uses an HTML designer.

This workshop will begin by reviewing HTML to ensure that everyone is comfortable with the standard HTML features and tags including lists and tables. The workshop will then explore both Netscape and Microsoft's dynamic extensions to HTML (http://developer.netscape.com/library/documentation/communicator/dynhtml/index.htm and http://www.microsoft.com/gallery/files/html/) as well as Cascading Style Sheets (CSS). Cascading Style Sheets provides a user-friendly way to format documents for the web. Dynamic HTML allows developers to support interactivity and sophisticated animation without a lot of hard programming. Participants will have an opportunity to include these extensions in their web documents.

The workshop will also focus on the newest web publishing language - Extensible Markup Language (XML) (http://www.w3.org/TR/PR-xml.html), which is designed to be the next generation of a language for web publishing. As described by the designers: "The Extensible Markup Language (XML) is a simple dialect of SGML, which is completely described in this document. The goal is to enable generic SGML to be served, received, and processed on the Web in the way that is now possible with HTML. XML has been designed for ease of implementation and for interoperability with both SGML and HTML."[1]

The workshop will conclude with a discussion of how these extensions can be used in the classroom. This discussion will include a look at what other educators are doing. The author has been teaching Internet and web publishing courses for over four years in the U.S. and internationally. For the last three years, he has been invited to conduct Chautauquas to university faculty for the National Science Foundation. A compendium of his work can be found on his web pages at http://jaring.nmhu.edu.

1 Extensible Markup Language (XML), World Wide Web Consortium 8-December-1997 [http://www.w3.org/TR/PR-xml.html].

JAVASCRIPTS: A PRE-CONFERENCE WORKSHOP DESIGNED FOR EDUCATORS

PRESENTED BY

DR. NARAYAN MURTHY AND DR. STUART A. VARDEN
SCHOOL OF COMPUTER SCIENCE AND INFORMATION SYSTEMS
PACE UNIVERSITY
PLEASANTVILLE, NEW YORK 10570

Email: murthy@cs.pace.edu & svarden@pace.edu

GENERAL DESCRIPTION

Most Web pages are still static, and offer no provisions for interaction between the client and server. This half-day workshop is designed to provide Information Systems educators with the basics of JavaScript programming in support of interactive services and animation via the World Wide Web. The notion of using JavaScript as a vehicle for introducing basic programming concepts to non-computing majors will be discussed.

Participates are expected to be familiar with a structured programming language and know the basic elements of Internet technology including HTML.

TOPICS TO BE COVERED

Topics to be covered in the workshop include:

1. What is JavaScript

   a. Overview of JavaScript
   b. The difference between JavaScript and Java
   c. The difference between JavaScript and Common Gateway Interface (CGI)

2. Getting Started

   a. The SCRIPT tag
   b. JavaScript variables
   c. Functions in JavaScript
   d. Simply input and output.
   e. Simple arithmetic computations

3. Basic Language Elements

   a. Basic data types
   b. Relational and logical operators
   c. The IF-Then-Else structure
   d. For and While Loops

4. JavaScript Objects

   a. What are objects
   b. Arrays
   c. Spring objects

   d. The window object

5. Forms in JavaScript

6. Images and Animation

7. Sample Programs and Pedagogical Issues

INSTRUCTIONAL ENVIRONMENT

The workshop will be delivered by means of lecture, discussion and demonstration.

The Computing Professional in the 21st Century

Jimmie Haines, Industry Expert in Residence
University of Nebraska at Omaha

The rapid change in computing technology coupled with changing business and industry processes driven by ever-increasing competition to be first to market is significantly changing requirements for computing support to achieve these objectives. These changing requirements necessitate an increasing demand for a whole systems approach to be taken by computing professionals when addressing the computing support requirements. This approach also requires a different set of instructional programs not currently taught in most academic institutions. The computing professional in the 21st century will be required to have a good foundation of computing disciplines knowledge, an understanding of business and industry processes, a knowledge of systems engineering fundamentals, fundamental knowledge of business principles, and will be required to be adept at systemic thinking, problem solving and be proficient in team work relationships. The computing professional will also be required to have completed capstone projects demonstrating the level of proficiency required to demonstrate they have mastered the level of learning expected. The rewards for a computing professional possessing these characteristics will be equivalent to senior engineering professionals and managers within business, industry and government compensation and reward structures. Recognition of when computing technology development and its support for achieving business, industry and government business and problem solutions will be a key component to the computing professionals success.

The Shape of Futurist Things to Come: Critical Perspectives toward Futuristic Approaches

Jo Ann Oravec
University of Wisconsin-Whitewater
Business Education and Office Systems Department

Abstract

Futurism provides a set of tools and notions that can stimulate the technological imagination of students, as well as illuminate aspects of public policy and corporate strategy. As we approach the new millennium, futurism will be of increasing interest to students. In this article, I provide a critical perspective toward the use of futurist methodologies and perspectives in post-secondary information technology, business, and communications courses. I contend that although futurist techniques still have considerable value for the classroom they should be coupled with a critical and reflective perspective toward their application. The updating and fine-tuning of futurist perspectives can make them more approachable to audiences that are attuned to recent advances in computer networking and graphics capabilities.

Introduction

Speculation on the character and quality of the future has long been a popular pursuit; the positions of soothsayer and oracle have played important roles in many cultures. Scholars, religious figures, and political leaders have often generated prophecies and visions of the "shape of things to come." Efforts to develop sets of intellectual tools that enhance the capabilities of individuals and groups in everyday contexts to project real or desired futures are more recent, however.

In this article, I provide a critical perspective toward the use of futurist methodologies and perspectives in post-secondary information technology, business, and communications courses. I contend that although futurist techniques still have considerable value for the classroom they should be coupled with a critical and reflective perspective toward their application. The updating and fine-tuning of futurist perspectives (as described in this article) can make them more approachable to audiences that are attuned to recent advances in computer networking and graphics capabilities. Developing and interpreting rich portraits and projections of the future-- which include social and political dimensions as well as technological-- can indeed introduce new and valuable perspectives for the consideration of present conditions as well as future ones.

A variety of activities, associations, and professional roles associated with "futurism" have sustained an intellectual and social presence during the past several decades. However, the levels of public awareness and overall acceptance of futurist techniques and perspectives have waned somewhat since their heyday in the 1960s and 70s. A small number of tools and techniques associated with futurism have retained a dedicated following among some educators-- including scenario construction and forms of trend projection-- although the development of new teaching materials using these techniques has been sporadic.

Many administrators, communications specialists, and researchers utilize futuristic techniques in their efforts to generate insights and communicate ideas. This in itself provides some rationale for introducing them in educational contexts, since an assortment of futurist genres are found in the corporation reports, research compendia, and community planning documents that are otherwise used in classrooms. Attempts to decode the discourse involved with futurism-- which can include the language of expertise and professionalism, as well as technological and quantitative dimensions-- are relevant in many post-secondary contexts.

Teaching tools and approaches are often introduced in the classroom in a "decontextualized" manner; they are employed in the classroom in a manner that does not reflect their origin or the legacy of their use. In contrast, context-sensitive approaches explore and emphasize how various methods were developed and fine-tuned; they consider the personal, political, and economic purposes of futurist narratives. Presenting futurist techniques and perspectives as part of Western intellectual tradition helps to provide context for discussions of futuristic approaches and contribute insights as to how they might be adapted to today's needs.

Back to the Future: A Brief Account of the History and Legacy of Futurism

The intellectual and social impacts of futurist thinking in North America and Europe are considerable (Beckwith, 1984). Such self-proclaimed futurists as Alvin and Heidi Toffler (1970), Marshall McLuhan (1967), George Gilder (1992), and John Naisbitt (1982) have introduced innovative concepts and approaches into public discourse on information technology and communications. Futurists have also made substantial impressions on the development of information technologies, as well as on the political and social contexts of their utilization. Many futurists have also had specific influences on education (see Hirsch, 1967), affecting the quality of public policy discourse at the macro level as well as influencing the character of instruction.

Futurist associations and organizations have had a potent influence on corporate and public policy development in the past decades (Kennedy, 1993). Spokespeople associated with the World Future Society (with its widely-distributed publication, *The Futurist*) have directed the attention of the nation to futuristic perspectives even in periods when emergency situations collapsed the public's focus to the present and recent past. "Thinktanks" such as the Rand Corporation have supplied analyses to military and public policy leaders on technological and social topics; the Brookings and Hudson Institutes have produced sets of well-regarded studies that have tackled pressing social and political problems. In information technology and communications, such organizations as the Gartner Group attempt to interpret societal trends related to technology.

Futurist writers have often used fiction as a vehicle to explore their utopian and dystopian visions. H. G. Wells (1936) developed an influential vision of the future in *The Shape of Things to Come*, as did Edward Bellamy (1888) in *Looking Backward.* Both works were products of an industrial age that placed the technologist as a heroic figure. George Orwell's (1948) *1984* and Aldous Huxley's (1932) *Brave New World* established modern imageries and themes of a future gone awry and of technologists over-extending themselves. In centuries past, intellectuals utilized utopian and dystopian writings to express current political points as well as to project long-range social agendas (Baczko, 1989).

As we approach the year 2001, interest in futurism among students and the public-at-large will probably increase dramatically, triggered by public events and media activities associated with the new millennium. Classrooms can be sites for exploration and experimentation with futurist approaches. Introducing futurist strategies and methodologies in a critical and reflective manner will help students become better consumers of the influx of predictions, projections, and rhetoric that is likely to flood the media in the years to come. Many students may soon choose to experiment with futurist rhetoric in their occupational contexts, particularly in communications activities such as advertising and public relations.

Information technology and communications courses are natural venues for futuristic approaches and perspectives, although these approaches can be of value in a variety of classroom settings. Although few students will become professional futurists or forecasters, they will soon rely on reports generated by organizations that specialize in futurism and trend projection. In their upcoming roles as information technology and communications professionals, those who design, sell, and manage information technology in organizations will encounter many articles and advertisements that have futuristic themes. Also, utilizing futurist perspectives in information technology and communications history classes can illuminate important aspects of intellectual endeavor. Both historical and futuristic approaches produce narratives of human activities; both can be considered as forms of "story-telling," reflecting the biases and values of their authors and readers.

Genres of the Future: Futuristic Techniques and Teaching Materials

Many futurists have been highly reflective about the set of methodologies they have developed and nurtured, openly discussing its strengths and weaknesses (Williams, 1981). Some futurists have also been self-critical of the stalled development of new kinds of futuristic techniques and perspectives. The "standard" set of futurist techniques, and related teaching materials, can be classified into the following genres:

(i) *elicitation* techniques include group and individual exercises that help us extract our visions on real or desired futures. Elicitation techniques can be specific (focusing on particular questions or issues concerning the future) or quite inclusive, encouraging us to develop and expand on our general attitudes and impressions about future trends;

(ii) *projection* techniques involve quantitative and qualitative strategies for capturing and forecasting trends, as well as recognizing the possible cyclical dimensions of change;

(iii) *analytical* techniques such as paradigm analysis (Barker, 1992) can help to stimulate reflective thinking on the part of participants about how various intellectual schools and approaches relate to each other;

(iv) *expertise analysis and synthesis* include initiatives to understand the future by eliciting and congealing the forecasts and projections of the leaders in a field. The presumed wisdom of authorities and professionals has often been tapped in efforts to understand the future; structured methodologies for synthesizing the perspectives of often-opinionated specialists in an area include Delphi methodology, developed by Olaf Helmer at Rand Corporation in the 1960s; and

(v) *consensus-building* approaches seek to synthesize and establish common visions of the future among members of a group or organization; these approaches can combine elicitation and projection aspects.

In the 1980s and early 90s, there were relatively few efforts to produce educational materials in futurism. However, a good number of the futuristic exercises generated in the 60s and 70s can still be quite useful in today's classrooms if conducted in a manner that reflects on their origins and purposes (see Hencley, 1974). Teaching materials labeled as "futurist" generally include one or more of the following tools:

1. *Futuristic scenario development*: Generally, scenario development takes the form of writing assignments in which students generate fleshed-out narratives of future events and organizations. Developing "day-in-the-life" treatments of everyday activity in the near-term or distant futures can convey some of the basic notions of systems thinking. For example, in order to accommodate one's projected technological changes, one must consider and possibly incorporate other sets of changes (such as alterations in certain regulations or social mores).

Critical analysis of others' scenario-development efforts can reveal aspects of their character and personal style. A set of recent "celebrity-generated" scenarios have been published by *Wired* magazine about the future of computing technologies, which can serve to stimulate discussion concerning industry trends (Wilkinson, 1995). Scenario development can also be organized as a group endeavor. At UW-Whitewater, students studying information technology were involved in a cooperative exercise in scenario generation in which teams were assigned to portray various aspects of life in the future; reports of the teams were subsequently crystallized into a single presentation.

2. *Brainstorming*: Brainstorming techniques are elicitation techniques generally associated with the stimulation of group creativity, but they often have been used by futurists as well. Brainstorming can aid in loosening the personal and intellectual barriers that group members can bring to discussions about the future. Brainstorming encourages the production of insights and visions without the normal "censoring" process that accompanies idea production in most settings.

3. *Trend analysis and projections*: John Naisbitt's (1982) techniques in *Megatrends* inspired a host of trend projection efforts. Naisbitt's approach in gleaning newspapers for emergent themes has been adopted by a host of consulting firms and thinktanks. Specific sets of trends such as those Naisbitt has elicited can be used in classrooms to stimulate discussion of particular issues. There is also a large assortment of quantitative tools that assist in analyzing time series data and in characterizing cyclical trends. Increasing numbers of these are computer-based, and include help features for novices.

4. *Paradigm analysis*: Kuhn's (1970) *Structure of Scientific Revolutions* served to popularize the use of the notion of the "paradigm shift," employing it to understand aspects of the history of science; paradigm shifts are radical alterations in the basic assumptions of a field, as well as in its vocabularies and methods. Joel Barker's (1992) futurist approaches incorporate paradigm-related exercises in contemporary management and public policy contexts. Toffler's (1980) identification of various "waves" (or eras) of human development is another example of the analytical approach.

Some futuristic activities are hard to classify, such as the development of a "time capsule" for the future. Students store and send messages to the future by selecting various artifacts for inclusion in the capsule; the selection of what artifacts and symbols to include can stimulate discussion of aspects of both the future and the present. The time capsule approach can draw in many students who find other forms of discussion too theoretical; real artifacts can be used in these efforts and provide some "grounding" to the proceedings.

Some Approaches for Introducing Futurism in Today's Classrooms

Futurist issues often migrate into classrooms without conscientious effort. There are a variety of strategies for introducing futurism deliberately and reflectively into educational contexts, most of which can be used in conjunction with the others:

introducing "futurism" as a set of separate, identifiable perspectives: Discussion of some of the ways in which futuristic techniques are historically and contextually bound can aid students in their efforts to be reflective and critical in their utilization. For example, much of the work in developing the "standard" set of futuristic techniques was conducted in the Cold War era, with the projections and scenarios produced often utilized for civil defense and military planning initiatives. Reflections about these and other historical roots of futurism can lend insight about the overall course and development of intellectual and political history.

infusing futuristic exercises and philosophies into curriculum: Such approaches as trend projections and scenario development have often been infused into curricula without being placed under the rubric of "futurism" or given other forms of contextual placement. Although this strategy conserves classroom time, it can also serve to decontextualize approaches that have long and influential intellectual legacies.

fine-tuning and experimenting with futurist strategies and techniques: Futuristic techniques can be introduced into the classroom with the attitude that they are works-in-progress, approaches that are malleable and adaptable; in this way some of their flaws and limitations can be mitigated. Initiatives to share these experiments with other educators may lend some meaning even to less-than-satisfying classroom efforts.

discussing the failures and limitations of futurist methodologies: Case studies of how futurist predictions have failed can add realism and perspective to the treatment of futurism in the classroom. Norman (1993) provides some excellent insights into how predictions involving the computing and transportation industries have fallen far short. The incredible rises in popularity of the personal computer and the Internet were not predicted by industry pundits, much to the detriment of organizations that needed to regroup rapidly in order to accommodate their impacts (Oravec, 1996). The consequences for companies-- as well as communities-- of poor predictions of technological futures can be catastrophic. The study of futurism can equip students to become better consumers and producers of predictions and trend projections, as well as of the rhetoric employed in discussions of the future.

acquainting students with futuristic methodologies and concepts through fiction, especially science fiction: Science fiction provides a wealth of futuristic insights and images, both in film and written formats. Some advances in robotics and virtual reality are closely tied to science fiction literature, such as in the work of Asimov (1986) and Gibson (1984).

Stressing the practical ramifications of futurist methodologies can serve to stimulate interest in them, especially among students who are doing career planning for themselves or others. Predictions can indeed be social forces in themselves: for example, trend projections by computing industry luminaries such as Bill Gates (1996) and Andrew Grove (1996) can serve as self-fulfilling prophesies, invigorating the efforts of hardware and software developers to meet certain projected timeframes. Books and materials that assist managers in utilizing futuristic techniques in support of strategy development and marketing are growing in number: James (1995) has directed her efforts toward the training of managers in futuristic approaches and Popcorn (1996) has utilized trend identification and projection as tools in marketing arenas. The implications of futurist methodologies for career planning can provide added incentive for students to understand trend projection and scenario construction techniques.

Some Strategies for Increasing the Range and Effectiveness of Futuristic Methodologies

Many of the most popular futuristic techniques were developed in the 1960s and 70s, well before personal computers were widely available and long before the Internet became a common societal resource. Some relatively minor shifts in futuristic techniques may make them more acceptable and conceptually available to today's audiences. For example, a greater emphasis on graphics, sounds, and images could make the activities more appealing to those who have experience in multimedia. Scenario development efforts have often been text-oriented, conducted as pen-and-paper exercises; scenarios can also be constructed by students using video and computer graphics tools and conveyed via multimedia. Computer software that provides templates or worksheets to assist with scenario construction can also make such efforts more appealing for individuals who are comfortable with word processing software.

A growing pool of examples of futuristic scenario development efforts can be found in video and CD-ROM format, including the CD-ROM that accompanies Gates' (1996) *The Road Ahead*. Some corporations (including Microsoft, Apple, and Sun) have used scenarios to convey aspects of their corporate visions to the public, usually projecting about a 10-year time horizon into the future. Analysis of such scenarios can provide insights as to the priorities of those organizations and the directions their leaders are taking. By comparing two or more scenarios, instructors can help students to be sensitive to the slants the corporations provide on futuristic themes. Although recently-developed scenarios can be of great value, futuristic scenarios produced in past decades can also lend insight as to the philosophical and social values associated with technology in previous eras; a number of these are in film or video format (Oravec, 1992).

Linking futurist techniques with computing tools can also help to update them for new audiences: Delphi exercises (in which experts' predictions are shared and synthesized in a carefully-structured, round-robin manner) have already been conducted via computer networking (Murry and Hammons, 1995). Futurist efforts can be enhanced with use of the Internet and various network-based applications as well. For instance, the contacting of experts for projections or for Delphi-style studies has been made more feasible through network linkages. Analyses of the popularity of various World Wide Web sites can be used in some restricted contexts as indices of trends, in a manner comparable to Naisbitt's (1982) analyses of newspaper clippings.

Many critics of futurist techniques have targeted their ideological leanings, stressing the manner in which the techniques assume certain technological and economic imperatives (Illich, 1971). Dublin (1993) analyzes "futurehype," and explores how futurist rhetoric can be used to conceal various ideological agendas in business and educational contexts. Basic assumptions about the world and about human nature are embedded in futuristic methodology in a variety of ways: for example, the dimensions of the timeframe that is used to project the future constrain and shape our discourse. Assumptions about technological determinism (whether certain kinds of advances in technology are inevitable) are also readily found in futuristic exercises and in the scenarios produced in business and public policy contexts. Instructors can avoid some of these distortions by reframing futurist exercises so that they incorporate opportunities for reflection and value analysis.

Development of forms of futurist rhetoric and technique that include non-technological themes can also serve to include audiences that are weary of technically-saturated visions of the future. Approaches that balance the technological and the social can gain broad acceptance: for example, Toffler's (1970) *Future Shock* captured the attention both of technologists who were interested in Toffler's technology-related insights and of humanists who were concerned with the possible social impacts of rapid change.

Some Reflections and Conclusions:

Futurism provides a set of tools and notions that can stimulate and involve students, as well as illuminate aspects of public policy and corporate strategy. The philosophies and rhetorical approaches associated with futurism can also contribute a systems orientation in the classroom, encouraging students to consider how various aspects of social and technological systems are linked. Futurism can provide a transformation in focus in classroom activities, shifting the frame of the issues under discussion and making students aware of the time-bound dimensions of various classroom materials and approaches. Much of the value of these activities can be lost, however, if futuristic approaches are introduced uncritically and are not updated to incorporate available computer networking and multimedia capabilities.

In our roles as educators, we should heed many of the warnings of the critics of futurism: futurist rhetorics and methodologies can indeed be powerful ideological tools in the classroom, positioning a wide assortment of biases and value components as "futuristic." Some perspectives that are placed under the rubric of futurism have been largely attempts to cast particular political agendas (such as deregulation efforts) in a positive light (see Caldwell, 1995, for an example). Labeling projections and scenarios as futuristic should be employed as a way to signal that they are open to discussion and analysis, rather than as a guise to stifle inquiry and conceal assumptions. Classroom presentations that consider the rhetorical and value-laden dimensions of futuristic narratives can equip students to interpret-- and possibly even gain from-- the onslaught of oratory and prophecy associated with the coming of the next millennium.

References

Asimov, I. (1986). *Robots and Empire*. New York: Ballantine.

Baczko, B. (1989). *Utopian Lights*. New York: Paragon House.

Barker, J. (1992). *Future Edge: Discovering the New Paradigms of Success*. New York: W. Morrow.

Beckwith, B. (1984). *Ideas About the Future: A History of Futurism, 1794-1982*. Palo Alto, CA: Beckwith.

Bellamy, E. (1888). *Looking Backward*. Boston: Ticknor.

Caldwell, J. (1995). Hybridity on the Superhighway: Technofuturism and Historical Agency. *Quarterly Review of Film and Video*, 16(1), pp. 103-112.

Dublin, M. (1991). *Futurehype: The Tyranny of Prophecy*. New York: Dutton.

Feingold, N. (1989). Futuristic Exercises: A Workbook on Emerging Lifestyles and Careers in the 21st Century and Beyond. Eric: ED311279.

Gates, B. (1996). *The Road Ahead*. New York: Viking.

Gibson, W. (1984). *Neuromancer*. New York: Berkley.

Gilder, G. (1992). *Life After Television*. New York: W. W. Norton.

Grove, A. (1996). *Only the Paranoid Survive*. New York: Doubleday.

Hencley, S. (1974). *Futurism in Education: Methodologies*. Berkeley, CA: McCutchan.

Hirsch, W. (1967). *Inventing Education for the Future*. San Francisco: Chandler.

Huxley, A. (1932). *Brave New World*. London: Chatto & Windus.

Illich, I. (1970). *Deschooling Society*. New York: Harper & Row.

James, J. (1995). *Thinking in the Future Tense*. New York: Simon & Schuster.

Kaufman, R. (1996). Ideal Visions: A Modern Imperative. *Educational Technology*, 36(3), pp. 50-51.

Kennedy, P. (1993). *Preparing for the Twenty-First Century*. New York: Random House.

Kuhn, T. (1970). *Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

McKerlich, W. (1987). The Futurists and Schooling. *Education Canada*, 27(4), pp. 14-18.

McLuhan, M. (1967). *The Medium is the Massage*. New York: Random House.

Murry, J. and Hammons, J. (1995). Delphi: A Versatile Methodology for Conducting Qualitative Research. *Review of Higher Education*, 18(4), pp. 423-36.

Naisbitt, J. (1982). *Megatrends*. New York: Warner Books.

Norman, D. (1993). *Things That Make Us Smart*. Reading, MA: Addison-Wesley.

Oravec, J. (1992). *Interactions in Science and Society*. Bloomington, IN: Agency for Instructional Technology.

Oravec, J. (1996). *Virtual Individuals, Virtual Groups: Human Dimensions of Groupware and Computer Networking*. New York: Cambridge University Press.

Orwell, G. (1948). *1984*. New York: Harcourt.

Popcorn, F. (1996). *Clicking*. New York: HarperCollins.

Sturgess, P. (1985). A Futuristic Fantasy. *School Arts*, 85(2), pp. 32-33.

Toffler, A. (1970). *Future Shock*. New York: Random House.

Toffler, A. (1980). *The Third Wave*. New York: Morrow.

Wells, H. (1936). *The Shape of Things to Come*. New York: Macmillan.

Wilkinson, L. (1995). How to Build Scenarios. *Scenarios: Special Wired Edition*, 1.01, pp. 74-81.

Williams, L. (1981). Some Friendly Criticisms of Futurism. *Educational Studies*, 12(1), pp. v-xv.

A Design Methodology for Teaching Event-Driven Languages to Novice Programmers

Peter Shackleton
Department of Information Systems
Victoria University of Technology
Melbourne, Australia
Email PeterShackleton@vut.edu.au

Abstract

This paper reports on the use of a program design methodology used to help students master the concepts of program development using an event-driven language in an introductory programming subject. Event driven languages, which use events to combine procedural and object-oriented concepts, require a novice programmer to switch between paradigms at different stages in the design and development process. The research found that most students do not have a clear mental picture of the operation of an event-driven system and that this is impeding their ability to master more difficult concepts. A seven step design methodology was developed to provide some structure for teaching the concepts of programming when using an event-driven language. The research found that, although benefits flowed from the use of this methodology, a significant amount of work must be performed by lecturers at a conceptual level with students before the benefits of any methodology can be fully harvested. The paper concludes with recommendations for changes to the methodology.

Keywords

Event-driven programming, Visual programming environments, Information Systems curricula

Introduction

One of the unique characteristics of the computing discipline is rapid and on-going change. When tertiary institutions first established Information Systems courses to cater for the growing demand of business for graduates, they too locked themselves into this endless cycle of change. Now, as computers are becoming increasingly more powerful and permeate more of the daily operations of businesses, tertiary institutions are being forced to re-evaluate the content of their courses.

Programming, always a fundamental building block in Information Systems curriculum, is one area which has not escaped pressure to change. Programming environments have changed significantly in recent times with the advancements in technology and software and the procedural programming paradigm, so long the backbone of introductory programming subjects, is increasingly being replaced with languages from other paradigms. Studies in the United States of America have revealed an increasing acceptance of event-driven languages in introductory programming subjects (Tesch 1996) and they are now being used by two Victorian universities in first year programming subjects.

It is clear that introductory programming subjects aim to teach a range of programming concepts rather than just the syntax of a language. Fundamental to these subjects is the notion that students should *plan before acting*. Structured programming is the most popular method used for procedural languages and has a number of conceptual modeling tools such as structure charts and hierarchy charts. There is, however, no recognised methodology for the event-driven paradigm and it is clear from the research that lecturers who are using event-driven languages are still trying to determine an appropriate methodology to enhance learning programming concepts and in presenting material.

This study evaluated the use of one design method which placed emphasis on the development of a screen layout and a list of active events with appropriate responses. The methodology comprised seven steps incorporating elements of analysis, design and testing. Although a methodology must provide rigour in the design process, it must also help students to understand the concepts of programming. This study evaluated the design methodology and found that, although students came to the subject with differing sets of cognitive processes and a range of skills, the methodology helped most of the students through the difficult process of learning an event-driven programming language.

Finally, the study found that there is far more movement back and forth between design steps when working with event-driven languages compared to procedural languages. Moreover, this movement needs to be encouraged to facilitate learning, but creates problems for lecturers teaching an event-driven language. The study found that students placed emphasis on different steps in the design methodology; for example, mature age students concentrated on understanding the nature of the problem through the program statement, while younger undergraduates appeared to launch straight into screen design.

Programming in Information Systems Courses

The rise of the application package on microcomputers during the last fifteen years has been a most significant aspect of computing. The early versions of these packages restricted the user to using them a certain way. Current application packages with recordable macros, however, offer capabilities and possibilities for interconnection and customisation that, in many cases, make creating your own application from scratch with a programming language an unproductive alternative. Programming, using application package macros, is now a skill that many students will use to advantage if they learn how to do this properly. According to Cooke (1990):

> *'The irony is that the more powerful and flexible an application becomes, the more options you have, and the more useful it becomes to be able to perform diverse functions based on system state. If you have commands that can alter system state, conditionals that choose alternate execution pathways, and a method of storing these things, you have a programming language' (211)*

It goes without saying that the specific skills needed for programming have also changed. As we continue to move further away from the processing core of the computer through the introduction of higher level of programming languages, we surrender some control of the machine but may gain visibility over the problems we are solving. The languages and our view of programming become more abstract. When this occurs, it is possible that a programmer will require a different set of skills depending on the specific language level they are using. DeGrace & Hulet Stahl (1990) believe

> *'there is an optimal distance and, therefore, an optimal language for programmers trying to write applications, another language for the casual or end user, and still another language for systems and embedded-systems programmers' (11).*

Event-Driven Languages

Programs designed using *event-driven* languages such as Visual Basic respond to different events which are usually initiated by the user, although they can also be initiated by the program itself. In an event-driven language, the programmer builds up screens by defining forms containing Windows controls such as buttons, text boxes, scroll bars, labels, and other user-interface objects. The programmer sets the properties of each object and generates code that executes in response to events such as the click or movement of the mouse. The increased use of event-driven programming languages in applications has merged many of the previous clear and distinct programming tasks.

The processes followed in different paradigms such as object-oriented programming may have shifted the emphasis from one task to another or changed the very processes themselves. Varhol (1994) believes the process of programming in an event-driven language *makes a programmer look less like a writer laying down words and more like an electrician wiring together circuit components.*

It may not be possible to isolate a set of tasks that can be broadly associated with computer programming in totality. Instead, the purpose of a particular programming language or the role of the system that is produced may dictate different tasks for different activities in different contexts. Visual programming environments have also changed the nature and responsibility for work undertaken by a programmer. As Wilkes (1991) states:

> *'the development of modern workstations and programming environments has made it possible for immense power to be put at the disposal of one person. If that person is a programmer, he or she can handle every stage of a large programming project - taking a broad view of the work as well as working on details when necessary. The result is to make the modern programmer an autonomous professional with full responsibility for the work done' (23)*

Nevertheless, irrespective of the programming language or environment, programming requires:

> *'... a programmer to explicitly use some potentially powerful problem-solving skills. A programmer must manipulate data using only a small set of primitive instructions; they must decompose a large problem into a series of smaller manageable tasks; and finally they should test the programmed solution and make changes to the code' (Linn, 1985 :14).*

One of the major problems faced when using an event-driven programming environment in either an educational or a professional context is the inappropriateness of traditional design techniques and the lack of widely accepted suitable alternatives. Representational schemes designed for use in a procedural programming environment do not lend themselves to the event driven, forms-based nature of a event-driven programming environment.

The traditional flowchart depends for its effectiveness on a predictable flow of control from one element of the program to the next. Such a predictable control flow is largely missing in an event-driven language. While flowcharts or structure charts might have limited use when designing the code for a particular module of the program, the generally accepted design approach for event-driven programs involves the use of relatively short modules. Thus the effort of using these tools for a relatively small code fragment is largely wasted.

The need for a design scheme for event-driven languages is more pressing at the level of the form design, and the interaction between forms. The tendency to fragment code into separate modules attached to the various events on different form controls makes a useful design scheme essential, particularly in more complex programs. The isolation of code modules, together with the fact that they tend to be *hidden behind* events relating to different forms and controls, means that it can be difficult to keep track of the consequences of a design change, or trace the execution of a program.

While event-driven languages have largely eliminated the danger of *spaghetti code*, they have created the spectre of what might be referred to as *ravioli code* (Braithwaite, 1996) where hidden morsels of program code sink beneath the surface of the form "sauce". What is needed is a design process that reflects the form-based approach of event-driven languages.

The Program Design Methodology

A program design methodology for the teaching of event-driven programming was developed by Shackleton and McConville(1997) and contains 7 components[1]

Problem Statement
: a concise expression of the overall aim of the system.

Defining Diagram:
: shows the inputs which need to be processed to produced the required outputs.

Screen Layout:
: the screen layout or user interface and shows the placement of the objects with their names.

Event/Response List
: a table of test data together with expected results for specific inputs.

Variable & Constant Table:
: lists and describes the general variables in methods used in the program.

Procedure Pseudocode:
: a group of pseudocode algorithms for each method

Problem Statement, Defining Diagram and Screen Layout

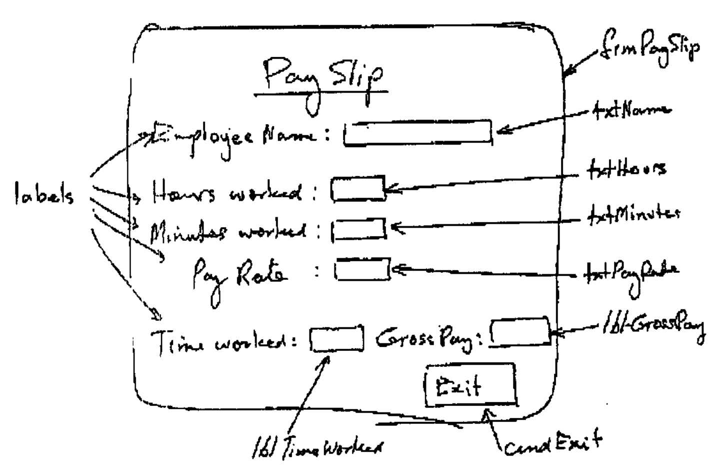
Students often fail to read problem documentation and the *problem statement*, the first stage in the process, is increase the students understanding of the problem. Students give a concise outline of the problem and a brief task description.

A *defining diagram* is used to assist in clarifying the problem and formalising the task of identifying inputs, processes and outputs. At the end of the second stage, the aim is for students to have a clear understanding of what needs to be obtained (the **input** section of the defining diagram), what is to be produced (the **output** section of the diagram) and the typical sequence of processing steps (the **tasks** section of the defining diagram). An example would be:

Input	Tasks	Output
HoursWorked MinutesWorked PayRate	Get HoursWorked Get MinutesWorked Get PayRate Calculate TimeWorked Calculate GrossPay Display TimeWorked Display GrossPay	TimeWorked GrossPay

The screen layout is extremely important in the design of event-driven programs because it enables the students to consolidate their understanding of the problem so far and to more closely consider all of the inputs and outputs required. It also gives the student a concrete object from which to work on the more detailed design of what actions are to be taken in response to the various events that the user may invoke.

To design the screen, students were encouraged to represent the screen or form on a sheet of paper rather than directly on the computer. The student builds up a form by progressively adding objects using the defining diagram as a guide. As an example, they would indicate the main heading for the screen and draw an Exit button if appropriate. Next, using the defining diagram, they may indicate the position of label boxes to contain the input prompts and the position of the text boxes which will contain the users' input values. The next stage might involve drawing label boxes to display the output values (obtained from the output section of the defining diagram) and next to these they may place the labels that will inform the user what each output represents. Further command buttons and other controls may be added that will be required for the tasks section of the defining diagram. The student then allocates a *name* to each of the objects. Students then have a paper screen design like this:



---

[1]This program design methodology has now been published in a book by Shackleton, P. & McConville, D, Program Design through Visual Basic (3rd Edition), Data Publishing, Melbourne, Australia, 1997.

The Event/Response List

The fourth step of this program design methodology is the heart of the methodology as it identifies all of the possible events which the student will allow the user to perform on the screen and the responses which they want the program to activate. These response will include the anticipation of any user errors and the display of relevant error messages. Moreover, this stage forms the basis for writing the algorithms (and the program code or *methods* as the last step in the process).

Students were encouraged to look in turn at each of the objects (controls) on the form, and decide which *controls* they want to respond, to which *event* they should respond, and what they want that *response* to be. Students are asked to write the description of each event as briefly, but also as concisely as possible, so as to isolate each probable event. The response portion should also be concise, but most importantly, it should convey a good description of what actions need to be performed. In this section students are still concentrating on *what* is to happen, not *how* it is to happen. For example:

Event:	The user types a character into text box 'txtName' (ie. *changes* its value).
Response:	Check to see if it is the Enter key, if it is then Tab to the next text box.

Procedure Pseudocode

After completing a series of test cases with data and identifying form and general variables, students move onto the development of pseudocode for the larger event and general procedures.

Research Methodology

The research was conducted amongst students in the introductory programming subject at an Australian University over two semesters. Both undergraduate and postgraduate students were involved in the study. Several instruments were used in the case study for the research project:

- Documentation
- Interviews with lecturers
- Interviews with students
- Observations

Research Findings

The major findings of the study are briefly presented

Conceptual Models

It is generally accepted that human memory is essentially associative and must be presented with concrete retrieval cues to make contact with relevant knowledge. Although most students come to Information Systems courses having worked in a Windows environment, many have great difficulty in the early stages understanding the concepts of event-driven systems. The study found that many students have very little trouble developing and modifying a screen layout but have great difficulty conceptualising the operation of the system to assist them with development beyond this stage. A major cause of this problem is the inability of most students to develop a corresponding mental representation of event-driven systems which is exacerbated by the fact that there is no suitable conceptual model that can adequately describe the operation of an event-driven system. Although event-driven languages have unique characteristics, they incorporate aspects of the object-oriented and procedural paradigm and the study found that lecturers, often unknowingly, find themselves describing an event-driven system in one of these other paradigms creating even more confusion for students. Moreover, the study found that lecturers do not have a range of real-world examples and metaphors that can assist them to describe event-driven systems and teach programming in this paradigm. This may be partially due to the limited amount of support for the language at this early stage but the study found lecturers often face difficulty developing an appropriate mind-set for event-driven languages and leaving behind their procedural habits.

In many respects, the conventional main line procedural program is comparatively easy to comprehend, although a student may find it difficult to convert a solution to a series of ordered instructions. In the procedural paradigm, control is surrendered to the computer, and each line is executed one after the other. Selection and iteration constructs separate the logical from the physical structure of the program and increases complexity, nevertheless, the program is executed from the first line and works its way down line by line. The study found that this start-at-the-top and work-your-way-down approach is relatively easy to comprehend compared to event driven systems. This was clearly identified by a large number of students who were comfortable with systems involving a command button to start execution rather than automatic calculation in lost focus and change events.

Events

In event-driven programming, a system moves from one static state to another by responding to an event. On an event occurring, a system follows a predetermined path according to programmed instructions included under an event procedure of a particular object. Thus, although two screens may look identical on different systems, there may be a significant difference between the two systems depending upon the events and their responses. The event-response list, therefore, is instrumental in determining the structure and operation of a system. In this design methodology, the event-response list has the added aims of assisting students identify where to place the code and to provide a systematic method for dividing up the programming task and developing the code in event and general procedures.

The analysis found that the concept of an event, although apparently easy to describe, is very difficult for most students to understand. Moreover, lecturers often contribute to this confusion by modifying the definition of an event or placing a different interpretation on an event at different stages in a subject. Students were confused about the following four areas:

- The *boundaries* of an event - that is, whether to include prior actions in an event such as an input to another object
- The *context* of the event - whether events should be viewed from a *programmer's* or a user's perspective or both
- The *status* of an event - the distinction between active and passive events
- The *level of detail* in a response - whether to include multiple paths such as for validation.

The result is an inadequate description of the events of a system which makes it difficult for a novice programmer to identify events and to move onto the coding of object methods.

Event Boundaries

Analysis of the data reveals that students have different interpretations of what is meant by an event which impedes their understanding of the concept of event-driven programming. Students appear to understand external events such as the click of a mouse on a button and most internal events such as form load. The concept of an external-related event, such as on-change however, can be difficult for some students to identify and to code.

In theory, an event does not include a number of prior steps but some students appear to benefit from outlining the steps prior to an event in the event response list. In the early stages of the introduction to programming subject, students appear to build a mental model which has the computer program as controlling the system not, as is the case in event-driven systems, where the user can determine the order of events. Students have a better understanding of the concept of an event-driven system in the latter part of the subject where they tend to include validation of inputs and disabling of controls at that time.

The research found that the failure to adhere to describing systems in terms of true events causes immense problems for students particularly those who are struggling to understand the concept of event- driven programming. Including a sequence of inputs or steps in the description of an event may help some students understand how to derive an output but it creates the illusion that the system will automatically follow these steps and emphasises a procedural approach in an event-driven environment. This appears to be very confusing for some students.

Event Context

An event can be viewed from two different perspectives or *contexts*; a user or a programmer perspective. The response to an event from a *user* perspective is the change or combined set of changes to the *observable* parts of the system; it may be a new form on the screen, an output added to a form, or intentionally saving a file. A *programmer*, however, is aware of the structure of the system which may be different from the observable parts of the system.

Although students were told to describe events for a system from a programmers perspective, in the early weeks of the subject in particular, most students who up until that point in time had only been users of applications, had difficulty identifying events from a programmer's perspective. The difference in events and responses from a user and programmer perspective was most evident when moving between forms on a multi-form system, when one event changed the value of a variable prior to the calculation of an output by another event or in *system* events such as on form load. When moving from one form to another, changes are often made to the new form prior to its display - there are often many options open to the programmer to make these changes. Similarly, the user is often oblivious to the operations that can be done on the initial loading of a system such as opening files and setting restrictions. Finally, while operating a system, the user may input data or change options values which in turn can change the value of variables or trigger the calculation of some interim values prior to calculation of the final outputs.

Event Status

A control object can have multiple events and it is only when code is attached to an event that it is deemed to exist. Some objects are placed on a screen with the intention of having an attached event while others are only created to help with display, take inputs or receive outputs. The purpose of an object frequently depends on the existence of an event.

The structure of an event-driven system is determined by the status of events and this appears to cause problems for students. As an example, if a command button is used instead of a series of on-change events, then a text box may change from being an active object in a system to one which only takes input and does not trigger an event. Similarly, if validation is assigned to an object, then this change in event status changes the role of the object from one of accepting any input to only accepting valid inputs. Moreover, some events are part of the program architecture and happen automatically (such as option buttons) which often leads to further confusion.

Response Detail

Observations of students and interviews with lecturers reveal that most students give very little consideration to how an output is going to be determined at this stage. This is not necessarily a bad trait, however, it reveals the issues associated with coding are unlikely to be considered before this stage. In a procedural language, a novice programmer would have had to consider architectural issues prior to the design of a system. In the design of event driven systems novice programmers are more likely to revisit earlier stages in the design process and to make modifications accordingly.

Placement of Code

Although there is an implicit link between an event in the event-response list and the placement of code in the matching object it is not explicitly stated. This caused many problems for students and needs to be addressed in further iterations of the design methodology.

It was clearly evident that it was difficult for many students to take a holistic view of an event-driven system. Students have great trouble determining the impact of one event upon another.

Testing

Sadly, the analysis reveals little change in the attitudes of students to the testing event-driven systems from students in previous semesters where a procedural language was used. Despite the importance placed upon the need to develop a system that is functionally correct, students often used ad hoc procedures and a limited range of data to test their systems. No student was observed testing their program from prepared data in classes.

It is often felt that object oriented and event-driven programming, which enables code to be distributed amongst events in different objects, can facilitate testing as the system is gradually developed. Despite the importance given to the development of test data in this methodology, in reality nearly all students do not return to this test data to undertake a comprehensive test of their finished systems. Although event-driven programming encourages testing on components of a system as functions are progressively added, it appears to discourage the testing of a system against formal test data on its completion. The ability to fragment the code into different events enables students to develop test data for that function which may not be exhaustive particularly when a system is complete. Given the problems of identifying and rectifying errors in a program irrespective of the programming paradigm, it is clear that testing is still viewed by most students as one of the least desirable tasks in programming.

Summary

It is possible that a major benefit of this methodology is its flexibility, that is, it enables students to select, re-order or modify individual steps that better suit their particular problem solving strategies, although it was never intended to be so. A concern, however, is that the deletion of too many steps could lead to an ad hoc approach to programming.

The analysis reveals that the vast majority of students adopted, in varying degrees, the first four steps ie. the problem statement, the defining diagram, the screen layout and the event-response list, and a limited form of pseudocode or Structured English. There is clear evidence to suggest that the majority of students were confused by the program variable table or found it unnecessary (this has not been reported on in this paper), and that most students adopted an ad hoc approach to testing.

The Event/Response List requires modification to clearly associated objects with events. Moreover, the problem statement and defining diagram can portray event driven systems as procedural and this requires modification. The author is currently trialing a Use Case Approach which would replace the first two steps of the methodology.

Finally, the program design methodology in its current format is difficult to use for multiple form systems.

Traditionally, programming has been taught *in the small* with the belief that many of the concepts could be extrapolated *to the large.* A major criticism of the program design methodology used in this study is that it is limited to teaching small systems. There is a need for further research which will enable a design methodology to be used for teaching and for the development of large systems. A graphic representation of a system, through a modified State-Transition Diagram may be of benefit for these types of systems.

It is, frankly, unacceptable that a paradigm so popular as the event-driven paradigm, comes with no design methodology and therefore has the potential to undo so much of the long term benefits that come from teaching program design as well as programming, in introductory programming subjects.

Bibliography

Ang, A. Y. and B. W. N. Lo (1991). Changing Emphasis on Information Systems Curriculum: An Australian Perspective. *Second Annual Australian Conference on Information systems and Databases Special Interest Group*, University of New South Wales.

Braithwaite, R. (1996). Design Tools for Event-driven Software Systems. *Australasian Conference on Information Systems*, Hobart, Tasmania, Australia, University of Tasmania

Cooke, R. (1990). Full Circle. *Byte*: 211-214.

DEET (1990). *Education and Training Needs of Computing Professionals and Para-professionals in Australia*, Department of Employment, Education and Training. Economic and Policy Analysis Division.

DEET (1992). *Report of the Discipline Review of Computing Studies and Information Sciences Education*, Department of Employment, Education and Training. Department of Industry , Technology and Commerce.

Towards a Broader Competency-Based IS Education: A Proposed Improvement Package for Analysis of Case Studies

U. Rex Dumdum
Department of Business and Managerial Science
Marywood University

William J. Tastle
Department of Mathematics and Computer Sciences
Ithaca College

Abstract

The globalization of the marketplace, increased demand for high quality products and services, and a continuing trend towards team-based high-performance organizations has had the continuing effect of requiring a dynamic information systems curriculum and a dedicated faculty continually engaged in a constant cycle of concept revision and the mastery of changing paradigms. Interwoven throughout the enlightened study of information systems is the development of technical, conceptual, interdependency, and moral/ethical competencies. Technical competence is partitioned into a tools-based competence and a transformative competency, that is, the ability to apply information technology as a transformative force for shaping, supporting, achieving, and maintaining strategic corporate initiatives. A method by which the development of this transformative competence can be accomplished is through the judicious use of case studies. Case studies provide a means by which IS/IT may be analyzed within the broadest domain possible. Toward that end we provide a selection of IS themes and corresponding cases that can be used in both the undergraduate and graduate curriculum.

Introduction

With the advent of the development of a new, more spirited form of commerce that is capturing the attention of industry and government, information systems educators must again turn to their curriculum with an eye towards continuous revision in the face of changing technologies. It is now well recognized (Dumdum and Tastle 1996) that at least three major trends are having a direct impact on IS education: the globalization of the marketplace and the organization brought about in part by electronic commerce capabilities, the increasing demand for high quality products and services, and a continuing trend towards team-based high-performance organizations.

Globalization continues to play a powerful and pervasive influence on nations, business, workplaces, communities and lives as we approach the millennium. The world is fast becoming a global shopping mall in which ideas and products are available everywhere at the same time, thus putting the power of choice into the hands of customers and thereby changing the terms of competition forever (Kanter 1995). The focus has shifted from one of product-orientation to that of customer-orientation, and as these customers become more technologically literate, they are able to perform their tasks of product identification and evaluation with increasingly improved aplomb. Consequently, Mitroff(1987) and Hamer and Champy (1993) suggest that American business must increasingly and effectively compete in a global environment in which extreme interconnectedness, flexibility, innovation, quick response, and focus on process rather than task, are fundamental features (Dumdum and Tastle 1996).

Also important is the concept of team-based organizational performance. Though teams are not the solution to everyone's current and future organizational needs, Katzenbach and Smith (1993) report that "teams outperform individuals acting alone or in larger organizational groupings, especially when performance requires multiple skills, judgements, and experiences." They further add, "teams represent one of the best ways to support the broad-based changes necessary for the high-performing organization." Thus the challenges we proposed in 1996 remain relevant and increasingly important:

1. The IS academic community must be proactively dynamic to insure that its curriculum is equally relevant.
2. As computer-based information systems and support technologies become more complex and increasingly take on critical roles in local, national, and global organizations, how can we help our IS students "develop confidence and competence in the necessary skills to be successful in current and future IS environments?" (Longenecker 1995)
3. Our students, as graduates, are being called upon to face increasingly complex challenges effectively: what types of learning experiences must we fashion to

effectively prepare them to be able to accommodate the demand for world-class high-performance team-based IS professionals?

Student Competencies

We have previously addressed four aspects of competence that are of particular concern to IS education: **technical** competence, **conceptual** competence, **interdependency** competence (Tastle and Dumdum 1994) and **moral/ethical** competence, and further examined them in light of the above challenges (Dumdum and Tastle 1996). Technical competence is defined on two levels, one involving a "tools" based competency which involves a knowledge-base of various hardware and software products at a reasonably sophisticated level of detail and the other, a **transformative** competency that involves the ability to apply information technology as a transformative force for shaping, supporting, achieving, and maintaining strategic corporate initiatives (Porter 1996) such as the rapid development and deployment of quality products and services (Morgan 1988), the reengineering of business processes (Hamer and Champy 1993), and the overall performance improvement of the organization (Sprague 1993, in Longenecker 1995).

Conceptual competency consists of mind sets and conceptual skills such as integrative vs. segmentalist mindsets, and interdependency competency which consists of the bipartite abilities of building bridges and alliances among stakeholders in an organization and to collaborate and lead in high performance teams to deliver world-class results. Moral/Ethical competency involves the ability to evaluate the consequences of change from an ethical perspective. This paper deals with enhancement of the transformative competency.

Enhancing Transformative Competency: The Improvement Package

Creating transformative competency among students in the IS curriculum can be accomplished through the judicious use of case studies. Though some IS programs provide for a project experience in the Analysis and Design, Software Engineering, and/or Database course(s), others provide a termination project course (see IS '97.10 – Project Management and Practice *in* Davis, et.al. 1997) by which students can experience the satisfaction of applying their entire repertoire of knowledge and skills in a team-based application of analysis, design, and implementation of a project. However, one successful experience does not make an IS professional, nor does it not allow one to experience (hopefully) the stress of failure. Of course, few companies or organizations would welcome a class of IS students to study, firsthand, a system failure. But we can come close to that experience through the use of case studies.

The Improvement Package

The improvement package (see figure 1) uses the socio-technical perspective that sees information systems and technologies as technical artifacts that are designed and deployed within organizational realities. Consequently, the IS/IT cannot be analyzed in isolation; instead, it must be analyzed with the recognition that organizational realities are equally important in determining the success or failure of any technological design and implementation.

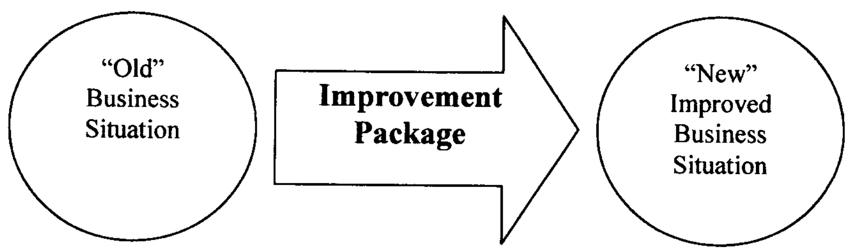


Figure 1 The Proposed Improvement Package

Underlying this perspective is an adaptation of Leavitt's model (Laudon and Laudon 1996) which states that the introduction of any information systems/technologies have consequences for task arrangements, organizational structures, and people, all within the context of the organizational culture (see figure 2). It is thus argued that in order to implement change through the successful placement of IS/IT, the consequences on the other three components must be anticipated and incorporated within the improvement "package." In addition, any of the five components can be a primary driving force. For example, a change in organizational structure will impact the other components and hence necessitate appropriate changes in the organizational culture, IS/IT support and enablement of users, task and process redesign, and the enhancement of people capabilities.

The intent of the improvement package is to assist in bringing the organization closer to its corporate strategic intent. According to Hamel and Prahalad (1989, 1994), *strategic intent* is an obsession found among companies that have risen to global leadership over the past 20 years. They claim that strategic intent is a corporate obsession with winning at all levels of the organization and with sustaining that obsession over the 10- to 20-year quest for global leadership. It involves an intense analysis of an organization's competitors and for patterns of industry evolution. It also involves the articulation of corporate challenges and from these challenges, the envisioning of a desired leadership position and the establishing of the criterion the organization will use to chart its progress. Strategic intent further encompasses an active management process that includes: focusing the organization's attention on the essence of winning - achieving and maintaining global leadership; motivating people by communicating the value of the target; leaving room for individual and team contributions; sustaining enthusiasm by providing new operational definitions as circumstances change; and using strategic intent consistently to guide resource allocations. The improvement package therefore serves as a guide and mechanism for achieving strategic intent. It is successful when it actually yields a measurable improvement in the company or organization by bringing it closer to achieving its strategic initiatives.

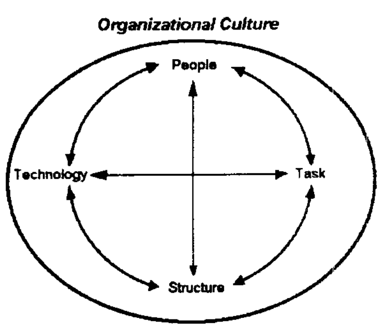


Figure 2 Levitt's Model

Using the Improvement Package in the Analysis of Cases

The rationale behind the analysis of cases using the proposed improvement package is to give students practical and professional training within the broadest domain possible. It seeks to link students to the realities of business and engage them in a practice-oriented problem solving instructional mode (Lundberg 1993). The use of case studies is a philosophy of professional education that mates knowledge and action in which students wrestle with the conditions of the problem at hand, seeking and finding their own way out, applying knowledge in the process, and consequently learning in an active, rather than passive, mode. A table of IS themes and associated cases is enumerated at the end of this paper as an appendix. Each case is linked to its reference by means of a two letter code.

A way of actively analyzing cases is by using the Socratic method of engaging the students through a systematic elicitation of responses from the following carefully selected questions (Kriger 1993).

Opening Questions

1. General opener: "John, will you please lead off with an analysis of the situation?"
   Solicitation of issues or questions: "What are the issues in this situation?" or "What questions does the present problem situation raise?"
   Action question: "What would you do if you were the company president, at the end of the case?"

Analysis Questions

2. Questions asking for analysis: "What theories, models, or methods might we use to analyze the present problem or case?"
3. Questions asking for evaluation of and/or critique of what has been said: "Does anyone else see another way of evaluating/analyzing what has been discussed so far?"

Action Questions

4. Action question: "What would you do in this situation?"
5. Action question from a specific vantage point: "What would you do in this situation as the vice president of marketing?"
6. Change of assumption(s) and/or facts followed by asking: "Now what would you do" (This is especially useful to change the class to an action focus.)
7. Normative action question: "What should X do now?"

Questions That Redirect the Class Process

8. Information followed by a question in which the instructor is looking for the next level of analysis: "Our calculations show that sales have been increasing by 50% per year. What impact will this have on the various functional areas over the next 5 years if this trend continues?"
9. Open-endedness of the question: soliciting a yes-or-no response versus an open-ended response.
10. Lengthy question that helps set the stage for the student, especially appropriate for students who are shy or are intimidated by classroom participation. (One caution: the lengthy question tends to give away the instructor's preferred vantage point and some of the answer.)
11. General question that asks for disagreement: "Does anyone disagree?" (This type of question builds opposition and can be used to increase the level of creative tension in the classroom.)
12. Question directed to a specific person asking for agreement or disagreement: "Jennifer, do you agree with the previous answer?"

13. General query for other viewpoints: "Are there any other viewpoints?" (This type of question if useful when the class has been going down a perceived dead end or has been supporting only one position.)
14. Specific question, which focuses discussion when the class has been excessively diffuse: "What now?"
15. Role-playing: "Steve, will you play the role of the president?"
16. Factual question or asking for more data or specific analysis concerning the case: "What is the debt/equity ratio for this company?"
17. Question asking for a lengthy and/or detailed answer: "Will you elaborate in more detail?"
18. Question that challenges and/or probes a particular student: "Michelle, do you really think that your solution will work in the long run?"
19. Sarcastic question, which puts the pressure on, tests the depth of conviction and the level of thinking.
20. The zinger, or the use of a series of questions to get a student to go out on a limb and then asking a question that recalls a previous piece of information that contradicts the position the student has just affirmed. Essentially, one cuts the limb off after having forced the student to step onto it.)
21. Reopener: "Are there any further questions?"
22. Summation or closure question, for which the instructor asks for a student to summarize the major points of the discussion: "Michael, if you had to choose two or three themes that were the most important findings in our discussion today, what would they be?"

Metaquestions (Questions About the Class Process or Content)

23. Opinion questions, which ask for the beliefs, opinions, or perceptions of the class concerning the case analysis or subject at hand: "Maryann, what are your thoughts about the analysis so far?"
24. Feedback question; this is often used at a point in the class at which several directions may be taken: "Where should we go from here in our discussion?"
25. Process question: "Geri, are you aware of whether or not the class is listening to what you are saying?" or "How many of you wish to change the focus of our discussion?"
26. Question concerning previous discussions: "What did Rob (the person speaking two minutes ago) say?"

Conclusion

Transformative competence can be enhanced by exposing both undergraduate and graduate students to various business situations that would require them to be actively engaged in analysis using the proposed improvement package concept. The improvement package is intended to vastly broaden the domain space of analysis and design hence increasing the probability of successfully introducing change into the organization under investigation, thereby bringing it (the organization) closer to its strategic intent.

It is also the intent of the authors to help improve IS/IT pedagogical instruction through the introduction of the concept of the improvement package and also by the provision of a set of carefully selected case studies, each associated with a specific theme, to assist both students and instructors to actively engage them in the analysis of business situations in an ever changing environment.

Bibliography

Applegate, Lynda et al (1996). [AM]
Corporate Information Systems: Text and Cases. Fourth Edition, Irwin, Chicago.

Cash, James Jr. (1994). [CE]
Building the Information Age Organization: Structure, Control, and Information Technologies. Irwin, Chicago.

Davis, Gordon, John Gorgone, Daniel Couger, David Feinstein, and Herbert Longenecker, Jr. (1997).
IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. Available through ACM and AITP.

Dumdum, U. Rex and William J. Tastle (1996).
Globalization, Team-Based High Performance Organizations, and Information Systems Education: Issues for the Extended Curriculum, 1996 IACIS Proceedings, Las Vegas, Sept 26-28, 1996.

Hammer, Michael and James Champy (1993).
Reengineering the Corporation: A Manifesto for Business Revolution, Harper Collins Pub, New York.

Harvard Business School (1996). [HB]
Baxter International, Case number 9-195-103.
AUCNET, Case number 9-190-001.
Pacific Pride Services, Case number 9-194-007.
Cybersmith, Case number 9-396-314.
Geffen Records, Case number 9-395-173.

Kanter, Rosabeth Moss (1995).
World Class: Thriving Locally in the Global Economy, Simon and Schuster, New York.

Katzenbach, Jon and Douglas Smith (1993).
The Wisdom of Teams: Creating the High-Performance Organization, Harvard Business School Press, Boston, MA.

Kriger, Mark (1993).
The Art and Power of Asking Questions *in* Charles Vance (ed), mastering management Education: Innovations in Teaching Effectiveness, Sage Publications.

Laudon, Kenneth and Jane P. Laudon (1996). [LL]
Management Information Systems: Organization and Technology. Fourth Edition, Prentice Hall, NJ.

Liebowitz, Jay and Mehdi Khosrowpour (1997). [LK]
Cases on Information Technology Management in Modern Organizations. Idea Group Publishing, PA.

Longenecker, Herbert E. (1995).
IS'95: A Curriculum Model for Information Systems: A Report, A Request for Involvement," A Keynote Address at the International Association for Computer Informaton Systems Conference, Toronto, Canada.

Lundberg, Craig (1993).
Case Method *in* Charles Vance (ed), mastering management Education: Innovations in Teaching Effectiveness, Sage Publications.

Martin, E. Wainright et al (1994). [MO]
Managing Information Technology: What Managers Need to Know. Second Edition, Prentice Hall, NJ.

Mitroff, Ian I. (1987).
Business NOT as Usual: Rethinking Our Individual, Corporate, and Industrial Strategies for Global Competition, Josey-Bass Publishers, San Francisco, CA.

Morgan, Gareth (1988).
Riding the Waves of Change: Developing managerial Competencies for a Turbulent World. Jossey-Bass Publishers, San Francisco, CA.

Porter, Michael E. (1996).
Changing Patters of International Competition, in Deans and Jurison (Eds), Information Technology in a Global Business Environment: Readings and Cases. Boyd and Fraser Pub. House, Boston, MA.

Tastle, William J. and U. Rex Dumdum (1994).
Information Systems Competencies for the 1990's: Issues and Challenges, the Journal of Computing in Small Colleges, Volume 10, Number 2.

Turban, Efraim et al (1996). [TM]
Information Technology for Management: Improving Quality and Productivity. John Wiley & Sons, Inc., New York.

Appendix: Selection of Themes and Cases Suitable for Instruction Using the Improvement Package Concept

Themes	Cases
1. Business Process Reengineering	• A Comprehensive Process Improvement Methodology (LK) • Business Reengineering at a Large Government Agency (LK) • Reengineering the Federal Government with IT (TM)
2.Improving the Effectiveness of Software Development through Better Analysis and Design Methodologies, Tools and Technologies	• Changing the Old Order: Sequencing Organizational and Information Technology (LK) • Cost and Benefits of SW Engineering in Product Development Environments (LK) • Systems Requirements and Prototyping: A Case of a Market Research Firm (LK) • USCINFO: A High Volume, Integrated Online Library Resources Automation Project (LK)
3. Strategically Planning and Managing the Information Systems / Technology Function	• H. E. Butt Grocery Company: A Leader in ECR Implementation (AM) • Air Products and Chemicals, Inc.: Project Icon (AM) • Toyworld: Information Technology Planning (AM) • Symantec (CE)
4. Telecommunications and Networks	• Implementing a Wide-Area Network at a Naval Air Station: A Stakeholder Analysis (LK) • Risk and Rewards at Frontier Communications: Improving Customer Service Using Client/Server Technology (LK)

4. Telecommunications and Networks (cont'd)	• Baxter International: OnCall as Soon as Possible? (HB) • AUCNET: TV Auction Network System (HB) • Geffen Records (HB) • Pacific Pride Services, Inc. (HB) • Cybersmith: Explore, Create, Compete, Connect (HB) • Singapore Tradenet/Leadership: A Tale of One City (AM) • Open Market, Inc. (AM)
5. Management Support Systems and the Effective Use of Corporate Data Resource	• Better Army Housing Management Through Information Technology (LK) • DSS for Strategic Decision Making (LK) • Data Warehouse Paybacks (TM)
6. The Human and Organizational Side of IS/T	• The Internal Revenue Service: Automated Collection System (CE) • Otis Elevator: Managing the Service Force (CE) • Informate the Enterprise: An Agenda for the 21st Century (A Reading: CE)
7. Recruiting and Developing IS/T Human Resources	• No Excuses Management (A Reading: CE) • Information Technology and Tomorrow's Manager (A Reading: CE)
8. Organizational Culture and Politics	• Business Reengineering at a Large Government Agency (LK) • The Clinical Information Systems: Case of MIS Leading Design Decisions (LK)
9. End-User Related Issues	• The Training Challenge: Installing a POS for Improved Reporting and Customer Satisfaction (LK) • End User Computing at BRECI: The Ordeals of a One-Person IS Department (LK)
10.IS/T Operations and Project Management Issues	• Introducing Expert Systems at The Corporation (LK) • Mismanaging a Technology Project: The Case of ABC, Inc. (LK) • Integrating Information Technologies into Large Organizations (LK)
11. Global IS/T Management	• Colliers International Property Consultants (AM) • Global Information Systems to Support Nestle's Global Business Strategy (LL)
12. Managing the Existing Portfolio of Legacy Applications	• American Foods Company (MO)
13.Outsourcing Selected Information Resources	• Pilkington PLC: A Major Multinational Outsources its Head Office Information Technology Function (TM) • Xerox: Outsourcing Global Information Technology Resources (AM) • General Dynamics and Computer Sciences Corporation: Outsourcing the IS Function (AM)

Attracting Non-Majors to the IS Department: Challenges and Strategies

Irv Englander
William T. Schiano
Bentley College
Department of Computer Information Systems
Waltham, MA 02154-4705

Abstract

The growing attention given to the Internet and electronic commerce in the popular and business press has generated tremendous increases in interest in and demand for computer science and information systems courses. Businesses are aware of a greater need for IS knowledge in all line and staff areas, with a corresponding focus in their hiring practices. Non-IS students see the benefits of developing a base of IS knowledge to complement their knowledge within their discipline. Through discussion of experiences at the authors' institution, this paper explores the issues of creating and delivering an attractive curriculum for non-majors while maintaining the quality of the major program.

Introduction

In most colleges and universities IS and CS courses for non-majors are seen as "service" courses that, while a necessary evil, are outside of the core mission of the department. Even IS minor programs are often simply treated as an ad hoc amalgam of courses designed for and predominantly delivered to majors. Students wishing to move beyond the basic courses are forced to take courses intended for majors. To date, there has not been sufficient demand to develop individual curricula for majors and minors.

While desirable, attracting students to an IS minors program creates new problems and costs, some of which may not be anticipated. Mixing majors and non-majors in the same core courses has led to significant "production" efficiencies, allowing for economies of scale in scheduling and course preparation. It also helps to increase the range of course offerings and to support additional faculty with diverse interests and capabilities. Conversely, the mix of students in the classes results in curriculum design that inevitably becomes a compromise between the majors' need for depth of technological understanding versus the minors' need for breadth and business relevance. This creates a frustrating situation both for students and for instructors. In general, the numbers of minors have been insufficient to allow the creation of alternative courses and curricula. Now, the evolution of technology into business is causing a significant increase in interest in IS courses and programs, which offers a number of new and exciting opportunities for IS departments: increasing enrollments, more diversity of course offerings, and improved courses for majors, among others. This paper discusses a number of alternatives and strategies for achieving these goals.

The Evolution of Business Demand for Technologically Competent Graduates

The extensive integration of computing into business commonly predicted for the last several decades is now essentially a reality in most firms and industries. Personal computer penetration for white-collar workers in the workplace is approaching 100% (Gault 1996) and it is generally assumed that most new white collar hires will be technologically literate. The growing focus on the use of the Internet for communication, information gathering, and electronic commerce has created additional need for individuals who understand the connection between the various business disciplines and information system concepts. As an indication of this need, the Gartner group predicts that by 2001 sixty percent of the U.S. labor force will have a legitimate business need for Internet access (Paulak, McGee et al. 1997).

The requirements of business are divided between the need for IS professionals who can plan and develop organizational information systems that satisfy rapidly growing and evolving business requirements and for specialists in other business disciplines with a solid background and understanding of IS technology and concepts (Clark, Cavanaugh et al. 1997; Melymuka 1997). At present, the reality of the marketplace, despite glib assertions by many about the younger generation's comfort level with computers, is that most business graduates are not prepared to use, manage, and plan for the broadening role of computers in business (Garner 1998; U.S. Department of Commerce 1998). As a result of this shortage, business college graduates so prepared enter the market at a substantial financial advantage. At Bentley College, 1997 graduates from the undergraduate Computer Information Systems program entered the job market at an average salary more than $8,000/year higher than the second place major. Just as significant, however, is the fact that other disciplines are finding that CIS **minors** are earning premiums of up to $10,000/year beyond the discipline major alone.

A Departmental CIS Strategy to Meet Business Needs

Business faculty sometimes argue that much of the IS knowledge needed by non-IS professionals could theoretically be delivered within the other business discipline curricula. The reality in most schools is that the faculties in other business disciplines do not possess the training, depth of knowledge, or interest in many of the aspects of IS that students will need, particularly in the face of rapid growth and change. Among the basic skills useful to a non-major with significant IS responsibility are systems analysis and design, networking, fundamental computer infrastructure, and database, as well as courses specific to the interface between IS and the various business disciplines. This suggests a substantial attraction for students to appropriate courses in the IS curriculum. It also fills an important and growing gap in the capability of graduating students that cannot easily be met by faculty in other business disciplines.

Although it is assumed that major IS development will be done by IS graduates, there is a substantial area of interaction between IS and business areas such as marketing, accounting, and finance. Bentley College views this intersection as vital to the future of business and central to the future of its graduates. To meet this need, the CIS department has formulated a continuously evolving strategic plan to attract non-majors to the department.

The strategy of attracting non-major students to IS courses and programs requires answers to a number of important curriculum-related questions. Most important, what skills or capabilities should an IS minors student have acquired at the completion of the minors program? This requires a careful examination of the career expectations of the students and of the businesses that will hire them. It seems clear that there is not a single answer to this question—that a number of different options or tailored programs are necessary to meet differing needs, interests, and requirements. This suggests at least some courses and programs to be designed in conjunction with our colleagues in other business departments, as well as courses developed from our own expertise.

Additional considerations include the ways in which to attract students to an IS minors program or to individual courses, how to design curricula that minimize the time required for individual counseling, and yet best meet students' needs, and how best to reconcile the inherent difficulty in integrating majors with minors and other non-majors into the department's programs.

Components of a Strategic Approach

The Bentley CIS department has developed a multi-pronged strategy to create courses and programs that initial results indicate meet the needs of business students in a way that is effective and attractive. The components of our approach include:

- New specialty business discipline majors that include a substantial IS component
- Minors and concentrations designed to meet the need of a wide range of business disciplines
- Specialized courses and electives grouped into clusters, that are tailored to specific groups and specific needs.

These components provide alternative options for business students to fulfill minors/concentrations and "joint" degrees or to simply take a specific course or courses of interest. The model attempts to avoid superficial "fun" courses that don't adequately serve students such as simplistic HTML authoring, web surfing techniques or tools-specific courses such as those offered by technical training organizations.

New Business Discipline Majors

Within the last year, faculty members in the CIS department worked with the Department of Accountancy to establish new graduate and undergraduate programs in Accounting Information Systems. New courses will be introduced in the CIS department to teach IS principles that meet the interdisciplinary needs of AIS majors, and IS faculty will also co-teach "boundary" courses with faculty in the Accountancy department. Appendix A shows the curriculum for this program. The new curriculum prepares students of accountancy to meet the needs of organizations with a heavy dependency on IS. The American Institute of Certified Public Accountants (AICPA) has identified six areas of new opportunity within an area called assurance services, which they define as "independent professional services that improve the quality of information – or its context – for decision makers." These six areas are comprehensive risk assessment, business performance, systems reliability, ElderCare Plus, health care effectiveness and electronic commerce. Many of these depend upon a solid foundation in accounting as well as information systems. Individuals in the CIS department are also working to establish similar programs with the Finance and Marketing departments.

Given the burdens of producing these new programs, the school has organized "platform" groups to focus on specific areas. Accounting Information Systems was the first group organized, and others are being considered around electronic commerce, role of group support systems, and marketing information systems. These groups will support curriculum at the undergraduate, graduate and continuing education levels. It is also hoped that bringing groups of similarly interested people together will lead to a more productive research community and facilitate greater communication among researchers at the intersection of business disciplines with IS, where little research and understanding currently exists. These platform groups are supported by a groupware infrastructure using Lotus Notes to reduce the burden of meetings. The CIS department is actively involved in these groups, raising the level of internal focus for the department, while also creating resource management challenges.

Course Clusters for Minors and other Non-CIS Majors

We have developed, and are teaching, the first of a number of planned clusters of courses that are intended to meet the needs of minors and other non-CIS majors. The clusters offer an opportunity to react rapidly to new developments in IS while keeping administrative overhead low. The IS department maintains control of the courses, but they can be taught out of any department, depending on the interests of individual faulty. These courses, taken as a group, will offer students in-depth knowledge in a specific area useful to augment their own business specialty. They are separate from the IS major, although majors may take the courses as electives. Clusters offer a means for packaging courses that integrate a particular area of technology or business focus. They provide a way in which to organize curricula for IS minors and are easy to administer. They can be built to support particular business needs recognized by other departments. Finally, they ease pressure on the department for individual counseling and advising.

The first cluster under development focuses on electronic commerce. Web skills, including web development, are in heavy demand across the curriculum (Thomson and Goyal 1996). The first course introduced as part of the electronic commerce cluster was a half-semester course on "The World Wide Web." The course description was left deliberately vague to accommodate the "moving target" nature of the material and avoid the need for annual reviews by the College's course change bureaucracy. In its initial iteration in Spring 1997, the course introduced students to the technology and use of the Web, taught HTML and introduced Javascript. For more detail on this course, see (Robertson and Schiano 1997). In its second pass, the web browsing and searching components have been absorbed earlier in the curriculum, and JavaScript now accounts for half of the course. We expect much of the HTML portion to be covered in the introductory "IS101" course next year and we will add dynamic HTML, the use of the Distributed Component Object Model, and other "advanced" features to the web development course.

The second course is Electronic Commerce, a full-semester course initially developed at the graduate level. The decision was made to develop it as a graduate elective open to IS and Management masters students with only a required introductory IS course as a prerequisite. We felt that graduate students would be more tolerant of the experimental nature of the material and that the business experience among the students would make it easier to test material about the business issues involved. The course was very well received and among the best rated in the graduate school.

The third course, presently in the planning stage, will offer a substantial introduction to the components, methodologies, and terminology that make up the technical infrastructure that underlies electronic commerce. For more on this course and the other courses in the cluster and on the process of developing an electronic commerce cluster, see (Schiano, Englander, 1998). In addition to the electronic commerce cluster, a separate programming cluster is planned that will offer C++, Unix and Java.

Half-Semester Courses

Our half-semester courses focus on a specific technology. Each course lasts seven weeks and is worth 1.5 credit hours. These courses allow us to unbundle the technology portion of an IS area from the theoretical underpinning. As a result, the technology portion of the material can be updated and changed rapidly and easily to represent current technology, without requiring complete redevelopment of the theoretical material underlying the technology. Although these courses require less theory than our regular, full-semester courses, they are not shallow, nor is the theory absent. Instead, the theoretical underpinning is presented by example. Half-semester courses move rapidly and require substantial homework effort. For more on the advantages of "unbundling" technology and theory courses, see (Waguespack, Chand et al. 1995).

In general, the theoretical courses represent the in-depth knowledge required by a CIS major. Certain half-semester courses are required for CIS majors to supplant the theory, but we are finding that it is possible to open many of the half-semester courses to all students. CIS minors can take certain theoretical courses and a number of half-semester courses appropriate to their specific needs and interests. We have found that it is possible to mix CIS majors and non-majors in half-semester courses without sacrificing quality and learning for either group.

Currently, we are offering half-semester courses in the IS aspects of web design, graphics, Visual Basic I and II, and Database design with SQL. In the immediate planning stages are half-semester courses in C, C++, database development and management with Access, Unix Programming and Use, and UNIX System Administration. The half semester courses are attractive to minors and other non-majors and offer IS majors exposure to practical applications of IS.

Observations and Current Results

Initial response to our strategic initiative has been overwhelmingly positive. In particular, the half-semester courses have proven to be extremely popular with students. We have not been able to offer enough sections of these courses to meet the demand. The number of CIS minors has increased within the past year, (the authors have requested this data and plan to include it in the final, published version of the paper) and is also attracting a significant number of new majors to the IS program. As a result, the basic logistics of delivering the curriculum described above are proving to be daunting. Scheduling courses around the core courses of other majors becomes important. Simply finding faculty to cover the courses that may be demanded can be difficult, as existing faculty have not previously focused on this type of course. Although they were designed to reduce administrative overhead, the half semester courses have introduced difficulties in logistics, including drop/add periods, managing incompletes, and the increased impact of missed classes. Quick grading turnaround is essential, to establish that students registering for a second-half course have met the prerequisites resulting from successful completion of its first-half predecessor. Where possible, we believe it would be easier to let the course run the length of the semester, with half the meeting time, to keep the course in sync with the rest of the college. In either case, close cooperation with the registrar's office is essential.

The number of new majors already attracted to the IS program by the new initiatives has created an additional scheduling problem. Because the new majors are "late starters" to the program, we have had to be more flexible in our course offerings and in managing prerequisite requirements.

We have observed that the new courses being offered in the curriculum need to be focused on business issues and the relevance of the material needs to be obvious on its face if the strategy is to be successful. If the relevance is not immediately obvious in the descriptions, if not titles, of the course students will need to receive advice about which courses to take and why. We have already seen a tendency of students to request courses on a "scattershot" basis, with the result that advising time has been heavy to direct students to appropriate courses to meet their needs. This will involve either a commitment of IS department time to advising or an education of advisors in other parts of the institution. Given the rate of curricular change in IS, reducing the need for advising to explain the value of courses is essential for reducing administrative overhead. We expect that a deeper understanding of the cluster approach will eventually alleviate some of this need.

The CIS department has been actively developing new relationships with other business discipline departments. By working with faculty in areas such as marketing, finance, accounting and law, we have helped develop courses that they will teach that will ultimately result in more opportunities for research and co-teaching.

Rapid changes in the technology, such as Visual Basic, JavaScript and HTML require constant attention. The unbundling of the technology from theory obviates the need to constantly change the theory courses, but does not change the need for faculty teaching the technology to keep up. We have adopted a policy of fixing the technology for the entire academic year, but switching to the latest versions between years. There were three main reasons for doing this. First, it allows us to exploit the new features. We have found this to be the least powerful reason since the earlier versions were generally far richer than we needed anyway. Second, it is a useful marketing tool to show state of the art software. Finally, the key reason is that it is difficult to source older versions of software for new students. A related problem has been the difficulty of obtaining appropriate textbooks that are current to the software version being used.

To ensure the relevance of the courses to non-majors, faculty developing the courses and, ideally, faculty teaching the courses need to understand business. For more CS-focused departments this represents a significant challenge. We have found that the business skills are essential in the development of courses, but that the delivery, at least at the undergraduate level, can be handled well by less business-savvy faculty.

Many of the courses for non-majors are outside of the core interests of faculty. This can create tension and sub-optimality as the gap between faculty research and teaching widens. While some faculty will express interest in the cross-disciplinary flavor of the non-major courses, we have tried to staff these courses with non-research faculty rather than disinterested research faculty.

As the number of non-majors taking courses in the IS department increases, faculty face an increasing challenge in balancing "rigor and relevance." In many instances, this is a false dichotomy and the real issue is between depth and breadth.

If an IS department is successful in this strategy, we anticipate that the number of non-majors will dwarf the majors. There may also be a dilution in the understanding of the value of the majors in the market. Students with IS minors will compete with majors for the same jobs, but will not have nearly the same depth of technological understanding. The large number of non-majors may also distract focus from maintaining a strong, deep major as generating attractive courses becomes more important. We are watchful as a department for the appearance of such trends.

The seven week courses have been complicated by the school drop/add period which allows students to enter the course in the second week. These students have missed almost 15% of the course, they can require extra attention from faculty, and are disruptive to the fast pace of the course as they struggle to catch up and to understand material already covered.

Faculty and staff with strong IS and business skills have been in strong demand in the market and within the school. Pressure on the CIS department to support and contribute to curriculum innovation in other departments has been high. As business programs follow the advice they have been giving firms for years and move away from strong "stovepipe" organizations, we can expect this trend to continue.

Despite the problems that have been raised by our initiatives, the department is pleased with the rapid evidence of the new programs' success, and plans to continue and expand our efforts

References

Clark, Charles E., Nancy C. Cavanaugh, et al. (1997). "Building Change-Readiness Capabilities in the IS Organization: Insights from the Bell Atlantic Experience." *MIS Quarterly* **21**(4): 425-455.

Garner, Rochelle (1998). "Pressure Gap: Transforming the IS Workforce." *ComputerWorld* **32**(5): 76(2).

Gault, Robert F. (1996). "The CEO's PC-Literacy Challenge." *Management Review* **85**(10): 29(3).

Melymuka, Kathleen (1997). "Skills Gap gnaws at IS Managers." *ComputerWorld* **31**(2): 64.

Paulak, E., K. McGee, et al. (1997). **The Rise, Collapse and Rebirth of the U.S. Internet Service Provider Market**, Gartner Group.

Robertson, J. Douglas and William T. Schiano (1997). "I Am Scheduled to Teach "World Wide Web:" Now What?" .

Schiano, William T., Englander, Irv.. "Developing an Electronic Commerce Focus within the IS Curriculum." Proceedings Of ISECON 98.

Thomson, Nancy and Amita Goyal (1996). *Integrating the Internet and WWW into Information Systems Curricula.* Information Systems Education Conference, St. Louis, Missouri, Education Foundation of the Data Processing Management Association.

U.S. Department of Commerce (1998). America's New Defecit: The Shortage of Information Technology Workers. Washington, DC, U.S. Department of Commerce Office of Technology Policy.

Waguespack, Les, Donald Chand, et al. (1996). *Crafting a Business Bachelor of Science Program in Information Systems Following on IS '95.* Information Systems Education Conference, St. Louis, Missouri, Data Processing Management Association.

Appendix A The Bentley College AIS Program
Required Courses for major in AIS:

Nine courses (21 credit hours):

AC 211 Intermediate Accounting I
AC 340 Accounting Information Systems
AC 376a Information Technology Auditing Fundamentals (1.5 credits)
AC 377a Information Technology Auditing Principles and Practice (1.5 credits)
AC 440 Advanced Accounting Information Systems
CS 230 Algorithms and Data Abstractions
CS 231 Programming Environment - Visual Basic (1.5 credits)
CS 360 Analysis, Modeling and Design
CS 361 Data Management with SQL (1.5 credits)

Electives: Three courses (nine credit hours). At least one of these courses (or three credits) must be an Accounting course and one course (or three credits) must be in CS.

AC 310 Cost Accounting
AC 377b Advanced Topics in Information Technology Auditing (1.5 credits)
AC 421 Internship in Accountancy (with AIS placement)
CS 232 Visual Basic Application Development
CS 233 Applications Programming I (1.5 credits)
CS 300 Security, Accuracy and Privacy in Computer Systems
CS 340 Computer Networks I
CS 363 Advanced Data Management Technology (1.5 credits)
CS 364 Rapid Application Development Technology (1.5 credits)
CS 460 Applied Software Project Management
EN 305 Writing for Accountancy
MG 342 Managing Technology-based Organizations
Other approved electives (e.g., Accounting, CIS, Finance, Statistics or Operations Management)

CPA Exam Eligibility

Those students planning to sit for the CPA exam should contact an advisor. Currently in Massachusetts, students electing this major would need to take three accounting courses in addition to the Required Business Courses listed above. These are:

AC 212 Intermediate Accounting II
AC 351 Federal Taxation I
AC 310 Cost Accounting or AC 320 Advanced Accounting.

Critical Success Factors in Large-Scale Integrated Information Systems Projects

Mary Sumner,
Southern Illinois University
At Edwardsville
Campus Box 1106
Edwardsville, IL 62026
Msumnera,siue.edu

Abstract

In the past several years many organizations have initiated large-scale integrated information systems projects, using such enterprise-wide packages as SAP, Peoplesoft, and Oracle. These projects often represent the single largest investment in an information systems project in the history of these companies, and in many cases the largest single investment in any corporate-wide project.

These large-scale integrated information systems projects bring about a host of new questions. Some of these questions and issues are-.

- How are these large projects justified?
- Do Finns need to change their fundamental business processes, organizational structures, and business strategies to fit the package?
- What are the technical challenges associated with implementing a large-scale package such as SAP?
- What is the best way to implement a large-scale package: To work through the organization unit-by-unit? Or to use a cross-functional approach?
- What are the critical success factors in the implementation of a large-scale package?
- What are the implications of these projects for the skill and knowledge requirements of the IT workforce?

Background

Some of the "success factors" associated with large-scale client-server implementation projects include securing the support of top management (Beath, 1991), improving or "re-engineering" business processes before implementing IT solutions (Hammer and Champy, 1993), and assuring close involvement between users and the IT organization (Mumford, 198 1).

With new technology, it is often critical to acquire external expertise, including vendor support to facilitate successful implementation. Also, the costs of training and support are often underestimated, and these costs may be many times greater than originally anticipated. Client-server implementations often bring "surprises" with respect to cost, because of the costs of decentralized servers, systems integration software, technical support, and software updates and version control (Caldwell, 1996).

The lessons learned from systems development projects can also pose some challenges for large-scale integrated projects. Some of the "best practices" in project management include effective external integration strategies, such as creation of a user steering committee, user participation on the project team, and user responsibility for education and installation (Cash, McFarlan 1992). In addition, successful projects require the use of effective internal integration strategies, such as *use* of outside technical expertise, *selection of* an experienced project manager, and selection of team members with significant previous work relationships.

Other systems development practices which contribute to project success are effective project planning, effective change control, business justification, compatibility of skills with the skill set needed for project requirements, and leadership by a "champion" who markets the project internally (Beath, 1991).

Causes of Information Systems project failures

Much has been written about the causes of information systems project failures. Poor technical methods is only one of the causes, and this cause is relatively minor in comparison to larger issues, such as failures in communications and ineffective leadership.

In Robert Block's analysis, there are twelve categories which classify most system failures. These are summarized in the table:

Failure	Cause	Result
1. Resource failures	Conflicts of people, time and project scope due to insufficient personnel.	Incorrect systems with poor reliability, difficulty with maintenance, and dissatisfied users.
2. Requirement failures	Poor specification of requirements.	Leads to developing the wrong system with many changes in requirements downstream.
3. Goal failures	Inadequate statement of system goals by management.	Leads to developing the wrong system by leading to requirement failures.
4. Technique failures	Failure to use effective software development approaches, such as structured analysis/design.	Causes inadequate requirements specification, poor reliability, high maintenance costs, scheduling and budget problems.
5. User contact failures	Inability to communicate with the system user.	Causes inadequate requirements specification, and poor preparation for accepting and using the information system.
6. Organizational failures	Poor organizational structure, lack of leadership, or excessive span of control.	Leads to poor coordination of tasks, schedule delays, and inconsistent quality.
7. Technology failures	Failure of hardware/software to meet specifications-, failure of the vendor to deliver on time, or unreliable products.	Cause schedule delays, poor reliability, maintenance problems, and dissatisfied system users.
8. Size failures	When projects are too large, their complexity pushes the organization's systems development capabilities beyond reasonable limits.	Caused by insufficient resources, inadequate requirements specifications, simplistic project control, poor use of methodology, and poor organizational structure.
9. People management failures	Lack of effort, stifled creativity. and antagonistic attitudes cause failures.	Time delays and budget overruns occur, project specifications are poor, and the system is difficult to maintain,
10. Methodology failures	Failure to perform the activities needed, while unnecessary activities are performed.	This type of failure can lead to any of the consequences of system failure.
11. Planning and control failures	Caused by vague assignments, inadequate project management and tracking tools.	Work assignments may overlap, deliverables may be poorly defined, and poor communication may result.
12. Personality failures	These are caused by people clashes.	Passive cooperation and covert resistance, with possible acts of vengeance.

Student Computer Clubs Fill Curriculum Void and Facilitate Student Careers

Gerald (Jerry) E. Wagner, Professor Emeritus
California State Polytechnic University, Pomona
and
Doris G. Duncan, Professor
California State University, Hayward

Abstract

The only thing sure about the computer industry is that it will be different tomorrow thereby requiring different skills and entry-level qualifications of college graduates. This paper will describe how student clubs can be used to supplement the academic curriculum while relieving some of the burden of adding more non-technical topics to already overloaded computer classes.

Introduction

One of the criteria used in evaluating academic programs is the measurement of success (or failure) in terms of an institution's ability to place graduates in positions related to their major. For this reason, colleges and universities must continue to reevaluate the needs of organizations that recruit graduates from their programs. They find themselves in a role similar to that of any business with a product to market. The product must fit a need. In our case, the graduate must have the skills and qualifications that are needed and/or desired by the organization doing the recruiting.

Rapid Technological Change

Academic programs that involve preparing graduates for employment in the computer industry face a much greater challenge than most other academic programs, because of the rapid rate of change in the industry. Software and hardware that were classified as "state-of-the-art" at the time a particular curriculum was designed or even at the time a student entered into a 4-year degree program, will probably change dramatically and may even become obsolete before a student can complete the requirements that were in effect at the time they entered the college or university. Job titles and the associated skills required for positions requiring Computer Information Systems (CIS) and related degrees are changing in an attempt to keep pace with the technology that is being used. According to one study, many of the job titles in use today didn't exist ten years ago (1). "As paradigms shift, and systems architectures change, it is inevitable that the required people skills and educational programs to provide those skills must change in a complimentary fashion" (2).

Balancing Technical and Communications Skills

Many research studies have been completed in an attempt to help identify the skills and entry-level qualifications desired of CIS graduates by employers. Many of the completed studies have concentrated on attempting to identify the technical skills, those related to hardware and software, preferred by employers. Other studies have found that more and more employers are looking for more than technical skills when recruiting CIS graduates because, "computer personnel need a balance of both technical and interpersonal skills to develop information systems (IS) that meet users' requirements" (3). "As has been the case for several years, technical skill will remain essential for professional success; however, in addition to highly developed technical skill, the future CIS professional must expend greater effort in the area of organizational communications if he or she wishes to impact the organization at the executive management level" (4). Based on at least one study, interpersonal skills are even more important that technical skills (5).

The results of other research supports the importance of the need for non-technical skills by CIS graduates. The non-technical skills most frequently mentioned are oral communication skills, interpersonal skills, and written communication skills (6). "Communications skills required of today's computer professionals include the abilities to write internal documentation, to write external documentation , and to make presentations both to small and large groups" (7). "The ability to communicate verbally seems to be a key factor in career advancement" and "... is the foremost skill new business information systems employees need from college .." (8,9). Another study further supports the importance of communication skills and identifies them as the most important for information systems professionals (10). According to Jiang (11), "IS positions are demanding communications, interpersonal, and management skills. Educational institutions must continually adjust their curricula to meet the challenging needs of the business world". Another non-technical skill requirement that is frequently mentioned is the ability to work in teams (12). The importance of being able to work in teams has been recognized in the latest version of the model curriculum for undergraduate degree programs in Information Systems. It states, "Graduates need to be able to interact effectively with clients and to work more effectively in teams" (13). In addition, in our complex and competitive business world, "political skills are an essential talent needed by computer professionals in the 1990s" (14).

With all of the research that has been done to identify the skills needed by CIS graduates to succeed in their chosen career, we would expect that most academic programs have been or are being changed to better prepare graduates for the "real world of work". Although that may be true for most of the technical skill areas, the authors firmly believe that little or no progress is actually being made to provide CIS graduates with the required non-technical skills such as those identified above. In our state, the Chancellor's office of the California State University System has established a policy that all courses, regardless of subject area, include a "writing component". Based on our personal knowledge, that policy is not being enforced on most campuses. One reason given by CIS faculty is that the expanding list of computer-related topics that must be included in the course precludes the addition of non-computer topics. In those cases where a writing assignment is being required of CIS students, the professor giving the assignment only grades the paper for subject matter content and not for grammatical errors. Why is this? In most cases, CIS faculty say that they don't have time to grade the students' use of English. Furthermore, they say that English isn't their area of expertise. Therefore, they are of the opinion that the subject area of written communications should be the responsibility of the English Department.
Having taught CIS courses for many years and having faced the dilemma of being forced to choose between various computer topics that are all believed to be important, the authors can understand the reluctance of CIS faculty to become involved with the actual teaching of English and other non-technical subject matter areas. Yet, we firmly believe that the value of these non-technical skills is too important to ignore and have utilized active student participation in departmental clubs as a method of providing students with the opportunity to enhance their non-technical skills. The following sections of this paper describe how student clubs can be used for this purpose.

Starting a Student Computer Club

Although there probably are one or more computer clubs on most campuses, the authors recommend that a club become affiliated with a major professional organization like the Association of Information Technology Professionals (AITP), formerly called Data Processing Management Association (DPMA), if a majority of that club's members are CIS/MIS majors. Becoming a student chapter of AITP is not difficult and the "Student Chapter Guidelines" (15) that are made available to student chapters are extremely helpful inasmuch as they provide numerous suggestions and ideas for organizing and operating a student club. There are many other advantages to becoming affiliated with AITP or another professional group in this manner. Some of those advantages will be discussed later in this paper.

The greatest benefits of club membership come to those who are actively involved in club activities. With that in mind, student clubs should be organized to provide all students with opportunities to be active participants. This means that club involvement should not be limited to the officers only. The student clubs in which the authors have been involved have been very successful in involving a large percentage of students members. In addition to the usual slate of officers, the executive board of the student organization should be expanded to include a student representative to the local sponsoring AITP Chapter as well as the chairs of other working committees such as: Programs, Publicity, Fund Raising, and Membership.

Depending on the total number of members in the club, each working committee should have other student members. The committee responsible for programs could have as many different members as the club has meeting dates during the year. Each member of the committee could then be made responsible for planning one meeting. That would include determining the topic for the program, obtaining a speaker, introducing the speaker at the meeting, and following up with a thank you letter.

This not only gives more students an opportunity to get involved but, by spreading the workload, students are more willing to accept the responsibility for one or two meetings rather than committing themselves to a full year of work. Other committees can be organized in a similar manner to provide opportunities for a greater number of students.

Benefits of Club Participation

First and foremost, most students are aware that active participation in extra-curricular activities such as clubs provides them with another entry for their resume. What students don't realize is that most employers only look positive on the mention of club involvement if the entry includes service as an officer of the club or on a working committee in some capacity. Many recruiters have been known to ask during an interview, "I note that you include membership in the computer club on your resume. Were you an elected officer or what role did you play in the club?" This question would suggest that membership, by itself, is not always helpful in the job search process.

The authors are of the opinion that the benefits of active involvement in student clubs goes far beyond the ability to include a reference of that involvement on a resume. Based on our experience, we find that students who have been actively involved in the ongoing operation of a student club are the same students who have made the greatest improvement in their interpersonal skills. Students are provided with the opportunity to gain experience in the non-technical areas of leadership, group politics, written and oral communications, working as part of a team and management. Some examples of how these skills can be enhanced by student participation in clubs are provided in the next sections of this paper.

Improved Communication Skills

Serving as a committee member or member of the Executive Board of a student organization requires students to work together toward the accomplishment of the club's goals. Oral communications is involved in almost all aspects of being part of a team or organized group that must work together. In some cases, this might involve communicating on a one-to-one basis, whereas in other instances it might involve trying to sell an idea to a large group. In addition to working with other students, members of AITP student chapters have an opportunity to attend the monthly meetings of the parent chapter thereby getting the opportunity to converse informally with professionals in the field.

Using the earlier example of the programs committee, a student is given the responsibility of planning the entire program for one or more meetings. Once the topic is selected, the student must identify potential speakers. This can be done through contacts with other students, faculty, or members of the parent professional chapter if the student organization is a student chapter of AITP. The student must then follow-up by phone call or by letter to potential speakers. Because of timing, a phone call is usually the preferred method of follow-up. After the student has received an affirmative response from a speaker, the student must then send a letter of confirmation with more information confirming the time, place, and topic of the presentation. The student may also request additional information that can be used to introduce the speaker at the meeting. As mentioned previously, the student then sends another letter to the speaker after the meeting thanking the speaker for his/her presentation. Although a student may have the responsibility for obtaining a speaker for only one meeting, the student has been given real life experience involving all of the communication skills desired by employers: oral communications on a one-to-one basis, oral communications involving speaking before a group (introducing the speaker), and the business letter writing aspect of written communications.

Improved Teamwork Skills

Working together on committees and in the planning of club activities gives students experience in working together. As is most cases, a student soon learns that everybody doesn't think as he/she does and that compromises are often necessary. Working on teams or as part of a committee also provides students with an opportunity to practice their leadership skills.

Improved Leadership/Management Skills

Students who serve as elected officers or chairs of committees gain valuable leadership experience. They are often responsible for determining what projects will be undertaken during a term or academic year. Then budgets must be established, activities must be identified, people must be assigned, due dates must be set, and the overall process must be monitored/managed.

An excellent example of a great learning experience involves planning a computer programming contest or conference. The student chapter at one of the author's campuses traditionally plans one major all-day conference each year. A theme is chosen, a keynote speaker and other speakers are identified and confirmed, facilities are reserved, a luncheon and refreshments for attendees during session breaks are ordered and publicity must be planned and completed if the conference is to be successful. Students, faculty, alumni, and professionals from the community are invited to attend these one-day conferences. In an attempt to reach the largest number of professionals, the student chapter will usually involve the parent chapter of AITP in promoting the conference. Because of the magnitude of this kind of undertaking, it gives a large number of student members an opportunity to get experience in many of the non-technical skills that are desired by employers.

The sponsorship of computer programming and/or systems analysis and design competitions are also a major undertaking, but not quite as challenging as planning a one-day conference. These can be designed to serve as practice competitions for students planning to enter a team in the competitions at the AITP Annual Collegiate Conference which is traditionally held each spring.

Although each club has a faculty advisor assigned, students should be given the opportunity to make their own decisions regarding what will be done and how it will be done. The advisor's role should be just that—advisory, with the caveat that he/she is there to help the students avoid violating any policies of the college or university or undertake any project without adequate planning. Table 1 summarizes the benefits and challenges of student clubs.

TABLE 1
STUDENT COMPUTER CLUBS: BENEFITS AND CHALLENGES

BENEFITS	CHALLENGES
Improve communications skills, including interpersonal skills	Challenge of motivating students to join, participate
Improve teamwork skills	Challenge of motivating faculty to advise student club
Improve leadership skills	Challenge of fund raising

Challenges of Student Clubs

Many of the benefits that can be gained by student involvement in departmental clubs have been described in the previous sections of this paper. Faculty who have been involved as advisors of student clubs are well aware that these benefits do not come without continued effort on the part of the faculty advisor and student leaders. Each of the challenges identified in Table 1 with suggestions for overcoming each follows.

Motivating Students to Participate

It has been the authors' experience that most students wait until their junior or senior year of college before getting involved with clubs. In the case of community colleges, it is often the second or last year which creates an even greater challenge for them. One of the problems that is created when students wait until their last year to join is that the newly elected officers have not had the benefit of experience. They often end up making the same mistakes that were made by the previous group of officers who have graduated. This is not productive or a benefit to the club or student members. The club and its members benefit the most when student members get involved in a variety of ways over multiple years.

The following methods of encouraging more students to become actively involved in the department club have been successful at the authors' universities. First and foremost, the department must show that it supports the club. This can be done in many ways. For example, CIS faculty can be encouraged to announce club meetings in their classes and make positive comments about the speaker and/or program for the meeting. Extra course credit could be given to students who attend meetings with topics that relate to a course in which they are enrolled. The assignment of a class project that relates to the topic for a club meeting would also help emphasize the value of club attendance/participation. In addition, attendance at club meetings and/or functions by faculty is taken as a positive sign by students.

Students are often reluctant to get involved in clubs and accept positions of responsibility because of the vast amount of personal time that will be required. As mentioned previously, this objection can be overcome if the workload is spread out over a large number of student members. The formation of committees with a large number of members makes it possible for more students to get involved without making a major time commitment.

The bottom line is that students will get involved if they see a benefit. This is often best illustrated by inviting successful alumni or other professionals to speak to the club about their present positions in industry, what they do, and how they attained those positions. Each speaker could be encouraged to mention those skills that have been most instrumental in his/her success.

Motivating Faculty to Serve as a Club Advisor

With the pressures on faculty to publish or perish and teach heavy loads, service as a club advisor often counts very little when it comes to promotions and tenure. Considering the supportive value of a good departmental club, service as a club advisor should be given equal weight to that given service on other major department committees such as curriculum and class scheduling. Once departments, colleges or schools of business, universities, and accrediting bodies as a whole recognize the educational value of student clubs, and recognize faculty advisors accordingly, more and more faculty will volunteer to serve as club advisors.

Fund Raising

Fund raising is a necessary part of virtually all successful student clubs. Funds are required to announce meeting topics and speakers, provide lunches and/or other tokens of appreciation for the speakers. Funds may also be necessary to help pay for the travel expenses of student members who present papers, participate in programming or systems case competitions, or attend professional conferences out of the local area.

Historically, student clubs have raised funds through membership dues, the sale of magnetic diskettes, car washes, bake sales, etc. Although these are all good, they often fall far short of meeting the financial needs of the club. Other fund raising activities to consider would include:

1. organizing and sponsoring regional programming and/or systems contests,
2. conducting mini-workshops and seminars,
3. organizing and sponsoring half day, full day or multiple day conferences with speakers from industry, and
4. job fairs.

In each of the fund raising examples above, registration fees would be charged. If a systems or programming competition were to be held, the top student team(s) from the club could be selected to represent the club at a national competition with a portion of the funds raised by this event being used to help pay the students' travel expenses. Student-conducted mini-seminars and/or workshops have been very popular on one of the authors' campuses. These seminars and/or workshops are usually of one-half day duration and are usually scheduled on Friday afternoon. Past topics have included PC Hardware, Windows95, and Navigating the Web. Attendees at these sessions included other students, faculty, staff, and members of the local community. The presenters have been student club members who received no remuneration and a classroom was used for the session so the only costs involved were for refreshments (if served). Although members of the local community are often charged a nominal fee to attend the seminars and/or workshops, students and other attendees from the campus community are admitted free.

A maximum of one major conference of one-half day or more should be planned and scheduled each year because of the major amount of time and effort that is required to do it right. In addition, the authors recommend that this be planned for some time during the spring term to give the working committee of the club as much time as possible for planning and making all necessary arrangements for an activity of this magnitude. A theme must be chosen; a date or dates must be determined; facilities must be scheduled; speakers identified, contacted, and confirmed: meals and refreshments must be arranged; announcements and/or invitations must be designed; publicity (e.g. web site) must be completed; and volunteer workers must be scheduled to help on the day of the conference.

This is a major undertaking, but one that could be made much easier if the local (sponsoring) chapter of AITP is involved. The local chapter members could help provide or identify speakers for each of the sessions. It could be an asset in promoting the conference by providing its mailing list or by publicizing the conference in its monthly newsletter. In the case of a conference of this nature, the attendees usually come from industry and are often alumni, employers who recruit from the campus, and other members of the computing profession. For that reason, the registration fees are established high enough to cover all costs associated with the conference as well as a profit for the club. Our experience has been that a major conference of this nature can be a good fund raiser as well as an excellent learning experience for the students involved.

Summary

The importance of non-technical skills such as oral and written communications, leadership, and management to CIS graduates is not disputed by most CIS faculty. Yet, the rapidity of changes in computer hardware, software, and applications has forced CIS Departments and faculty to choose between the inclusion of technical topics or non-technical subject areas in the curriculum. Based on the authors' knowledge and experience, most CIS faculty have chosen to stick with computer-related subject matter and have left the teaching of non-technical subject matter to other departments. Because of that decision, it would appear that many CIS students graduate without the desired level of communications and other non-technical skills.

The authors firmly believe that a properly designed and operated departmental club can help improve the desired non-technical skills of students. Participating club members can gain leadership, management, and teamwork experience by serving as an officer, chair of a major committee, or workshop leader. Oral communication skills and the ability to work as part of a team are enhanced by student participation in committee planning meetings. Many positions within a student club require written communications giving students an opportunity to gain valuable experience in that area as well. Lastly, students are faced with "political" situations requiring tact and compromise if progress toward a stated goal or objective is to be achieved.

A departmental computer club can help fill a void in the curriculum by providing a valuable learning experience to students without detracting from the primary mission of the department—that is to provide graduates with marketable skills related to the technical aspects of computers.

References

1. Mawhinney, Charles H, Morrell Joseph S., and Morris J. Gerard, "The IS Undergraduate Curriculum: Closing the Gap", **Proceedings of the Eleventh Information Systems Education Conference (ISECON'94),** October 28-30, 1994, 249-256.
2. Goldman, James E., "Design and Implementation of a Practical Business Oriented Undergraduate Data Communications Curriculum", **Journal of Information Systems Education**, Summer 1994, 80-85.
3. Young, Dale, "The Relative Importance of Technical and Interpersonal Skills for New Information Systems Personnel", **Journal of Computer Information Systems,** Summer 1996, 66-71.
4. Mott, Dennis L. and Aukerman, Rick A., "Communication Tips For CIS Professionals", **IACIS Refereed Proceedings**, October 2-4, 1997, 239-242.
5. Benbasat, I., Dexter, A and Mantha, R., "Impact of Organizational Maturity on Information Systems Skill Needs", **MIS Quarterly,** 4:1, 1980, 21-34.
6. Insley, Robert G., Becker, Jack D., and Breshears, Robert L., "Aligning Business Communication Skills Curriculum to Meet IS Managers Expectations of IS Graduates", **Journal of Computer Information Systems,** Summer 1996, 7-13.
7. Hanchey, Cindy Meyer, "Communication Skills and Programming Languages", **IACIS Refereed Proceedings**, October 2-4, 1997, 235-238.
8. Sivitanides, Marcos P., Cook, James R., Martin, Roy B., and Chiodo, Beverly A., "Verbal Communication Skills Requirements for Information Systems Professionals", **Journal of Information Systems Education,** Spring 1995, 38-42.
9. Hilton, T.S.E., "The Place of Interpersonal Communication Skill in Business Information System Curricula", **IBSCUG Quarterly,** Fall 1990, 10-15.
10. Albin, M, and Otto, R.W., "The CIS Curriculum: What Employers Want from CIS and General Business Majors", **Journal of Computer Information Systems,** Summer 1987, 15-19.
11. Jiang, James J., "Requisite Skills for new Business Graduates: Recruiters' Views", **Journal of Computer Information Systems,** Fall 1994, 28-30.
12. Leitheiser, R., "MIS Skills for the 1990s: A Survey of MIS Managers' Perceptions," **Journal of Management Information Systems,** Summer 1992, 69-91.
13. **"IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems",** Published by the Association of Information Technology Professionals, Association of Computing Machinery, and Association for Information Systems, 5.
14. Ketler, Karen and Walstrom, John, "The Changing Requirements for Information Systems Personnel: The Importance of Being Politically Astute", **Proceedings of the Eleventh Information Systems Education Conference (ISECON'94),** October 28-30, 1994, 160-166.
15. **STUDENT CHAPTER OPERATIONS HANDBOOK,** published by DPMA The Association of Information Systems Professionals (now AITP, 505 Busse Highway, Park Ridge, IL 60068-3191.

Proficiency Exams: An Aid To Student Retention

Martha M. Harvey, Midwestern State University
Carolyn R. Harris, Midwestern State University

The first group of computer literate students is on our doorstep. Academia must not impede the progress of these capable students by requiring them to enroll in the basic microcomputer applications course. By recognizing and responding to this changing student population, universities can increase retention, improve student and faculty morale, and expedite upper-level course enrollment. This paper describes the methodology of a small Texas university's response to this challenge.

Introduction

Retention is the constant companion for many small universities today. Student services, counseling, student centers, financial aid—all are designed to retain students. In the Division of Business Administration we make every effort to do our part. We work one-on-one with our students, promoting involvement through student organizations, work-study, and internships. But one of our most appreciated retention tools is the Proficiency Exam. This exam is given within the division in Microcomputer Applications with thoughts of adding a second exam in Business Communication and/or Business Environment and Public Policy.

Rationale

The department of Business Computer Information Systems originated the Microcomputer Applications exam in order to serve those students who enter the university with the computer skills necessary for success. One three-hour course in Microcomputer Applications is part of the university core requirement for all graduates regardless of major. Many students enter the university today with word processing skills. The traditional high school graduate may have completed a course in school. Some students are self-taught. A large percentage of our students are non-traditional and have developed computer skills in the workplace. From different backgrounds with different ages, they come to our university computer literate.

The entering students who are required to take the three-hour Microcomputer Applications course quickly become bored and disillusioned. The University insists they pay for a course they do not need, hand in assignments they could do before, listen to lecture material they have already mastered, and generally waste their time. Then we lecture about making the best use of time. These conflicting values disillusion the student and some drop out. With budgetary constraints of today's university, we need to retain each of these capable students by better meeting their needs.

The proficiency exam is one way to encourage the student. It is a way of recognizing the capabilities already developed and rewarding prior learning. It promotes a happy environment and a satisfied student. At our university, a student may elect to challenge a course by passing such an exam. There are exams in foreign languages, mathematics, computer science, English, and business administration.

Literature Review

Literature in the area of proficiency exams is scarce. Much of what does exist is no longer current and not applicable to the new skills of today.

Recent literature of interest to our study falls in the realm of Total Quality Management (TQM), viewing the student as a customer. This focuses attention on the students and their needs and enhances the quality of education (Schlechty, 1993). Other tenets of TQM are process improvement and empowerment of lower level personnel. TQM in the classroom can transform the educational process (Turner, 1995). Students who are empowered to challenge a course feel more in charge of their destiny and are more likely to be satisfied customers of the educational system.

However, viewing the student as the only customer of the educational system may lead to the erroneous conclusion that to achieve total customer satisfaction, we must give all A's or cater to a multitude of student demands. We can retain our perspective by also viewing the student as a product-in-process for other customers (Sirvance, 1996). These other customers include the next instructor in a sequence of courses and the employers of our graduates.

What are universities doing to accommodate students who have experiential learning? A cursory examination of college catalogs in our university library and on the Internet shows that virtually all of the universities represented accept CLEP exams and many have in-house proficiency exams in various subjects. The College Board states that more than 2800 accredited colleges and universities award credit for satisfactory scores on CLEP exams (www.collegeboard.org). A study by Jones-Delcorde (1996) shows that 1200 U.S. colleges and universities provide an assessment service of college-level learning through experience. A much earlier survey (Cangialosi,

1981) showed that 98% of respondents used various formats to award credit for extra-institutional learning.

Universities may be concerned with the economic impact of giving credit by examination. Valley (1978) addressed this and raised issues that still seem relevant. He cites studies that discuss the effects of changing enrollment patterns, the need for consideration of nontraditional students, and the positive impact of credit-by-examination on faculty, recruitment of students, and alumni support. Another early survey (Gillmore, 1974) showed that students who gain proficiency credit tend to graduate with more total credit hours and more credit hours in upper division courses. If a current survey indicates this is still the case, it has great economic implications for a university. The time spent in upper division courses is particularly beneficial for Texas universities, where state funding is higher for upper-level courses. Gillmore's study also showed that students with proficiency credit tended to graduate sooner and with higher GPA's that those with no proficiency credit.

Administration

The Microcomputer Applications Proficiency Exam is administered during the registration time period each semester, summer school included. The student pays a $35 fee at the university business office. Fifteen dollars of this fee remains with the business office, but $20 is sent to the Division administering the exam. The Division offers the $20 fee to the instructor administering/grading the exam, but our BCIS faculty declined the personal profit and has set up an account for these funds to buy specialty computer equipment/software for the students.

The exam is administered in our computer lab. Each candidate presents the receipt from the business office and receives a packet of instructions with diskette. This exam covers Microsoft Word and Excel for Windows 95. It is completely hands-on, requiring the student to perform a number of practical tasks. In Part I of the exam, the student must move, copy, number pages, italicize, underline, bold, and spell check several pre-typed selections as well as produce documents on their own. They format a letter, changing type style and size, change to unequal left and right margins, and print it on a furnished letterhead. In addition, the student must reformat an article to produce a newsletter utilizing several style and column changes. The topic of mail merge and several others are not included with the thought that the successful student can pick up these techniques if they are needed. Students do well on this word processing portion of the exam.

Part II of the exam covers the Microsoft Excel spreadsheet. A simple personal budget must be constructed from partial information. Automatic features (such as EDIT/FILL) for setting up dates, changing percentages, entering, changing, and printing formulas are required. Rows and columns must be inserted, and gridlines added and deleted in various positions. The sheet must be printed in landscape mode with a specified header. Students generally have more trouble with the spreadsheet portion of the exam than with the word-processing.

The exams are graded within a 24-hour time frame in order to allow the unsuccessful student to register for the class. A detailed grading-point scheme is provided, and three instructors grade each exam. Students must earn a minimum of 60 points out of 100 on each part with a combined score of at least 140 points in order to obtain credit for the course. Grades of A, B, C or "No Credit" are assigned. A student may decline his/her grade and elect to take the course.

Advantages/Disadvantages

Due to space limitations, regular sections of Microcomputer Applications are restricted to business administration majors. The proficiency exam, however, is not. Thus we are able to serve students from all areas of the university through this exam. A small additional income is also generated for the BCIS program.

This exam is not easy. Not all students who attempt this exam are successful. Our pass rate is approximately 68%. However, having been given an opportunity to pass the proficiency exam softens any unhappy feelings about being required to take the course. This results in a more satisfied student population. This 'happy' student is a retained student.

An obvious disadvantage to the proficiency exam is the lack of credit hour production. Each successful proficiency exam candidate lowers our credit hour production by three hours. But we believe that this credit hour reduction is overshadowed by the public relations aspect of student management. The student is delighted to be allowed to enroll in upper level classes more quickly. The university profits because funding in the state of Texas increases for upper level course. This proficiency exam promotes the qualified student to these upper level courses faster.

Conclusion

The first large group of computer literate students is entering the university now. The computer application course was designed 10 years ago to develop skills necessary for the business student to successfully enter the workplace. The need for these skills has increased. But we must recognize and respond to the changing student population. If we are to increase retention, students must not be required to spend their time or money on information that they already possess. Potential decrease in credit hour production is offset by increased student morale and the opportunity to fit higher level courses into an already limited time frame. Students perceive these opportunities as faculty commitment toward meeting individual needs. We in academia must respond quickly to this challenge.

References

Cangialosi, Judith, "Credit-Granting Practices for Extrainstitutional Learning in Postsecondary Education Institutions: Report of a Survey," College and University, v57 n1 p39-60, Fall 1981

College Board Web Site, http://www.collegeboard.org/index_this/clep/html/cred000.html

Gillmore, Gerald M., et. al, "Student Educational Benefits from Proficiency Testing: An Empirical Study," Educational Testing Service Technical Report, 1974

Jones-Delcorde, David H., "Non-traditional Education: An Important Option for Changing Times," Canadian Manager 21(1): 19-20, Spring 1996

Schlechty, Phillip C., "Schooling, Business, and the New American Dream," Business Horizons 36(5): 3-8, 1993 Sept/Oct

Sirvanci, Mete, "Are Students the True Customers of Higher Education?" Quality Progress 29(10): 99-102, 1996 Oct

Turner, Ronald E., "TQM in the College Classroom," Quality Progress 28(10): 105-108, 1995 Oct

Valley, John R., "That's a Very Good Question: The Economic Impact of Credit by Examination," Educational Testing Service Technical Report, 1978

Paradigm for a Master's Program in Information Systems Management

by

Dr. Ronald J. Kizior
Management Science Department
Loyola University Chicago

Abstract

Trying to develop and start a new academic program is always a formidable task. This paper relates the steps that were taken to develop a Master of Science in Information Systems Management [MSISM]. This process actually took one calendar year, and the first quarter of new students to the program started in September of 1997. We feel that we have developed a program for which there is a demand, and we hope to substantiate that by reaching our goal of at least 40 students enrolled by the end of the first academic year of existence.

Why start a Master's program in MIS? Is there a right time to start a Master's program? What gave you the idea to try to start a Master's program? The answer to these questions, and an explanation of how a Master's program in MIS was developed and finally executed is the purpose of this paper.

1. Idea Time[1]

A few years ago our MBA program went through a substantial change in curriculum and philosophy. An outcome of this change was a program that had more flexibility built into it. This was exemplified by the fact that there were more courses that were offered than before, and some structural changes in terms of required and elective courses. This was done in order to give the student more choices in the course selection process. In response to this, the management science department decided to offer several new courses, such as a telecommunications course, a strategic information systems management course, a client server course and a decision support systems course. The response to these courses and to some of the other courses that were previously offered was more than expected. Given the limited number of courses that a MBA student could take beyond the core level and the limited number allowed in an IS area of concentration, several students voiced some frustration that they could not take additional courses. There seemed to be quite an interest in courses that were a little more technical in nature than was the case before. With this experience, the idea came into existence that possibly a separate program, different from the MBA, but yet on the master's level might be of interest.

2. Competition Review

One of the first things that had to be done, which was during the summer of 1996, was to search out information on existing programs both on the local level and nationwide basis. The major focus was on what other schools were currently offering in this area. There were several programs that existed, but they had evolved out of management science departments, and therefore included a substantial amount of O.R. and math background. Others had been developed from electrical engineering departments, and therefore lacked the management perspectives. Since this was an opportunity of a lifetime, we felt that we could build a program that would have a management perspective, but yet provide a substantial amount of new technical information relative to today's information technology. Numerous brochures were reviewed from these local and national programs, in order to get some sense of the type of courses that were presently being offered. After sifting through these various brochures and the internet and comparing them to

1. A schematic is provided in Appendix B showing the flow of steps taken as referenced numerically in this paper.

the type of courses that we were currently offering in our MBA program, we came to realize the type of courses that we would like to include in our program in order to make it unique and one that we believe would be acceptable by the market.

3. Proposal Time

The next step was to write up a proposal for this program. The complete list of components that made up the proposal are listed in Appendix A. Part of this proposal was a description of the competitive analysis that we believed existed. We believed that we were starting with the student in mind, and focusing on the information systems area. We believe that other programs had been developed by creating courses specifically for the purpose of giving existing faculty members courses that they could teach. This was certainly not our objective. We wanted to create a curriculum that would be attractive to our customers, namely our students. We would then get the necessary faculty to implement these courses.

4. University Resources

The proposal went through numerous iterations. The IS faculty provided input and discussion regarding course content, along with numerous iterative reviews with the department chair. Although the courses that we were planning to offer were unique to our department and faculty, we did try to take advantage of some of the infrastructure and resources of the university. The catalog form that was developed was consistent with other university brochures. Conveniently, our accounting program had recently developed a masters in accountancy program, and had gone through the process of setting up various brochures, pamphlets, and application forms. The formats and description of various university resources provided an excellent starting point for describing our program. We also showed that in addition to the unique set of courses, other university resources, such as the library and computer facilities were on the same level as, and in some instances superior to, those of other institutions.

This proposal not only included the list of required courses, descriptions of each course, entrance requirements, and ancillary facilities available to each student, but also included an option for our own undergraduate MIS majors to stay on one more year to obtain their masters. This alternative program is what we refer to as our five-year program. This option would give our undergraduate MIS majors the opportunity to obtain a regular BBA degree in MIS after four years and then continue on for one more year and receive their Master's degree. we formally refer to this new master's degree program as our Master of Science in Information Systems Management [**MSISM**].

Once the proposal had gone through numerous revisions on the departmental level, it was then submitted to the Graduate School MBA Curriculum Committee, whose members include the dean of the business school, the associate dean and the director of the MBA program. An important part of the proposal was the budget. The budget was necessary in order to show the dean and other university administrators that this program would be self-supporting as well as to point out the resources needed to make the program viable.

5. Higher Level Approval

After making it through the MBA curriculum committee, the proposal had to be submitted to the university-wide Graduate School Coordinating Board. The various directors of all graduate programs within the university make up this Board. The Board looked at three important aspects of the proposal. First, they examined the academic creditability of the program. Second, they wanted to make sure that there was nothing overlapping with existing programs and courses. Third, they were concerned about the cost to the university and what resources would be used, and if there were additional resources necessary to properly complement the program. We assured them that the library and computer facilities were sufficient, and in some cases were superior to other universities. One of the reasons for the minimal strain on existing resources is the fact that this new program would be an evening program just like our MBA program.

6. Academic Vice President & Design Activities

The next step after approval of the Graduate School Coordinating Board was to submit this proposal to the Academic Vice President. His major concern was budgetary issues. How much revenue will this program generate? How many new faculty members do we have to hire? Can adjunct faculty be used, and what affect will that have on the integrity of the program. Actually, while this proposal was submitted to the Vice President's office, design on brochures was started simultaneously. Design of such documents usually goes through several iterations and it is also a rather time consuming process. Therefore, we wanted to start them as soon as possible.

7. Operational Level Activities

Once the proposal was approved by the academic vice president, then things switched to what we can call the operational level. There were several new courses that were a part of this proposal, and therefore these courses had to be made part of the registration system. The Office of Registration and Records [ORR] had to be contacted, and these new courses registered. Also, the program itself had to be registered with the Office of R & R.

Meanwhile, the parallel activity of designing the brochure continued. Other brochures used by other programs were looked at for ideas, especially the one that the Graduate Accounting Program had designed. We also took care that our design did not significantly resemble any part of theirs, especially the color scheme. Even though we wanted to be sure that our program was different, there were certain factors that we wanted to look at in order to make sure that our brochure was unique and identifiable, yet remain within certain parameters that were conformable with other university documents.

8. Web Page

During April of 1997 appropriate Web pages and links were designed with information for this program. By this time our printed brochures were received, and those students who had previously taken the GMAT exam, and who had specified Loyola, were sent not only the regular MBA brochure, but also received our new MSISM brochure.

9. Processing Information Requests

It was now a case of waiting to see what kind of response we got. Requests came from e-mail that originated from our Web site, as well as the return-mail card that people sent back which was part of the MSISM brochure that was mailed out.

10. Admission Activities

Letters of acceptance and rejection, application forms, and other written material had to be developed. All of these activities were basically done during the summer of 1997. All requests for information regarding the program were saved in a database, which is still growing currently.

One of the unique things of this entire process was that this was done without a formal university approved budget. Mailing, photocopying expenses, and graduate student help were all covered by our departmental budget. In order to get the brochures printed, special funds were provided through the dean's office. The official budget for the program did not go into effect until the start of the 1997-98 school year.

11. Committee on Admissions

One of the last things that was formed was the Committee on Admissions. This committee is composed of five members of the Management Science department, which includes the department chair, even though the chair does not teach within the program. The Committee on Admissions is now an on-going committee, which reviews all applications, and discusses all unique circumstances that may occur with each application. There are more exceptions than one can imagine.

12. Advisory Board

Another step that has not been completed is the formal creation of an Advisory Board. We expect to have 6 to 8 people participate in this board, and plan for them to meet twice a year.

13. Enrollment Goals

The overall goal of this program is to have 40 students enrolled within one calendar year. As of the fall quarter we had accepted 14 students, and 8 actually registered. For the winter quarter we accepted 10 student and 8 actually registered. And currently for the spring quarter starting in March we have sent out 16 letters of acceptance. Our goal is to try to average 10 new students each quarter. Under this projection, we would have 40 students enrolled by the time the summer quarter of 1998 is in progress. The above figures show that we are a little below projections, but with spring and summer quarters to go, we still might reach our goal of 40. Not bad for a first year program.

14. Business Scholars Program

Also in the works is the creation of a Business Scholars Program opportunity within the MSISM program. This is basically a graduate assistantship program. It is anticipated that the first award can be given at the start of the Winter quarter of 1997.

The assistantship would be good for four consecutive quarters. By starting in the Winter quarter, we insure that the graduate assistant would be around during the summer in order to help faculty with summer projects.

15. Final Comments

And lastly, throughout this proposal process, we have been in contact with and have received suggestions from the AACSB, in order to be within their accreditation guidelines. All that we can do for the time being is sit back and wait for the student to register.

16. Further Ramification

Once this MSISM program was accepted and in operational form we encountered several situations that we had not expected. One situations was an inquiry from students who may have started a master's program at another institution, and would like to transfer into our MSISM program. Would we accept them? Under the current policy, we our limiting the number of course that we are accepting from other graduate programs to two. This would reduce the required 12 course program down to 10 courses for those students transferring in from another graduate program.

In general we have found this program to be very receptive. We have found that several people accepted into the program have had master degrees already, but have decided to make a career change. They are therefore using this program to provide themselves with the appropriate background and foundation to pursue a career in the information systems area.

Appendix A

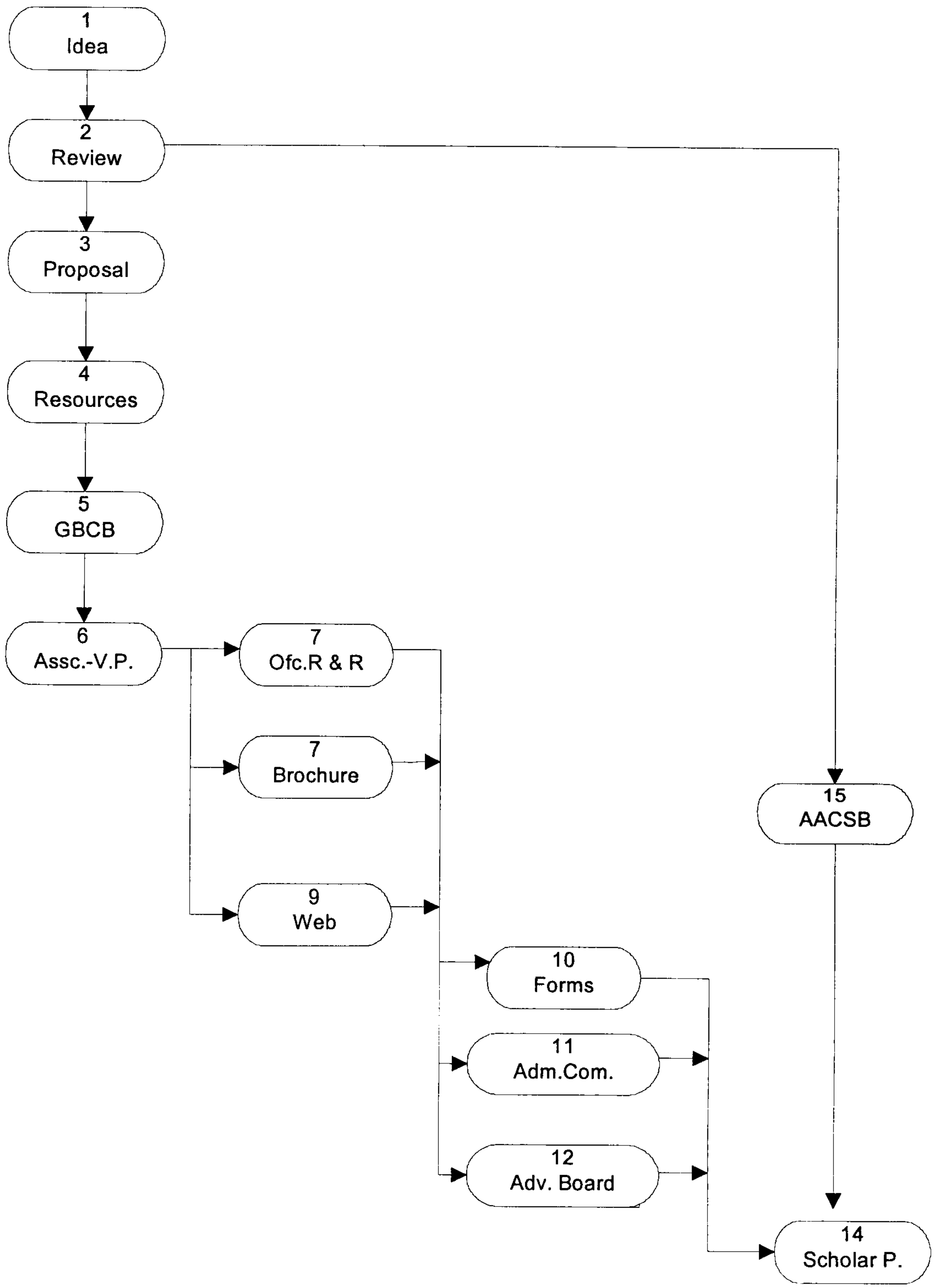
Program Proposal

Table of Contents

1. Motivation
2. Purpose of the Program
3. Competition Analysis
4. Resources and Accreditation
5. Location of the Program
6. Admission
7. Recruitment
8. Relation to Current Information Systems Concentration in MBA Program
9. Advisory Board
10. Curriculum
11. Five-year Program
12. Internships
13. Placement
14. Program Director
Appendix - I. Proposed Schedule for 1997-98
II. Course Descriptions
III. Cost/Benefit Analysis

Appendix B

Paradigm for MSISM



Evaluating Understanding in an Information Systems Course

MAJ Todd L. Smith
United States Military Academy
dt4571@exmail.usma.edu

LTC Nathan A. Buchheit
United States Military Academy
dn5017@exmail.usma.edu

MAJ Joe Adams
United States Military Academy
dw0205@exmail.usma.edu

Abstract

The need to integrate aspects of both Information Technology and Information Systems Design, as discussed in the *IS 97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems, 1997,* has led to the introduction of a new end-of-course project for the Computer Systems course taught at the United States Military Academy (USMA). Designed to provide a capstone experience, the project requires CS students to work toward a significant team goal, demonstrate an ability to evaluate technical components of a computer system, and accurately determine the information needs of an organization and make system-based recommendations. Although still relatively new, preliminary feedback indicates the value of such a capstone design project. Initial student response indicates the value of a project that ties together and integrates the various topics covered during the semester.

1. Introduction

Computer and information systems are critical to the success of organizations. They provide a means of achieving competitive advantage in business endeavors and efficiency within academic, government, and non-profit organizations. The importance of computer systems to organizations establishes a strong bond between educational programs and the need to teach both the theoretical knowledge and the practical application of information or computer systems (Mawhinney, Morrell, and Morris, 1994; Trauth, Farwell, and Lee, 1993). The Computer Systems Course, discussed in the following sections, attempts to accomplish both of these tenets. In actuality, its contents include two of the five recommended Information Systems Presentation Areas as discussed in the *IS 97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems.* These areas are shown in bold in Figure 1.

As indicated the Computer Systems Course integrates the aspects of Information Technology and Information Systems Development by first allowing students the opportunity to gain a depth and breadth of knowledge of the technical aspects of computer information systems. It then affords the students the opportunity to apply that knowledge to the actual decision making process of analyzing, planning, and designing an information system.

2. Background

The United States Military Academy (USMA) curriculum is very structured, requiring a heavy emphasis on science and math courses during the first two academic years. Each student is required to take an Introduction to Computing course during their first year as part of this emphasis. During their second year of studies, students choose a major and begin to take the lion's share of courses that directly relate to their selected majors. The Computer Systems Course is offered at this time and is a required course for Computer Science Majors and those pursuing a Field of Study that attempts to provide a practical, hands-on, breadth-first approach to information technology. It is a CS 2 course that introduces students to several areas including Operating Systems, Architecture, Networking, Multimedia, and Information Retrieval. The course focuses on performance analysis of computer systems and the components that affect performance.

Thus, the typical student taking the Computing Systems course is a first or second semester junior with only one previous Computer Science courses. Two factors add some diversity to the class makeup. First, some CS majors defer the course until their senior year and, consequently, may have already taken several other CS courses. Second, the course attracts students from other majors. The emphasis on Information Technology and its use of the World Wide Web as a vehicle to demonstrate principles draws a variety of engineering and humanities students.

3. Course Structure and Goals

There are two main objectives for the Computer Systems course:

1. Provide cadets the technical background in emerging technologies to allow them to design computer-based information systems.
2. Describe, analyze, and evaluate information systems and their components.

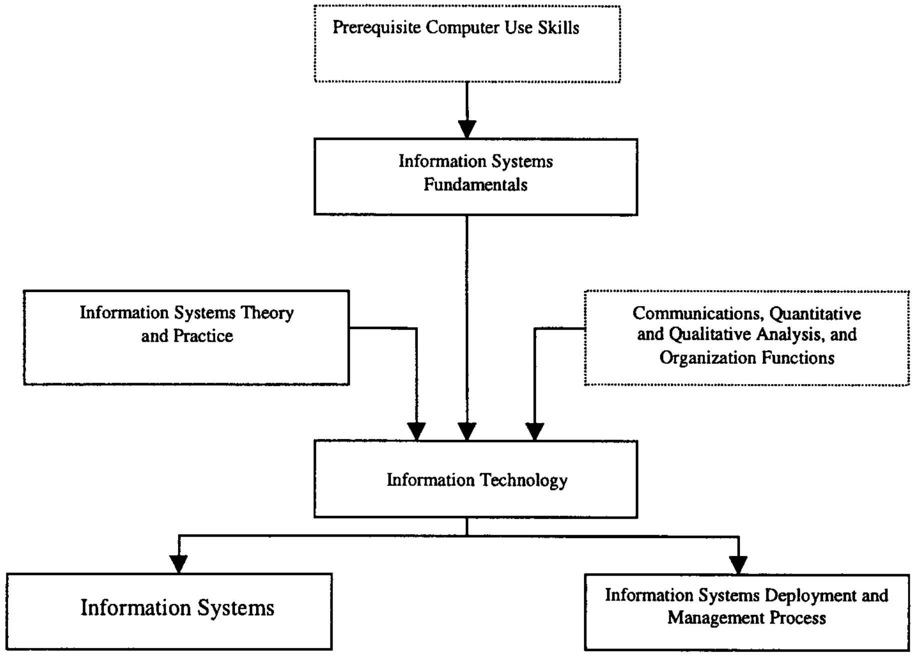


Figure 1. Curriculum Presentation Areas for IS Curriculum (adapted from IS 97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems, 1997)

Each daily learning objective is inherited from these two objectives. Instructors use a variety of means to evaluate progress. These include 14 daily quizzes, three or four homework sets, three exams, and four projects. The quizzes evaluate preparation for class. The homework and exams evaluate understanding of course concepts, and the projects provide a vehicle for evaluating the Analysis and Synthesis levels as discussed in the Bloom Taxonomy (Curtis, Carver, Lane, 1996). Project submissions are in HTML format and are evaluated for both web and organization context.

Computing Systems includes six major topics as listed in Table 1. Hypermedia and Multimedia topics are presented first. Students develop the skills necessary to complete their assignments during this phase of the course. The next topic area, Workstation, discusses the CPU, Memory/Busses, Storage, Input/Output, and Human Factors.

Following this, the subject of Servers is explored from both a hardware and software perspective. Privacy and Security are also included in this block of lessons. Servers conclude with three-student teams starting and administrating their own web server (World Wide Web Consortium, 1997). The course then addresses Information Systems Management and includes a total of six lessons covering topics such as Systems Analysis, Workflow, Decision Making, and Benchmarking. This is followed by three lessons on Networks and the course then concludes with three lessons on Information Retrieval.

Obviously, this is a breadth-first course that requires students to consider a wide variety of Information Systems topics. In order to facilitate the students' global comprehension, we created an end-of-course project that would require the students to 1) Work towards a significant team goal, 2) Be able to evaluate technical components of a computer system, and 3) Examine the information needs of an organization, and make a systems-based recommendation.

4. Description of the Final Project

During the 1997 Fall Semester a new capstone project was developed and integrated into the Computer Systems course. This project allows students to demonstrate their ability to design a computer based information system, thus illustrating both a theoretical and technological application of knowledge gained during the semester. Prior to this project being incorporated into the course curriculum there had been no such holistic approach to measuring the degree of student understanding of course material.

Topic	Number of Lessons
Hypermedia/Multimedia	5
Workstation	9
Servers and Research Presentations	6
Information Systems	6
Networking	3
Information Retrieval	3

Table 1: Computing Systems Topics

4.1 Problem Scenario

This project is adapted from an actual project currently being implemented by the United States Army. In the scenario, the student has just graduated and obtained a position at an educational facility. This facility is converting a floor of one of their buildings into an advanced learning center. They plan to have three types of classrooms on this floor: Level 1, Level 2 and Level 3. In a Level 1 classroom, instructors will be able to access digitized training materials and other required information through the instructor's multimedia workstation. From this workstation, the instructor will control the pace of instruction for the class. The Level 2 classroom builds on Level 1 capability by increasing interactivity with student multimedia workstations networked to the instructor's workstation. Students can train as a class, in various small groups, or independently. Distinguishing characteristics of Level 3 classrooms are the students' abilities to:

1) Control their learning pace,
2) Select the media with which they will learn,
3) Access worldwide sources of information,
4) Participate in training outside the confines of the classroom via the distance learning network.

We purposefully provide the students an abundance of information. During the Information Systems, section of the course, we stress the importance of an engineering design methodology (Suchan, 1997) consisting of a 1) Specification, 2) Analysis, 3) Design, 4) Implementation, 5) Testing, and 6) Maintenance. Using this methodology, the students create a concise problem specification from the voluminous requirements. They then identify the assumptions, constraints, inputs, outputs, constants, and variables associated with the problem. During the design phase, they decompose the problem into smaller problems that can be assigned to individual team members.

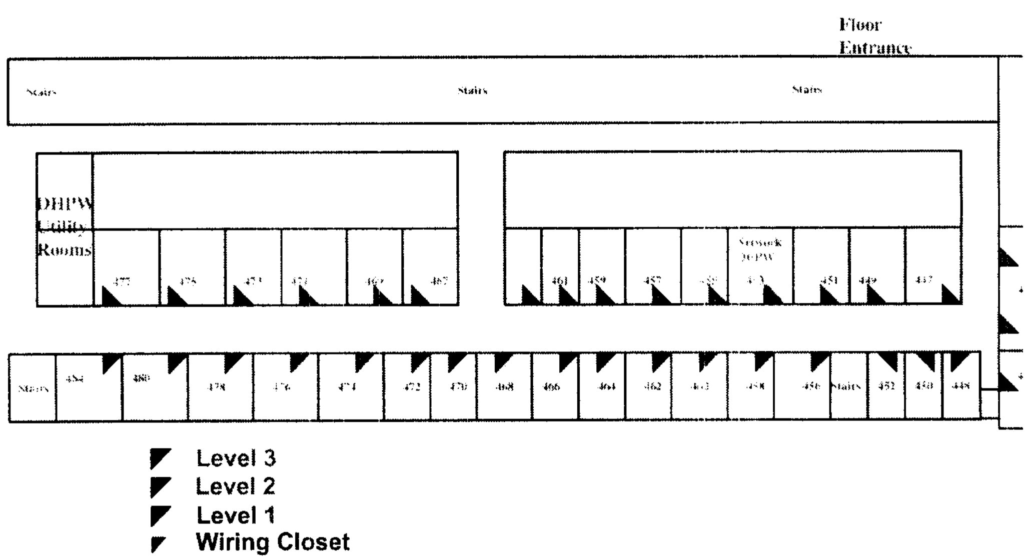


Figure 2: Learning Center Requirements

4.2 Project Requirements

Students are instructed to make recommendations to their manager in the following individual areas: student and instructor workstation configurations, projection equipment, teleconferencing, network equipment and topology, and network management. For each of these areas, we require that the students have three distinct courses of action and a set of criteria with which to evaluate the courses of action. The students use a decision matrix along with a sensitivity analysis to create a quantitative comparison of the alternatives. Finally, the student makes a final recommendation consisting of the integrated components. Additionally, they are required to consider the impact on the current staff with the restriction that there currently exists no funding for administrators. Instructors and current staff will have to maintain the classrooms.

One area that requires special consideration is teleconferencing. The project requires a system that is H.323 compliant, and the teleconferencing drives the bandwidth considerations. We do not cover teleconferencing in class, so students must determine the requirements during their problem analysis.

Students present the results of their project during the final three lessons of the course. During most presentations, the class and the team identified shortcomings in the recommendations that needed further study. This type of discussion is encouraged during the presentation and is used as a learning tool. Many teams made improvements to their project prior to the final submission based on these comments and discussion. Similar to other major submissions within the course, the students are also required to create a web site consisting of the complete results of their projects.

4.3 Team Composition

As stated previously, the class composition of Computing Systems is quite diverse. Though our students are typically in their third year, they range from second year to fourth year and also come from many different majors. Because of the disparity in student experiences, the scope of the project, and the importance of team building, we use three person teams in the final project.

We organize the students based upon three factors:

1) Major
2) Prior performance in the course, and
3) Dorm location.

First, we attempted to take advantage of the different backgrounds. CS Majors tended to excel in most portions of the course, but the final project encompasses many different domains. The best projects are those where the students take advantage of their diversity. Second, we tried to ensure that teams have one member from the top third of the class, one from the middle third, and one from the bottom third. Including quizzes and homework's, there are over twenty graded events during the term. This provides ample opportunity to assess student performance. Finally, since all of our students live on campus, we attempted to place students that live close together in the same group.

5. Student Feedback

After the second semester of using this project, we surveyed the opinions of the sixty-seven students. 63% of non-majors indicated that they benefited greatly from the final project. This compares to a value of 50% for majors. 100% of students indicated that they either benefited greatly or moderately. This compares favorably to the other projects and assignments in the class. Overall, students stated that they benefited greatly from 45% of the projects, benefited moderately from 38% of the projects, and benefited little from 17% of the projects (See Table 2). Many students indicated that they did not understand the importance of the material or the applicability until the final project. However, many indicated that they were not prepared to discuss networking issues after three lessons. This is understandable, but the diversity of the students provides a partial solution to this problem. With a CS Major in each group (some have had a networks course), the groups can task organize accordingly. Also, we stressed the practical aspects of networking rather than the theoretical. For example, we explain the usage of routers, hubs, switches, and firewalls as they are deployed in Information Systems.

6. Conclusion

Computing Systems is an exciting course within the Electrical Engineering and Computer Science Department because of its synergy. It is a blend of Information Systems, Information Technology, and Computer Science. It blends CS Majors, students of Engineering, and students of humanities. Finally, it addresses theoretical issues while stressing current market technology. Consequently, Computing Systems has become the initial course for the University's new Information Systems Engineering Major.

What we needed, however, was a capstone project that could bring unity and purpose to the disparity.

We believe this project accomplishes that goal. The Computer Science Majors have the opportunity to excel in the technical aspects. Engineering students can take advantage of their organizational and problem solving skills, and Humanities students can utilize their presentation and design experience. The scope of the problem is such that it necessitates research, consensus and effective team management. It forces the students to evaluate current technology in a challenging and timely environment. We have found the project to be an effective method of evaluating student knowledge and inspiring the students to research and evaluate the differences in current technology.

	Too hard	Too Easy	Neither Too Hard nor Too Easy
How would rate the difficulty of CS 383? **Majors**	6%	44%	50%
How would rate the difficulty of CS 383? **Non-Majors**	21%	0%	79%

	Benefited Greatly	Benefited Moderately	Little Benefit
Server **Majors**	33%	44%	22%
Server **Non-Majors**	15%	52%	33%
Final Project **Majors**	50%	50%	0%
Final Project **Non-Majors**	63%	37%	0%
Daily Quizzes **Majors**	11%	39%	50%
Daily Quizzes **Non-Majors**	64%	36%	0%
Product Report **Majors**	35%	24%	41%
Product Report **Non-Majors**	63%	29%	7%
Research Project **Majors**	50%	39%	11%
Research Project **Non-Majors**	68%	32%	0%

Table 2: Survey of Student Perceptions

7. References

Blair, Jean R. S.; Ressler, Eugene K.; Wagner, Thomas D; *The Undergraduate Capstone Software Design Experience*, Proceedings of the Tri-Ada '97 Conference, November 1997.

Davis, Gordon B., Gorgone, John T., Couger, Daniel J.; *Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems*, ACM, AIS, and AITP, available at http://info.acm.org/education.

Howard, Richard A; Carver, Curtis A; Lane, William D., *Felder's Learning Styles, Bloom's Taxonomy, and the Kolb Learning Cycle: Tying it All Together in the CS2 Course*, SIGSCE Bulletin, Volume 28, Number 1, March 1996.

Mawhinney, Charles L., Morrell, Joseph S., and Morris, Gerard J.1994. *The IS Curriculum: Closing the Gap*, ISECON 94 Proceedings, pp. 249-256.

Reeves, Douglas S., *A Course on Multimedia Technology for Computer Science and Computer Engineering Students*, Proceedings of the Twenty-eighth SICGSCE Technical Symposium on Computer Science Education, March 1997.

Suchan, William K.; Smith, Todd L.; *Using Ada 95 as a Tool to Teach Problem Solving to Non-CS Majors*, Proceedings of the Tri-Ada '97 Conference, November 1997.

Trauth, Eileen M., Farwell, D. W., and Lee, D.1993. *The IS Expectation Gap: Industry Expectations versus Academic Preparation.* MIS Quarterly, September 193, pp. 293-307.

World Wide Web Consortium, Jigsaw Web Server, Last Modified July 1997, http://www.w3.org/Jigsaw/User/Overview.html

Coordinating Multi-Section Courses: Using Multimedia and Intranets as Tools of Gentle Persuasion

Susan Helms and Gwynne Larsen, Metropolitan State College of Denver

Introduction

The effective use of appropriate technology in instructional delivery is a consuming issue in higher education today. This paper first investigates traditional methods of addressing the long-standing instructional issue of coordination of multiple-section courses, then the authors propose a simple approach to encourage consistency in content and delivery across multiple sections of introductory IS courses using multimedia presentations and simple text Intranet pages.

Multiple sections of courses, especially lower-level courses, are a common phenomenon in higher education. Whether the courses are required or elective, considerable effort has gone into the development of course content, and the introduction of new courses or modification of existing ones involves extensive approval processes. Some effort should then be expended to ensure that fundamentally the same topics, concepts, and skills are taught at the same depth and breadth from term to term in the multiple sections of these courses, particularly if they are courses required of various groups of students. Multimedia technology seems to lend itself perfectly as a vehicle to gather and disseminate necessary information.

Survey Methodology and Results

A thorough literature search revealed almost nothing on systematic course coordination efforts. To determine whether course coordination was in fact taking place at our college of over 17,000 students with more than 100 multi-section courses currently offered, a survey was taken. Since informal coordination of a small number of course sections can easily be implemented when only one or two instructors are involved, the survey dealt only with courses having 5 or more sections scheduled during the fall semester, 1997. The survey was completed by telephone, contacting one or more individuals in each department. Perhaps one of the most interesting results of the survey was the initial reluctance of most departments to discuss their course coordination efforts. In spite of the initial reluctance to discuss course coordination, the needed information was obtained from 83 courses in 23 departments. Table 1 displays a summary of the results.

How Multimedia Technologies Can Help

Even when common texts, syllabi, and exams are employed to ensure consistency in content across multiple sections of a course the delivery of that content and the relative depth and breadth of topic coverage can vary significantly. The involvement of many adjuncts and part-time faculty presents a potential problem with issues as simple as not being fully aware of the departmental goals and objectives for the course. Additionally, updates in the course goals and objectives may not be well implemented by full-time faculty who have taught the previous version of the course many times. One of the time-consuming aspects of teaching a new course for adjuncts, or for updating a course for regular faculty, is the development of new classroom teaching materials such as lecture outlines and overhead slides.

Multimedia presentations developed by faculty experienced with the local course objectives were found to be much more focused than the canned products available from textbook publishers. Much of the success of the presentations may have resulted from the fact that they were simply made available and not forced on faculty. Once available, faculty could use them in any fashion they chose, but at least students in each of the sections using the presentations saw the same outlines, the same terms emphasized, the same illustrations and diagrams.

How Intranet Sites Could Help

One of the major problems in coordinating multiple section courses with large numbers of sections is simply getting all necessary materials and information disseminated to the various instructors, particularly part-time instructors hired just prior to the beginning of the semester. In combination with available lecture presentations, a simple, text-only Intranet site could solve some problems by providing a repository for course materials as well as shared instructional tips and suggestions, exercises, etc.

Developing and maintaining this site would be an additional responsibility for a course coordinator, but would probably save time in the long run and provide a much better means of communication with instructors in their initial experience with the course. Combined with e-mail for ongoing communication, the Intranet site would ensure that part-timers and even late-hires did not slip through the cracks in their orientation to the course, and would provide a place where valuable suggestions could be available to all course instructors.

Discussion and Conclusions

The reluctance of departments to discuss their course coordination strategies and the absence of coordination efforts documented in the literature suggests that the whole area of course coordination for consistency of content delivery may be one of higher education's missing pieces. The results shown in Table 1, combined with initial reluctance to respond to the survey, suggests that coordination of multiple-section courses for consistency of content must not be a particularly high priority at this institution. That some course coordination is needed can hardly be argued when the following issues are considered: 1) approval for new courses or for changed course content is typically an elaborate process, 2) most multi-section courses are required courses and/or prerequisites for other courses, 3) accrediting agencies such as the A.A.C.S.B are mandating program consistency.

Many course coordination issues can be partially handled with some combination of common syllabi, texts, and exams. Most remaining course coordination issues are communication issues, for example, being certain that all the instructors understand the departmental goals and objectives for the course. Frequent meetings of all instructors to discuss the depth and breadth of coverage for specific topics would be ideal but not practical in large institutions with numerous part-time instructors. Hence the advantages of classroom multimedia presentations and Intranet sites are obvious. These tools are especially effective since they are non-coercive approaches with actual usage based primarily on the idea that using the tools is easier for the instructor than not using them.

As higher education in general is called to greater accountability by the public, by state legislatures, and even by accrediting agencies, some attention needs to be paid to ensuring consistency in content delivery across multiple sections of courses. In fact extensive coordination efforts may not be as important in content areas that are mature and slowly changing -- a de facto consensus may well have developed for courses in such areas. That cannot be the case for courses in rapidly evolving areas like information systems and other business and technology areas. Here the course content must be deliberately established and multi-section courses actively coordinated. Appropriate use of well-developed multimedia classroom presentations and useful intranet sites can be valuable, effective, non-coercive, time-saving tools in the coordination efforts.

Table 1
Results of Multi-Section Course Coordination Survey

Total number of courses responding to survey		83*	
Number of responding courses with 5-10 sections		57	
Number of responding courses with 111-20 sections		19	
Number of responding courses with >20 sections		7	
Percent of courses using common syllabus		67**	
Percent of courses using common text		69***	
Percent of courses using common exams		9.6	
Percent of courses having a designated course coordinator		51	
Percent of courses using formal meetings of instructors 24			
Methods of disseminating information:	28% office mail	34% email	29% one-on-one

*93 total
**some of these had required common elements and individual instructor differences
***a few of these had an approved set of texts from which instructors chose

Why Math and Science?
A Rationale for Inclusion in Information Technology Curriculum

Marcia Williams
NorthWest Center for Emerging Technologies
Bellevue Community College
3000 Landerholm Circle SE
Bellevue, WA 98007

Abstract

Employers want computer professionals who can think and solve problems. Math and science are excellent courses to help develop these skills. This paper identifies the non-content outcomes from studying math and science and suggests changing requirements to include math and science content that is closely related to the computer major. Among the sources for this research are industry computer professionals who were math or science majors.

Overview

When designing curriculum for Information Technology, computer content appears to be central and the most important component. However, considering how quickly products and approaches change, a course of study that only focuses on the latest software products and languages will produce students whose skills are out of date before they graduate. Ask the question, "What do employers want from entry level employees?" and among the items at the top of the list will be "a person who can solve problems, especially problems they've never seen before."

The NorthWest Center for Emerging Technologies [1] researched and documented the functions and skills for Information Technology degrees, publishing the results in *Building a Foundation for Tomorrow: Skill Standards for Information Technology*[2]. The eight career clusters included are: Database Administration Associate, Information Systems Operator, Interactive Digital Media Specialist, Network Specialist, Programmer/Analyst, Software Engineer, Technical Support Representative, and Technical Writer. Emerging careers currently being researched include: Web Designer, Systems Integrator, and Software Tester. Professionals in each career cluster rank problem solving as one of the most important skills for success.

Problem solving can be learned and taught through various disciplines. Pure problem solving is a *process* that is best learned when applied to problems relevant to the learner's long-term goals. Math and science deal with both *content* and *problem solving process*. In fact, math and science offer a unique perspective to the skills involved in understanding, approaching, and solving problems. Combining the math and science approach to problem solving with math and science content that is relevant to IT content would strengthen student preparation for computer careers.

Questions

A question is, Why teach Math and Science in an Associate level Information Technology curriculum? Graduates from IT programs have been successful with no science and only a minimum of math. Why fix something that doesn't seem broken?

Baccalaureate-level Computer Science programs traditionally require a year of calculus and usually a year of Physics. MIS programs require calculus and lab science. Are these the best math and science classes? Are there others that would be a better match?

In a time when the Information Technology Association of America notes 190,000 unfilled IT jobs, are current math and science requirements an unnecessary obstacle preventing otherwise capable students from selecting computer majors? Are there other content areas that can teach problem solving in a rigorous way?

New information from the IT Skill Standards demonstrates a gap between current programs and math and science skills. By analyzing the functions, one sees both math and science content and problem solving process skills. Additional thinking with respect to the results of studying math and science strengthen the rationale to include both math and science *content* and *problem solving* in new and updated IT curriculum.

Science is a way of thinking much more than it is a body of knowledge.

Carl Sagan

Content and Process

When considering math and science for Information Technology, most people think of the traditional math and science classes and see little relevance. But there are two distinct outcomes from studying math and science. The first, and most obvious, is the *content*, typically defined within courses such as Biology, Calculus, Physics, and Linear Algebra. The second, but less obvious outcome, is the mathematical and scientific thinking *process* that results from a disciplined study of these subjects. If you ask math or science majors who are not actively employed using the content of their degree, "What did you get out of your major?" the response will most likely be "a process of thinking." It is this process of thinking that is important for people in Information Technology careers.

Similarly, when you ask Information Technology professionals what math and science they use in their jobs, most often they will say "none" because they are thinking of content rather than thinking process. Traditional math and science courses are not oriented towards computer-related problems so it is difficult for students to understand the value of these courses to their long range career goals.

Given the task to develop scenarios that require some math and science content, brainstorming sessions with professionals from various IT careers produce many sample problems that new employees will be expected to solve. Presenting these relevant problems to the students first and then identifying the math and science they need to learn motivates students. Students don't ask, "Why do I have to learn this?"

Math and Science Thinking

Mathematics is the language of technology.

Leon H. Seitelman

What are the elements of mathematical and scientific thinking independent of content? Table 1 lists elements of math and science thinking that are *process* skills. These entries are the result of research from a variety of sources including the Web, a collection of reports/findings from research and professional groups, and data panels consisting of faculty and professionals. This is not to say that only math and science teach these outcomes, but that rigorous study in math and science uniquely prepares students with these skills.

The inclusion of communication as a math/science element may not reflect the current state of typical math and science classes. However, NCTM and professional science educator's organizations are advocating the inclusion of technical communication elements in teaching math and science.

All of the elements in Table 1 contribute to successful problem solving and are part of the content-independent outcomes that result from studying math and science.

Why Math and Science Content?

Content is the vehicle to teach *process*. However, it is not enough to require that computer students learn, for example, calculus because mathematics teaches good thinking. Computer students should be taught content that is relevant to their career goals.

In examining *Building a Foundation for Tomorrow: Skill Standards for Information Technology*, there are numerous performance criteria, technical knowledge areas, and foundation skills in the eight career clusters that relate directly to math and science content. For example, the Analysis task of Programmer Analyst includes the following, much of which is math *content*, but which includes *process* skills also:

- Information is accurate and complete.
- Ability to decide when enough information has been gathered.
- Determination of appropriate questions.
- Ability to pose critical questions.
- Ability to identify and prioritize the need for data.
- Appropriate information and data analysis techniques are applied.
- Ability to visualize tasks sequentially and identify interdependencies.
- Knowledge of estimating tools and methodology.
- Ability to predict outcomes/results based on experience or prior knowledge.
- Appropriate estimating techniques are used.
- Appropriate costs are identified and collected.
- Benefits are quantified over time.
- Return on investment is calculated accurately.
- Knowledge of principles of cost/benefit analysis.
- Ability to project possibilities and consequences.
- Ability to forecast mathematical outcomes/events.
- Ability to evaluate mathematical data/applications.
- Ability to examine information/data for relevance and accuracy.
- Ability to judge logical consistency.

Examination of the other clusters produces other lists.

Math and science content such as statistics, data transmission, magnetism and data storage, functions, logic, and geometry are appropriate in one or more clusters. Each of these can assist in teaching math and science thinking while providing relevant content to the long term goals.

Table 2 is a preliminary list of content areas and their potential for inclusion in the eight career clusters. Some of the content entries are directly found in the Skill Standards, while others are inferred through additional inquiry to career specialists.

It is important to note that the Skill Standards identify tasks and functions and do not specify *content*. Thus, to rely on the Skill Standards as the only input to content would not be sufficient to design curriculum. Faculty, industry professionals, advisory committees, and other groups add specific value to transforming the Skill Standards to curriculum.

Recommendations

Recommendation 1 Include both math and science content and thinking in IT curriculum, using context-based problems.

Teach just-in-time content, a departure from just-in-case content. Collaborate with IT professionals to develop and enhance activities. Identify both process and content objectives.

There are three key points to this recommendation:

- Include math and science content.
- Include math and science thinking.
- Integrate math and science in context with IT-relevant topics.

Example 1.1 Data Transmission (Network Specialist, Technical Support, Computer Operations)

Your team will construct integrated circuits to transmit amplitude modulated voice from one side of a room to another, using either radio, infrared, visible light, or electrical signal. Write a user's manual for your device and a trouble-shooting guide. Deliver the project to another group, who will attempt to create a source of interference that will prevent the device from working. The original group will then work to overcome the interference.

Example 1.2 Physics for Technical Support

The NorthWest Center for Emerging Technologies piloted an innovative science course for Technical Support students called *Cyberscience*. It included units in magnetism, electricity, integrated circuits, and data transmission. Physics instructor Art Goss started by asking students what happens when one puts a magnet near a computer. The students developed experiments to test the effect of magnetism on storage disks. They practiced hypothesis development, data gathering, and technical writing. They learned how the read/write heads work on computer drives and created a three word code on a piece of magnetic tape using a magnet.

All of the activities and content were drawn from that part of physics that relates to the computer. On the process side, students learned how to:

- Describe and apply the basic principles of the scientific method
- Develop, test, and justify hypotheses
- Select an experimental process, make accurate measurements, and analyze results
- Make connections between and draw conclusions based upon separate sets of data
- Analyze and solve problems using scientific methods
- Record, organize, and display data in a rigorous and logical manner

By starting with scenarios that relate to the computer and math and/or science, it is not difficult to develop context-based course material. The outcome is both content and process that are addressed by math and science.

Recommendation 2 Develop Math and Science activities specific for the cluster.

Starting with a group of professionals, brainstorm activities that graduates will be expected to complete in years 1-3 after graduation. Consult the Skill Standards, identify the math and science content and thinking.

Example 2.1 Measuring Data Transmission (Database Administration, Computer Operator, Multi Media, Network, Programmer/Analyst, Software Engineer, Technical Support)

Record the speed of data transmission of various kinds of files (word processed document, graphic, video clip) on different computer configurations (CPU speed, RAM, speed/kind of modem, type of communication media). Vary the size of the files (longer/shorter document, larger/smaller graphic, longer/shorter video clip). Create appropriate visuals to present the data. Devise hypotheses about the relationships between file size, computer configuration, and transmission speed. Does double file size imply twice as long to transmit? Does double CPU speed imply half as long to transmit?

It is important for technology workers to understand the impact of sending files of various sizes to locations.

Example 2.2 Hexadecimal representation of colors (Multimedia)

Produce a color chart for the various shades of a color by specifying the hexadecimal representation of the colors. Include at least 32 entries whose hexadecimal identifiers are sequential.

The eight career clusters have some math and science activities and content in common, but they are unique enough to not start with the idea of a core math and science content curriculum. However, the process thinking skills that are identified in Table 1 should be taught with the appropriate math and science content and reinforced through the computer content.

Example 2.3 Help Desk Statistics (Technical Support)

Students spend two quarters in an on-campus Help Desk internship, supporting faculty, staff, and students who use college-owned computers. Calls come to the Help Desk and are logged into a Call Tracking System.

Students take the data from three weeks' activity and produce statistical reports on their own performance including:

- call volume
- numbers of calls solved by the student and referred to networking, support, hardware, and the phone system
- number of calls open more than four days

They prepare the statistics in a table format. Then they compare their statistics to previous reporting periods and to the performance of other students. Using past experience, students devise future performance goals. They also gain an awareness of metrics and how they will be used to measure individual and team performance.

Recommendation 3 Provide instruction in the problem solving *process*, including elements from Table 1.

Help students make connections between *content* and *process*. For example, when simplifying rational expressions to solve for x, help students see how *simplification* generally makes problem solving easier. How can this idea be applied to other problem solving scenarios?

Use class discussions and student journaling to help students understand the problem solving process. What did they do when they got stuck? How did they know which direction to try next?

Example 3.1 STARR Report (Technical Support)

In this written assignment, students use the STARR structure to describe a problem solving activity they have completed. The components are: **S**ituation, **T**asks, **A**ctions, **R**esults, and **R**elevancy. Each section has a specific set of questions. The Actions section gives good insight into the problem solving process and the Relevancy section describes how the student will use lessons learned in future situations.

Summary

Typically, our teaching and learning focus is on "getting the right answer." With technology undergoing such rapid change, today's answers have little relevance to tomorrow's problems. Developing skills to solve problems one has not previously encountered will raise the value of a graduate to prospective employers.

A proposed strategy to increasing the level of problem solving skills for IT graduates is to infuse math and science thinking, particularly the skills listed in Table 1, throughout an IT curriculum. In addition, including relevant math and science content will reinforce the thinking skills as well as add increased value to the graduate. The ultimate result will be to increase the IT graduate's ability to solve problems.

The scientific mind does not so much provide the right answers as ask the right questions. Claude Levi-Strauss

References

[1] The NorthWest Center for Emerging Technologies (NWCET) is an NSF-funded Advanced Technology Education Center. Additional funding is from Microsoft and Boeing.
[2] Available through the NWCET website: http://nwcet.bcc.ctc.edu

Math/Science Element	Description
Analytical Thinking	Ability to use reasoning involving truths that are logically consistent.
Precise Language	Ability to define terms unambiguously; ability to make statements in terms of observable and quantifiable data; ability to question statements and conclusions for clarification of ambiguous terms.
Logical Thinking	Ability to use reasoning based on relationships among propositions in terms of implication and contradiction; looks for consistency and inconsistency; ability to make logical connections between hypotheses and data, and develop appropriate experiments; able to sustain a consistent approach in complex, multi-step problems; ability to classify problems.
Problem-solving	Ability to approach problems in a systematic way, to look for patterns, to recognize elements that meet consistency and inconsistency with past experience and knowledge; includes the ability to break problems down into smaller components, restructure them, develop new approaches, challenge assumptions, suspend judgment, and brainstorm.
Conceptualization	Ability to ask the right questions; how a person approaches a problem; ability to answer the question asked, not a different question.
Data Gathering	Ability to identify needed data; ability to observe, organize and record data; ability to recognize unexpected evidence.
Data Analysis	Ability to organize and evaluate data in a way that leads to conclusions and decisions consistent with the data; knowledge of when there is sufficient or insufficient data; ability to judge reasonableness of result.
Computation	Ability to accurately perform mathematical operations.
Estimation	Ability to estimate results; ability to evaluate results for reasonableness and recognize when a result does not seem probable.
Prediction	Ability to predict probabilities and outcomes with degrees of certainties; understanding of cause and effect.
Hypothesis Development	Ability to construct a falsifiable hypothesis from which an experiment can be designed; ability to specify that data that would support or contradict a hypothesis.
Modeling	Ability to represent relationships and data in another way, using a model such as an equation, diagram, or graph; ability to abstract from specific situations to general situations; ability to apply general models to specific instances.
Experimentation	Ability to design an experiment or observation to test a hypothesis, duplicate results, understand control factors, use experience form other situations, learn how to eliminate variables.
Simplification	Ability to take complex relationships and problems and reduce them to related simpler problems with fewer variables; ability to work with parts of a problem and apply the results to more complex problems.
Pattern recognition	Ability to recognize patterns from discrete instances; ability to question universality of generalization; ability to generalize specific instances into formulas and make conclusions.
Communication	Ability to communicate technical information to non-technical audiences; ability to write/explain procedures to describe technical processes or algorithms.

***Table 1** Elements of Math and Science Thinking independent of content*

Content Area	Database Admin	Operator	Multi Media	Network Specialist	Program/ Analyst	Software Engineer	Technical Support	Technical Writer
Statistics	✓	✓		✓	✓	✓	✓	✓
Functions	✓	✓	✓	✓	✓	✓	✓	✓
Logic	✓	✓	✓	✓	✓	✓	✓	✓
Relational Algebra	✓				✓			
Number Systems	✓	✓	✓	✓	✓	✓	✓	
Geometry			✓					
Linear Equations						✓		
Exponents and Logs						✓		
Magnetism		✓		✓			✓	
Electricity		✓		✓			✓	
Integrated Circuits		✓		✓			✓	
Data Transmission	✓	✓	✓	✓	✓	✓	✓	
Cost/Benefit Math	✓		✓	✓	✓	✓		✓
Calculus						✓		

Table 2 Suggested math and science content for each career cluster

Investigating How Female Computing Students Differ from Other Students - Phase I

Carol Chrisman
cachrism@ilstu.edu

Thomas P. Schambach
tpscham@ilstu.edu

Applied Computer Science Department
Illinois State University
Normal, Illinois 61790-5150

Abstract

The ratio of women seeking computing degrees has been declining at an alarming pace over the past decade, contributing to the critical labor shortage in the computing field. This study investigates how female freshman students intending a computing major differ from other college freshman; such investigation is needed in order to determine critical factors that may influence young women's career choice decisions and selection of computing related fields of study. Data for analysis in this study was collected via survey methods using self-reports and perceptions of nearly 2700 individuals preparing to enter their first semester as college students. Important factors for investigation included the high school academic experiences and the academic self-confidence of these students. The student sample was split to evaluate the perceptions of probable computing major females compared to other freshman females, and to compare probable computing major females to their male counterparts. Probable computing major females differed notably from other freshman females in that they had substantially higher academic self-confidence and had participated in more computing oriented courses as part of their high school curriculum. Furthermore, compared to males, females' choice of computing major appears to be highly influenced by both academic self-confidence and computer related high school course experiences.

Introduction

Many people and organizations are concerned about the shortage of women entering computing careers. There is a critical labor shortage in computing and, although women are more than half the population, they are a significantly underrepresented percentage of the population earning computing degrees. According to the National Science Foundation [Hill 1997], bachelor's degrees awarded in mathematics and computer science declined among both men and women from 1985 to 1995; in computer science, the percent decline in degrees to women was nearly twice that of men. NSF reports that in 1985, 14,431 women earned degrees out of 39,121 total bachelor's degrees in computer science, but in 1995 only 7,063 out of 24,769 bachelor's degrees were to women reflecting a 51% decrease in CS degrees awarded to women. Whereas data shows actual CS degree awards to women has declined, the critical labor shortage in the computing profession could be alleviated if women were effectively encouraged to participate equally with men in the profession.

Fortunately, increasing enrollments in computing programs at our university show that students are responding to the abundant job opportunities in the computing profession. At our university, enrollments in our department's Computing programs have increased by 69% in the period spanning Fall 1991 through Fall 1997, with actual enrollment increasing from 463 to 781 majors. Distressingly this enrollment increase does not reflect equal attraction and participation by female students; the percent of women with computing majors has declined from 30% in 1991 to 24% in 1997. This pattern of declining female enrollment parallels the national decline in CS awards to women [Hill 1997] . This is a cause for concern within our department and for our Industry Advisory Council and other frequent recruiters of our graduates.

Previewing Perceptions of Incoming Freshmen

In attempting to improve female enrollment we decided to first assess the computing related attitudes and experiences of students transitioning from high school to college. The Cooperative Institutional Research Program (CIRP) is a national longitudinal study of the American higher education system. Established in 1966 at the American Council on Education, the CIRP conducts annual freshman surveys and is now the nation's largest and longest empirical study of higher education, including data on some 1,400 institutions and over 8 million students. The annual CIRP freshman surveys are now administered by the Higher Education Research Institute at the University of California, Los Angeles, under the continuing sponsorship of the American Council on Education. The CIRP freshman survey is an extensive 4 page questionnaire that gathers a wide variety of information about the realities and perceptions of incoming freshmen. The 1996 CIRP Survey [Bae 1997] shows that men and women differ greatly in their intended fields of study. An indication of the relative interest men and women have in computer science at the college level is given in the 1996 data where 4% of entering freshmen men but only 1% of entering freshmen women report they intended to major in computer science.

Our university is one of those taking part in the CIRP freshman survey. The CIRP freshman survey is administered to new freshmen during a summer on-campus preview activity. Each participating institution receives the data about their students so that they can conduct further studies on their own. We decided to examine our university's data and specifically to investigate the responses by students indicating their intended college major as computing. We compared information on this group of intended computing majors to information on all freshmen from our university (who completed this freshman survey); more particularly we examined the new students' self perceptions and high school academic experience with a particular focus on potential gender associated differences.

Our long term research goal is to understand what influences female students to choose a computing major and to investigate interventions that may enhance female proclivity for enrollment. The research described in this paper focuses on the freshman student's answers to two components of the survey: the amount of high school preparation in certain subject areas and their self rating on certain traits as compared with the average person their age. Examining the self ratings of traits allows us to consider the role of self-efficacy and self-esteem in influencing the choice of intended major.

A suggestion in the research on women [Hackett and Betz 1981] is that low self esteem and low self-efficacy expectations, rather than low ability, affect the career behavior of women. In other words, women of ample intellectual and academic ability may self-select out of an occupation or college major due to limitations in self-perception. Efficacy expectations are expectations or beliefs that one can successfully perform a given behavior. These expectations determine whether or not behavior will be initiated, how much effort will be expended, and how long behavior will be sustained in the face of obstacles and difficult experiences.

The data reported in this paper comes from the survey of freshmen entering college in the Fall of 1996. Our university's data consisted of approximately 2700 freshmen students of which 108 (4%) indicated their intended major as computing. The intended college major is taken from a question that asks students to select their probable field of study from a list of different undergraduate major fields. Students who selected "Computer Science" or "Data Processing or Computer Programming" are considered to be "Probable Computing Majors" for the purposes of this research. This subset of our freshmen students which will be referred to as *Probable Computing Majors* or sometimes as *Computing Students,* includes 27 women and 81 men. Since this sample size is relatively small we are limited in the conclusions we can draw from this data.

Examining the Data: High School Preparation

One of the survey questions asked "During high school (grades 9-12) how many years did you study each of the following subjects?" with possible responses of none, ½, 1, 2, 3, 4, and 5 or more. The subjects included Computer Science among other typical high school subjects. Since research has suggested that women may be less likely to select a computer major because they feel less prepared to major in computing than men, we were especially interested in the amount of preparation in computer science. Since most high school subjects are studied for several years, students who reported 1 year or less of study on a subject were considered to have little high school preparation on that particular subject. Segmented by our research focus of All New Freshmen versus Probable Computing Majors and into gender based sub-categories, Table 1 reports the percentages of students who reported little preparation.

The first thing to note from Table 1 is the fact that Computer Science is the subject high school students are most likely to take for only 1 year or less. Almost 90% of female students and over 83% of male students experience one year or less of computing education. In fact, 40.4% of the male students and 53.7 % of the female students reported no study of Computer Science (not shown). This is somewhat alarming since we are rapidly becoming a technological society where computer skills are critical and colleges are assuming incoming students to be computer literate. It appears that many high school students are not receiving adequate preparation in this area. The contrast to subjects like Arts, Music, and Foreign Language, that are enriching but not commonly as critical for future employment or everyday interactions in a technological society, is interesting. High schools are providing much stronger preparation in Foreign Languages than in Computer Science.

Table 1. Percent of Students Reporting 1 Year or Less of High School Study on a Given Subject

High School Little Preparation on Subject	All Freshmen at ISU		Probable Computing Majors	
	Female % n=1661	Male % n=999	Female % n=27	Male % n=81
Foreign Language	8.8	13.8	14.8	13.6
Physical Science	50.7	43.3	61.5	34.6
Biological Science	57.5	61.4	44.4	64.2
History/Am. Govt.	8.5	9.8	14.8	14.8
Computer Science	89.6	83.6	53.8	67.5
Arts and Music	49.0	61.0	59.3	65.4

Table 2. Percent of Students Reporting More Years of High School Study on Selected Subjects

High School Preparation Heavy on Subject	All Freshmen at ISU		Probable Computing Majors	
	Female %	Male %	Female %	Male %
Computer Science > 1 year	10.4	16.4	46.2	32.5
Math 3 years or less	38.3	32.5	40.7	19.8
Math 4 years or more	61.7	67.5	59.3	80.2

There is a gender based difference in preparation among the *Probable Computer Majors* as 53.8% of women and 67.5% of men, report little preparation in computer science. In accord with prior research and cultural norms, males often select science and technology careers despite lack of formal education in the area. It is interesting to note that the females expressing interest in computing careers were also those with more computing experience in High School. This suggests that more technology experience may increase women's comfort level and attitudes concerning computing and computing careers.

It would be natural to expect high school students who are considering a computer major to spend more than 1 year on the subject. Table 2 reports the percentages of *Probable Computer Majors* who reported heavy preparation in computer science by studying the subject for more than 1 year in high school. The fact that female students who intend a computer major are more likely than their male counterparts to have more than 1 year of computer science preparation suggests that one way to influence women to choose computer majors in college is to encourage them to take more computer science in high school.

Because so many people, especially students and high school counselors, associate computing ability with mathematical ability, we also looked at the high school mathematics preparation. Since high school students typically study math for several years we report in Table 2 data on both "3 years or less" and "4 or more years" of math study. Again there is a large gender difference among *Probable Computer Majors* that is not reflected among all freshmen at our university. Male computing students are 20% more likely to have 4 or more years of math. We are somewhat puzzled by the fact that the percentages for women computing students both with 3 or less years and with 4 or more years of mathematics study show no variation from those of the overall freshmen women. Apparently women considering a computing major are not as likely as men to be motivated to maximize the amount of mathematics taken in high school.

Examining the Data: Self-Perceptions

Another aspect that we investigated was the component of the freshmen survey questionnaire that concerned self-perceptions of certain traits, many of which seem relevant to success in the computing field. Students were asked to "Rate yourself on each of the following traits as compared with the average person your age. We want the most accurate estimate of how you see yourself." with response options consisting of Highest 10%, Above Average, Average, Below Average, and Lowest 10%. Table 3 reports this data, considering responses of Above Average or Highest 10% an indication of a ***Strong*** self perception and responses of Below Average or Lowest 10% indications of a ***Weak*** self perception on the trait.

A much larger percentage of women in the *Probable Computing Major* group see themselves as strong compared to all freshmen women on traits such as: Academic Ability, Mathematical Ability, and Self-Confidence (Intellectual). Overall, there is a 20% difference in ratings for these traits as Mathematical Ability shows a 24% difference, Academic Ability has a 21% difference, and Self-Confidence (Intellectual) has a 20% difference. In addition there is a 10% difference on Drive To Achieve. This seems to suggest that women who will become computing majors have higher self-esteem than an average freshman woman and also have a higher opinion of their overall academic abilities. However, women computing students relative to all female freshmen perceive themselves as less strong in Writing Ability (20% gap) and Public Speaking Ability (13% gap).

Examining gender differences within the *Probable Computing Major* group, females rate themselves substantially stronger than males on Drive to Achieve (21% difference) while there was no gender difference in the all freshmen sample. Females also rate themselves somewhat stronger on Academic Ability and Intellectual Self-confidence. This varies substantially from the All Freshmen sample where males report stronger self-perceptions. This finding suggests that women with exceptionally strong academic efficacy and achievement motivation are the ones selecting computer majors.

We also note the smaller percentages of women rating themselves strong on the traits: Artistic ability, Competitiveness, Creativity, Physical health, Self-understanding, and Writing ability. Higher male ratings on Artistic ability and Writing ability are counter to stereotypes about traits where women are traditionally thought to be better than men. This contradictory finding was not as noticeable in the All Freshmen sample and thus could be a difference in computing women or alternatively could be an artifact of the small sample size for *Probable Computing Major* females.

Limitations

The accuracy of the students perceptions of their own abilities is not known. Nonetheless, perceptions outweigh reality in career choice decisions. The accuracy of self-perceptions of Academic Ability were verified by comparison to self-reports of high school GPA and ACT scores. This study is limited by the small sample size of female freshmen who are *Probable Computing Majors*. It is hoped that larger sample sizes of female freshmen intending to major in computing can be obtained by combining data from multiple universities or using multiple years of data in a future study.

Interventions

Our department is interested in increasing the proportion of computing majors that are women. Some possible interventions that are being considered are reviewed in this section. First, we examine the concept of having sufficient female role-models and mentors and then discuss a few issues relevant to our recruiting efforts.

A common concern reported in the literature is the lack of mentors and role-models for women computer science students. Our department has a relatively strong representation of women faculty including 4 of 15 tenure track faculty (27% women), with three women full professors. In addition, 2 of 4 full-time temporary and several part-time faculty are women. Thus, approximately 32% of the department's full-time faculty are female and there are several senior faculty to serve as role models and mentors for women. Nonetheless, we need to ensure that our women faculty don't become "a well kept secret" and that we actively advertise our "Women in Computing" to high school prospects and to non-committed-major students within the university.

In order to attract non-committed majors within the university we have recently established a *Women in Computing* bulletin board that is in a well-traveled area of a Liberal Arts building. This bulletin board is used to advertise success of *Women in Computing* and to illustrate photos and biographies of our female faculty; similar postings of our women friendly environment are envisioned for the department web page. We have also requested soon to be released videos from an ITAA Taskforce that is charged with promoting diversity in the computing labor force. These videos will be used in entry level computing courses that include a more balanced gender representation of students who are often uncommitted to academic programs or may have targeted a computing major and could benefit from visual role model illustrations.

The department currently calls prospective students (who have high ACT scores) and we could potentially stratify our call lists to align female faculty with female prospects. In addition, we are considering a new practice of sending prospective women students a letter highlighting our women faculty, their accomplishments, and potential programs or course offerings that may seem more women friendly and may increase the number of women students who decide to enter computing and come to our university.

In addition, our department currently sponsors a summer CyberCamp for high school students. Although our past CyberCamp sessions have been successful we did not obtain equal participation by female students. Educational research [Steedman 1982] suggests the generalization of "invisible women" in the traditional classroom and a proclivity of females to be non-participants in discussions and applications of science and technological matters when involved in a co-educational classroom environment. Based on these generalizations and associated theories we are considering the addition of a Women's CyberCamp that would promote less inhibited technology participation in a female only environment that could focus on topics that are likely to be of interest to female teenagers. We are hopeful that such an experience would excite these young women about cyber possibilities and inspire them to further their computing education and consider potential technology inclusive careers.

Conclusions and Future Research

This research suggests several findings that need further investigation. Differences in the amount of high school preparation in computer science suggest that more technology experience may increase women's comfort level and attitudes concerning computing and computing careers. Moreover, differences in self-perceptions suggest that women who plan to become computing majors have higher self-esteem than average freshmen women and also have a higher opinion of their overall academic abilities. Thus, it is incumbent upon faculty members in high schools and colleges to find ways to enhance the self-confidence of female students especially in regards to their science, math and technological capabilities. Role models, visual cues, and experiential episodes have the potential to enhance women's computing efficacy.

Planned future research will expand on sample size and evaluate role models, visual cues, and experiential episodes and the impact these potential interventions have on enhancing women's intellectual efficacy and choice of computing oriented majors. We also plan to study issues related to retention of women majors and to investigate whether self-efficacy is related to success of women within our computing major. As part of this effort, we plan to conduct focus group sessions with students from our entry level courses to get feedback on gender in computing issues.

References

Bae, Yupin and Thomas M. Smith, "Women in Mathematics and Science", National Center for Education Statistics NCES 97-982, July 1997.

Hackett, Gail and Nancy E. Betz, "A Self-Efficacy Approach to the Career Development of Women", Journal of Vocational Behavior, vol. 18:3, 1981, pp. 326-339.

Hill, S. "Science and Engineering Bachelor's Degrees Awarded to Women Increase Overall, but Decline in Several Fields", National Science Foundation NSF97-326, November, 1997.

Steedman, J. Invisible Women: The Schooling Scandal. London: Writers and Readers (1982).

Table 3. Student Self-Perceptions on Given Trait

Strong means self-rating of above average or highest 10%
Weak means self-rating of below average or lowest 10%

Strong & Weak Self Ratings on Traits	All Freshmen %		All Freshmen at ISU				Probable Computing Majors			
			Female %		Male %		Female %		Male %	
	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak
Academic ability	57.1	1.0	52.7	1.2	64.5	.8	74.1	3.7	69.1	0.0
Artistic ability	23.6	44.6	20.9	46.9	28.3	40.8	18.5	37.0	30.9	29.6
Competitiveness	55.7	8.4	45.0	10.7	73.9	4.7	48.1	7.4	61.7	12.3
Cooperativeness	71.6	1.9	73.3	1.6	68.5	2.4	74.0	3.7	68.7	2.5
Creativity	52.5	9.9	47.5	12.1	60.7	6.1	48.1	7.4	64.2	8.6
Drive to achieve	64.1	3.3	64.4	2.7	63.7	4.4	74.1	3.7	53.1	3.7
Emotional health	50.9	8.5	46.4	9.2	58.4	7.5	33.3	14.8	45.7	7.4
Leadership ability	58.0	8.9	55.5	9.5	62.1	8.0	59.2	11.1	45.7	4.9
Mathematical ability	33.0	31.3	27.5	35.3	42.3	24.6	51.8	11.1	58.0	13.6
Physical health	55.5	7.6	47.6	8.9	68.5	5.4	44.4	18.5	63.9	1.2
Popularity	44.4	5.8	39.8	5.3	52.2	6.6	44.4	7.4	40.7	11.1
Public speaking ability	32.7	28.3	31.8	29.1	34.0	26.8	18.5	40.7	19.8	32.1
Self-confidence (intellectual)	53.0	7.1	46.4	8.9	64.1	4.1	66.6	11.1	61.7	4.9
Self-confidence (social)	52.0	11.4	48.0	12.0	58.5	10.2	55.5	14.8	51.8	12.3
Self-understanding	55.1	5.0	51.0	5.6	62.1	3.9	48.1	3.7	64.2	0.0
Spirituality	37.4	17.1	38.3	14.4	36.0	21.6	37.0	22.2	28.8	20.0
Understanding of others	68.4	2.2	70.9	1.3	64.2	3.7	63.0	3.7	58.1	3.7
Writing ability	42.5	12.6	42.5	10.4	42.5	16.4	22.2	11.1	46.9	14.8

Retention of Women in the Technological Sciences
Issues impacting Education and Career Advancement

Moderators: Janet Kemp and Sharon Vest; University of South Alabama
kemp@cis.usouthal.edu/ vest@cis.usouthal.edu

Participants:

Don Caputo
Robert Morris College
caputo@robert-morris.edu

Ann Gates
University of Texas, El Paso
agates@cs.utep.edu

Suzanne E. Gladfelter
Penn State University
sg3@psu.edu

Magid Igbaria
Claremont Graduate University
Magid.Igbaria@cgu.edu

Jeanine Meyer and Stuart Varden
Pace University
jmeyer@fsmail.pace.edu

Pam Specht
University of Nebraska
pspecht@unomaha.edu

The purpose of this panel is to identify and present solutions to the barriers that women encounter in two different technological environments: (1) the academic curricula, and (2) a glass ceiling in the work place. To help overcome these barriers, significant support for women is needed in post-secondary education and job entry. Choosing an undergraduate major is the primary time that women drop out of the natural sciences and engineering education pipeline. Fifty percent of qualified males choose a scientific career compared to only 16% of qualified females. [Klawe and Leveson] Once a part of the work force, women are consistently under represented at the highest ranks even when all other factors are equalized. [Hemenway]

Studies have shown that the support of role models at every stage of education, especially at the post secondary level, is vital to the retention of women in the field. Role models come from a variety of sources, inside and outside the educational environment. To increase the mentor resource pool, support must be defined and provided at all stages in the professional progression. [Roberts]

A panel of eight, representing demographically diverse universities, discuss obstacles to women in these two critical environments, and provide insight into methodologies that show evidence of success in encouraging and retaining women. The action plans developed from the investigations include curriculum changes and support group activities. The panelists share feedback from surveys, program modifications, support group activities, mentoring strategies, and personal experiences to provide a comprehensive view of the problem and possible solutions applicable in a wide range of environments. The academic barriers will be addressed first by the panelists with positions on the glass ceiling issue logically following.

Support in Achieving Clearly Defined Goals is the Key to Retention

The Affinity Research Group (ARG) project, funded by the National Science Foundation, provides a physical setting in a cooperative environment in which undergraduate and graduate students engage in research. The goals of the ARG project are: (1) to increase the retention and participation of traditionally under represented groups in the computing areas, and (2) to provide a socialization and infrastructure mechanism for involving students with a range of backgrounds, talents, interests, and skill levels in research and outreach projects.

Studies have shown that many capable individuals may not persist in the computing sciences because they lack confidence in their abilities, feel isolated, or are unclear about their goals. The project's model addresses the factors that erode confidence by creating and structuring a supportive environment that (1) provides students with opportunities to interact with professors and other students about substantive topics, (2) educates students about the benefits of engaging in research, and (3) facilitates their understanding and appreciation for the research process and its practice. By establishing and processing individual and group goals, students involved in the ARG project acquire the ability to clarify and accomplish their goals and assigned tasks.

By providing a supportive environment and structuring skill development, we believe that all students, especially those from traditionally under represented groups, will persist and succeed in the computing sciences.

Is Programming the Critical Barrier to Retention?

Students were surveyed at the beginning and end of the core course in computing. This course is required of all undergraduates and usually taken by Freshmen. There were significant differences found in attitudes and experiences of the men and women involved. Additionally, there was evidence that negates the stereotypical patterns believed of men and women. The survey indicates that both men and women enter school with many positive attitudes about technology, but at the end of the first programming course, the attitudes are much different. It appears that programming is perceived as the critical barrier for all students.

Our position is that programming instills in students critical thinking skills, which are applicable in other areas. Also, we feel that the Freshman year is the appropriate place for this learning. Several methodologies are discussed focusing on the positive aspects of programming.

Recruitment and Retention of Women Requires Multiple Components and Participants

Math Options for Women is a career awareness program for middle school girls highlighting opportunities in the technological disciplines. The program unites young women and professional role models from academia, medicine, government agencies, business and industry for a day of panel discussions, workshops, hand-on-activities and a career fair. The program also trains secondary teachers to provide career guidance to young women who may be interested in technology. At the post secondary level, efforts to retain women include a Freshman Seminar that begins with a Developmental Year program, providing additional support for women majoring in computer science. Another retention effort, Project Visions, provides an active/collaborative/learning approach to computer science education using supplemental instruction leaders, peer mentoring, and individual tutoring. Results of these efforts are presented.

Retention is dependent on educational awareness and accessibility to program support

Once women are enrolled in a computing science course, the key to retention is educational awareness and accessibility to program support. Women must be made aware that they are capable of success in a technical field and encouraged to become involved in all facets of the discipline.

Enrollment statistics over the last five years and efforts to improve the retention of women are discussed. In Fall, 1996, a Women in Technical Sciences (WITS) support group was formed to focus awareness on the need to increase women in the field. The objectives of the group include: (1) establishing a network of women with similar concerns and interests; (2) providing a wide variety of role models in a variety of settings; (3) establishing ease of accessibility to faculty and community professionals for individual counseling and mentoring; and, (4) heightening awareness of women with regard to technology issues.

Results from a survey of all students majoring in CIS are discussed. Analysis of the results are used to identify specific needs of women that can be addressed to ensure continued success in the discipline.

Survey of Women Reveals Unmet Career Needs

Early research studies identify the retention of women in the technical fields as problematic, and has been confirmed through additional study. In some respects, technical fields are not unlike other fields in which women have found inequities in pay, promotions, and visible project assignments. However, technical fields also require considerable personal time to keep abreast of fast-changing technological developments. Taking time off for family can mean falling behind in the knowledge of what is going on in a company, as well as falling out of step with the field itself.

A survey of women in computing conducted recently revealed a number of unmet career needs. There was strong interest in technical and managerial training, networking, and career planning and management. As a consequence, a Women in Technology group was formed. The survey also revealed a need for women to feel formally connected with other women in technical fields . Such connection should contribute to retention

Tracking Women in Undergraduate Programs and Beyond

For four years, a Computer Science program of cooperative education has been tracking the selection, career mobility, and retention of women undergraduates. These students are actively working for 46 corporations or institutions in a metropolitan area. The corporations and institutions represent a range from world-wide corporations, to multi-site hospitals, to small and medium sized companies.

On-site visits to the workplace and performance reviews of current students are conducted. Additionally, information is gathered from management about career paths of former students who accepted full time employment after graduation. The primary goals of this effort are to determine female success rate, to track career advancement and retention, and to make comparisons to male workers in similar information technology positions.

An attempt is made to relate the data to original choice of a college major, from entry into one of the five major tracks of the IS program through change of major or drop-out.

The Impact of Gender Differences on Job Performance Evaluations and Career Success

United States government statistics have shown that although women have made impressive gains in employment during the 1980's, they continue to be under represented in positions of power and responsibility, especially in senior management and executive positions. This trend has also been observed in the IS field. It has been reported that women encounter a glass ceiling that prevents them from reaching the top levels of IS positions.

Understanding and eliminating barriers to advancement for various sub-groups in the workplace should be of concern to the IS field as a whole. This is not just because of the IS field 's increasing interest in managing human resources and rising personnel costs, but rather because of the significant demographic changes in the work-force projected by the year 2000. The Hudson Institute, in its U.S. Department of Labor report, estimates that by the end of the next decade only 15 % of the new job entrants will be U.S. born white males, while 20% will be U.S. born non-whites, 42 % will be U.S. born white females, and 23 % will be foreign born immigrants.

The findings represented here are the result of an independent study that was part of a comprehensive study of IS careers with special emphasis on job performance and motivation of IS employees. The study determined the impact of gender differences (female vs male) on job performance evaluations and career success.

Conclusion

The presentations are intended to clearly identify techniques and methods to improve the retention and advancement of women in the technical sciences and the work place, and to stimulate questions for additional investigations. All existing viewpoints cannot be covered in a single panel, nonetheless, the problem of retention and advancement of women is important and warrants continued discussion and study.

References

1. Camp, T. The Incredible Shrinking Pipeline. *Communications of the ACM*, Vol.40, No. 10, (October 1997), pp. 104-105.
2. Hemenway, Kathleen. Human Nature and the Glass Ceiling in Industry. *Communications of the ACM*, Vol. 38, No. 1, January 1995), pp. 55-61.
3. Klawe, Maria and Nancy Levenson. Women in Computing: Where are We Now?. *Communications of the ACM*, Vol. 38, No. 1, (January 1995), pp. 29-35.
4. O Rourke, J. Mentor Project Targets Female Undergrads , *Computing Research News*, Vol. 5, No.4, (Sept. 1993), pp. 3-5
5. Roberts, Eric. The Retention of Women in the Computing Sciences. *The Proceedings of the 29th SIGCSE Technical Symposium on Computer Science Education*. (Feb-Mar. 1998) pp. 366-367.

Survival of the Smartest: Application of Database-Driven Intelligence to Marketing

Blair Stephenson, Principal
MarketLink - Dallas

The focus of this presentation is on the intelligent application of knowledge about individual Customers and/or distinct Customer segments to design and execute highly effective marketing and sales strategies and programs. This knowledge is extracted from both internal and external data which has been consolidated into a marketing "information-base" for analysis and decision support. This knowledge has extremely high value in driving the development and/or enhancement of programs designed to acquire, retain or maximize Customers. The critical advantages of these intelligence-driven programs are that they are much more efficient and effective than general, non-targeted marketing; AND, they are measurable and accountable for their performance and return on investment.

This presentation will include a discussion of the types and sources of information which must be consolidated in a marketing database; and fundamental differences between the uses of marketing databases versus traditional business databases (transactional versus analytical). Also included in the presentation will be brief discussions of the roles and importance of quantitative modeling, research, response tracking, performance measurement and reporting for decision support. Examples of successful and not-so-successful database marketing programs will be interwoven into the presentation where appropriate. The issues and potential impact of privacy restrictions and the growth of electronic commerce (Internet) will also be addressed. The presentation will conclude with comments about the variety of career opportunities for MIS/CIS undergraduates and graduates.

"Real World" Experience for IS Students: Using Non-Profit Organization and Faculty Collaborations

Chad Grabow, Ph.D.
Mesa State College
cgrabow@mesastate.edu
Denise R. McGinnis
Mesa State College
mcginnis@mesastate.edu

Abstract

The 1997 curriculum model developed through the joint efforts of the ACM, AIS, and AITP suggests that information systems (IS) graduates should be ready for an entry level IS position. What better way to accomplish this than completing a "real world" project for an organization? If the project includes the skills required in the systems analysis, telecommunications/data communications, and database management, the IS student will have acquired the experience required to start their information systems career. Although using textbook cases can be useful, a real life project is preferable for many reasons. One difficulty with this approach is that it may be difficult to find real life projects for the students to complete. This paper describes how undergraduate students have completed projects in non-profit organizations. Using a non-profit organization to generate projects can be beneficial to the organization, the student, the faculty and the institution.

Introduction

The IS '97 Model Curriculum and Guidelines for Undergraduate Programs in Information Systems suggests that student integrate, synthesize, and demonstrate "their mastery of the design process acquired in earlier courses by designing and constructing a physical system using database software to implement the logical design."(IS '97 Model Curriculum and Guidelines for Undergraduate Programs in Information Systems, 1997) The key courses for students preparing for an IS career include systems analysis and design, telecommunications/data communications, and database management. It is extremely important that students actively participate in a suitable project. It has been stated that project-oriented courses can enhance student learning (Barrett, 1987). Since projects consist of many phases and activities, it seems to be well accepted that the students will complete a series project(s) in these courses. Many companies except IS students to complete an internship to demonstrate acquired competencies in these key courses.

It has been suggested that there have been improvements in the education of business systems professionals over the past years (Lederer, 1987). There are still areas in which the education of our business students can be improved. One of these is related to the projects that our students completed during their course work. Often these projects are artificial and not very realistic when compared with the projects in the real world. Real life projects tend to have uncertainty, are dynamic, and do not have "right" answers. It is the responsibility of the business or systems faculty to provide our students with a more realistic view of business systems through one or more projects. The students should be able to apply those techniques that are discussed in class. They should have a chance to gain an understanding of the organizational and political environment in which information systems professional must operate. Lastly, the student should gain an appreciation for the major role that communication skills have in the systems analysis and design process.

Constructing a project that meets all these lofty goals can be difficult if not impossible. There are several options available for projects in a systems analysis and design course (Grabow, 1997). Option one, the student can complete a case that have been presented by the author of the text or in a workbook. Option two, the instructor can construct a case based on his/her personal experience. Option three, the students can attempt to find their own real life case. Option four, the instructor can find real life cases for the students. Although there may be other alternatives, these options are the common. Each one has its own unique advantages and disadvantages.

Using an authored case has the advantage that it is usually well constructed and will answer most of the questions that the students may pose. This relieves the instructor of trying to contrive answers to the student's questions about the case. Option two has the advantage that all the students will work on the same case and therefore it will be easier to compare the student's performance. This option does not allow the student to experience a real systems opportunity. Option three, while better, it can be very difficult to adjust the scope of the project and assessment can be more difficult. Option four is similar to option three, but it appears to solve most of the problems. The project is a pre-determined size that is set by the instructor. All the students start at the same point in the project and it is real life. There are no "right" answers. The major problem with this option is the difficulty of finding such projects.

In 1988, an MBA course in systems analysis and design completed a project for the American Red Cross (McGinnis, 1989). The personnel at the Red Cross were very cooperative and helpful to the students. It is critical that the organization that is chosen is willing to work with the students. This is only possible if the faculty member makes the initial contacts. This is time consuming, but well worth the effort considering all the benefits.

The IS'97 Model (1997) suggests that IS majors should achieve a level 4 (application) competence for information systems analysis and design, networking and telecommunications, and database. Unsupervised practice is required to achieve this level. This paper will detail a current project that is being completed for a non-profit organization by the faculty and students of a four-year liberal arts institution. Faculty members initiated and oversee the project, but the students are responsible for the completing the project. The next section details the phases of the project.

"Real-World" Project - Phases

Phase 1

In the spring of 1997, a faculty member performed a requirement study for a local non-profit organization detailing the need for a local area network and supporting functional requirements with database management systems applications. The faculty member presented his recommendations to the director of the non-profit organization. The director granted approval for implementation of the recommended system. The faculty member sent a request for proposal to eleven local vendors. The requests for proposal details are shown in Table 1.

Although Windows NT was a suggestion, the vendors were encouraged to recommend the best system based on their experience in our community. Three proposals were submitted. The proposals were evaluated based upon capability and price. Two vendors suggested refurbished equipment in their proposal to keep the estimate for the project unrealistically low. This option was not acceptable due to the known lack of reliability of the equipment. These proposals were rejected which left only one viable proposal. This proposal is shown in Table 2

The client had very little experience with computers. The vendor suggested that Novell's operating system would be a more stable environment. This is why Novell was used instead of Windows NT. After negotiations, an agreement on hardware, software and prices was reached. The network installation was completed in May 1997.

Table 1 – Request of Proposal Components

Components	Minimum Requirements
Hardware	
Server	Pentium - 15" monitor
7 clients	Pentium - 15" monitor
Backup system	Tape backup
Laser printer	10-12 pages/minute
Software	
NOS	Suggested Window NT
MS Office '97	N/A
Support	
Installation	Physical and wiring
Maintenance	On call

Table 2 – Sample Vendor Proposal

Vendor Proposal

Hardware

Server - Compaq Prosignia 300, Pentium 120 MHZ, 32 MB RAM ECC, SCSI Controller 64 bit, Compaq PCI Ethernet card, 4X CD-ROM, EISA/PCI Bus, 2.1 Gigabyte hard drive, 15" SVGA Color monitor

Workstations - 6 ACER Pentium 133 Mhz, 16 MB RAM, 8X CD-ROM Drives, 15" Super VGA Color Monitors .28 dot NI 800X600, 1.2 Gigabyte hard drive, 32 bit PCI Ethernet cards, 3.5" Floppy, MS Windows '95

Upgrades to existing computers - 1 Pentium motherboard with CPU, two 8 MB RAM, 1.2 Gigabyte hard drive, 1 MB PCI SVGA, four 4 MB 72 pin chips

Printer - HP LaserJet 5N Printer

Backup System – Sony 4GB DAT tape drive, Cheyenne Arcserve 6.0 for Netware, Imation 4mm 120 DAT tapes (10 pack)

Software

7 MS Office 97 professional

NOS – Novell IntranetWare (10 user)

Installation

Cabling, network accessories, setup, and training

Phase 2

In the summer of 1997, three IS seniors completed an internship for the local non-profit organization. Based upon the completion of the systems analysis and design, telecommunications/data communications, and database course, the IS students commenced a systems study. After a briefing the non-profit director, the scope of the project was too large to be completed during one summer internship. A decision was made about which subsystems could be implemented based upon priority of need. Three subsystems were selected for logical design, physical design and implementation using a relational database.

The student completed the following tasks:

1. Object-oriented systems design
2. Logical database design
3. Physical database design and implementation
4. Design of test data
5. Form design (data input and on-line reports)
6. Reports design
7. Query design
8. Security design and implementation
9. Design of backup and recovery procedures
10. Developed and implemented training
11. Completed systems manuals

The students were required to learn Access 97 in depth to implement the database. Several faculty members supervised and assisted the students during this internship. At the end of the summer, a working version of the three subsystems and documentation was delivered and installed for the non-profit organization.

Phase 3

The Systems Analysis and Design Course, offered to undergraduates at Mesa State College in the fall of 1997, consisted of 18 students who were majoring in Business Administration with a concentration of Business Computer Information Systems. The class was broken down into four groups each consisting of four or five students each.

After course and individual introductions, the students first task was to form four project groups by interviewing each other. Their goal was to develop a balanced project group based upon interests, background and work experiences. Once the group was formed, their next task was to develop a set of work rules that would guide the project group throughout the semester. These rules included documentation review and approval, due dates, late submissions, penalty assessment, firing policy and work breakdown.

Following the methodology presented in Systems Analysis and Design and the Transition to Objects by Sandra Donaldson Dewitz, 1996, each group was responsible for four major deliverables:

1. Present System Analysis written report;
2. Present System Analysis oral report to management;
3. New System Design written report; and
4. New System Design oral report of management.

The Present System Analysis written report consisted of two major sections and supporting appendices as depicted in Table 3. The New System Design written report consisted of seven sections and supporting appendices as depicted in Table 4.

It was announced in class that there were opportunities to design and implement at least one of the projects that were started in the systems analysis and design course. This would allow students to not only begin a project but to complete a database implementation. Students could see the value of working on project activities that spanned several semesters and could lead to an internship.

One of the groups opted to continue work for the previously discussed non-profit organization. During phase 2, three subsystems were completed for the non-profit. The new group studied a fourth subsystem. They completed the requirements shown in tables 3 and 4 during the fall semester systems analysis and design course. It was necessary for the students to continue this work in the database management course during the spring semester of 1998.

Faculty collaboration was key to the success of this endeavor. Without faculty agreement for continuation of this project, it would have been difficult to complete the implementation of the fourth subsystem.

During the spring semester of 1998, using the documentation created during the systems analysis and design class, the students developed a logical and physical database design. They developed a prototype of the fourth subsystem.

Currently, a post implementation review of phase 2 is being conducted. Everyone who works for the non-profit organization is completing the survey. The results of the survey will be used to assist in the final phase of the project. The final phase of the project (implementation of the fourth subsystem using a DBMS and a DSS for this system) will be completed this summer with student interns.

Benefits of "Real World" Experiences

There are numerous benefits when students and faculty collaborate on "real world" projects for non-profit organizations. The non-profit organization, the faculty members, the students, and the institution derive these benefits.

The non-profit organization benefits because their costs are lower. The organization in this paper has reduced their staff by 1 1/2 persons in the first seven months after implementation of Phase II. With this reduction, the cost of the system and implementation was realized in the first seven months of operation. This allows the non-profit more flexibility given their scare resources. Additionally, they receive expert advice from faculty members who participate in this project.

Table 3 - Present System Analysis Written Report Requirements

Executive Summary - Cover Letter, Report Overview
Section 1. Current Systems Environment
History
Organizational Structure
Workflow Diagrams
Problems with the Existing System
Section 2. Project Definition and Feasibility
Systems Objectives and Project Scope and Constraints
Feasibility Analysis
General Design Alternatives
Recommendations
Conclusion
Supporting Appendices
Goal Analysis
User Analysis
Functional/Component Matrix
Workflow Diagrams & Affinity Diagram
Enterprise Object Model
Logical DFDs of Existing System
Critical Success Factor Analysis
Project Risk Evaluation

Table 4. - New Systems Design Written Report Requirements

Executive Summary - Cover Letter, Report Overview

Section 1. System Overview
- Section 2. Technical Specifications
- Section 3. Cost\Benefit Analysis
- Section 4. Construction Plan
- Section 5. Test Plan
- Section 6. Installation and Training Plan
- Section 7. Recommendations and Conclusion

Supporting Appendices
- Object Relationship Model
- Physical Database Design
- System Behavior Design -- Physical DFDs
- System Behavior Design -- Program Structure Charts
- System Behavior Design -- Use Cases
- Dialog Flow Diagram
- Interface Design
- System Flowchart
- Hardware & Software Specifications
- Cost-Benefit Analysis
- Construction Plan and Installation Strategy
- Test Specifications
- Training Plan

The faculty members have opportunities to update their skills by supervising students. This practical experience can be utilized in developing courses, classroom presentation, and professional development. Faculty collegiality can be improved resulting in a more cohesive department.

The student gains valuable work experience. This experience might provide the edge required attaining their first position in industry. Typical job announcement list experience as a prerequisite for employment. Most students only see faculty members in the classroom. Completion of these projects allows the faculty and student to work side-by-side on a common goal. Mutual respect is the ultimate result.

The institution also profits from these projects. Faculty members are performing community service in their areas of expertise. The outcome of this work is a closer relationship between the non-profit, the institution, and the community at-large. This is basically a win-win-win-win situation.

Conclusion

In 1997, Dr. Janczewski suggested that the value of course where students complete projects in the real world is appreciated by both the students and industry (Janczewski, 1997). The University of Auckland has been having students complete industry projects for many years and surveys suggest that there is a steady interest in completing these projects. "...students spoke well about the paper as a means of exposing them to real-life situations and gaining knowledge of group dynamics, application theory, project management, etc." (Janczewski, pp 326) He indicates that there were numerous complaints about the size of the workload.

It is strongly suggested that students complete real-life projects. It may be difficult to find projects for the students to complete. If this difficulty arises, consider using a non-profit organization. This situation can be beneficial to both the student and the organization. Quality work can be done for no charge. It may take additional time on the part of the instructor, but this time can be well spent. It allows you to become more involved in your community. There are many non-profit organizations such as the March of Dimes, the United Way, hospices, Girl Scouts, museums, hospitals and public school systems. These are just a few of the non-profit organizations that might benefit from the completions of a systems project by your students. In general, you will find that they will be very receptive to your students, particularly if you build a rapport with the organization.

A project of this nature can be very time-consuming for the students. The students can easily spend between 20 to 25 hours per week. This is quite a load considering many of the students are enrolled in other classes and working full-time. It may be necessary to meet with each group and consider the scope of their project. The scope may have be reducéd to obtain a project that can be completed in one term.

One potential problem with these projects is the issue of quality. For a variety of reasons, it is important that the projects be of high quality. The instructor will have to be familiar with each project and evaluate the documentation carefully.

The authors believe that the benefits of a real project outweigh the disadvantages. Students have a positive experience. The clients have a positive experience. It is recommended that the prepared document be part of a portfolio that students may use in their quest for a professional position.

References

1. Barrett, Robert A. and Dale K. Hockensmith, "Project Course in Systems Analysis", Proceeding of the Sixth Annual Information Systems Education Conference, 1987, 87-91.
2. Donaldson Dewitz, Sandra, Systems Analysis and Design and the Transition to Objects, 1996.
3. Grabow, Chad and Denise R. McGinnis, "Systems Analysis and Design Projects for Non-Profit Organization", 39th Annual Mountain Plains Management Conference, Grand Junction, CO, October 2-4, 1997,
4. IS '97 Model Curriculum and Guidelines for Undergraduate Degree Program in Information Systems, ACM, AIS, AITP, 1997.
5. Janczewski, Lech J., "Information Systems: Co-operation between university and industry, the case of New Zealand", Managing Information Technology Resources and Applications in the World Economy, Vancouver, B.C. Canada, 1997.
6. Lederer, Albert L.,"A Project-Based Systems Analysis and Design Course, Proceeding of the Sixth Annual InformationSystemsEducation Conference, 1987, 83-86.
7. McGinnis, Denise R. "Systems Analysis and Design Projects for Non-Profit Organizations", Proceedings of the 17th Annual North American Conference of the International Business Schools Computer Users Group, Hershey, Pennsylvania, July 23-26, 1989.

An Exploratory Analysis of Information Systems Education and Training for Air Force Officers

Donald A. Schmidt, Captain, USAF
56 CS/SCS
13960 W. Eagle St.
Luke AFB, AZ 85309
(602) 856-7241
don.schmidt@luke.af.mil

Michael G. Morris, Major, USAF
Air Force Institute of Technology
AFIT/LAS, Bldg 641
Wright-Patterson AFB, OH 45431
(937) 255-7777, ext 3351
mmorris@afit.af.mil

Abstract

This study explores what Information Resource Management (IRM) skills are required as perceived by the Air Force officers performing IRM duties. A questionnaire was sent to a sample of 501 Air Force officers performing Communications and Information Management functions. The results suggest that Air Force officers perceive interpersonal skills to be the most important IRM skill set, followed by managerial skills. Technical skills, while important, were perceived to be the least important for current Air Force Communications and Information officers. Based on these findings, recommendations for improving IRM training for Air Force officers are provided.

Introduction

As the Air Force enters the 21st century, it is clear that information technology (IT) will play a major role in meeting new mission challenges. As evidence of the growing importance of IT, the Air Force leadership recently added Information Superiority to the list of Air Force core competencies (AF Policy Letter Digest, Dec 96). Thus, given the importance of IT, it is imperative that Air Force personnel are properly trained to handle the new technology and systems (see GAO/HR-97-9).

Within the Air Force, responsibility for information technology and information resource management (IRM) has been given to officers in a new career field. On 1 March, 1996 the former Command, Control, Communications, and Computers career field and the former Information Management (IM) career field merged into a new integrated career field titled "Communications and Information." The duties and responsibilities have become increasingly critical as the Air Force aligns with the DoD to satisfy the objectives of legislation passed on the subject of information systems and technology (e.g., see Air Force CIO Responsibilities [www.cio.hq.af.mil] or Hluska, 1997).

Review of the Literature

IRM is not a new concept, in fact several sources trace IRM back to the late 1970s. Like many other concepts, IRM has evolved, and during this evolution the skills required to perform the IRM functions have also evolved (Kerr, 1991). Within the Air Force, in 1990, Scott (1990) investigated the actual educational background and knowledge base of Air Force IM officers. Scott found that information managers should be knowledgeable in the topic areas of people, computers, systems, models, organizations, and society. Scott concluded that "...[IM] officers have been given a job which they are unprepared educationally to perform" (pg. 83). In addition, In 1992, Biros and Cole (1992) evaluated the effectiveness of Air Force information management officer courses which led to a significant revision to computer training received at Air Force technical schools. However, this study did not focus on managerial aspects of IRM education and training.

In addition to Air Force-specific studies, there have been several recent studies completed to ascertain the particular skills required to perform the IRM functions in successful organizations (e.g., see Young and Lee, 1997). The results of these studies reveal striking similarities in the required IRM skill set. For example, Trauth, Farwell, and Lee (1993) completed a study to determine how recent changes are affecting information systems, technologies, applications, and personnel in considering the skills required of future information system professionals. They suggested that IRM core skills could be divided into three distinct groups; IS Tasks, Technical Skills, and Abilities. Lee, Trauth, and Farwell (1995) also studied the perceptions of industry and academia about the critical core skill sets, using a similar categorization scheme. More recently, Leitheiser (1992) completed a study to provide managers and educators with information on the current and future demand for MIS professionals. These research efforts were represented in the analysis done in support of IS'97 (Davis et al., 1997). IS'97 presents a comprehensive review of IS curriculum standards completed by the Association for Computing Machinery (ACM), Association for Information Systems (AIS), and Association of Information Technology Professionals (AITP). The recommended "presentation areas" for IS curricula included learning units devoted to IS fundamentals, IS theory and practice, information technology, information systems development, and finally, information systems deployment and management.

A number of other studies have also examined IS/IRM skill areas and have identified similar relevant skill sets (e.g., see Lewis et al., 1995; Longenecker et al., 1996). Looking across all these studies, several sets of skills emerge as important from all of them. While the names of these sets do not correspond exactly, the skills can generally be mapped onto one of three categories: (1) managerial/business skills, (2) technical skills, and (3) interpersonal skills. It is clear that each of these broad categories represents an important set of skills and serves as the basis for the IS97's body of knowledge. However, it is not clear from the literature which set is *most* important to IRM professionals. For example, Lee et al. (1995) found that business functional knowledge and management skills were the most important skill set for IRM professionals. However, other research has made a case for technical skills being the most important and valued (e.g., Trauth et al., 1993), while many studies have argued that interpersonal skills are the most critical (e.g., Leitheiser, 1992; Young and Lee, 1997). Given the broad range of skills encompassed by these areas, one of the goals of this research was to identify which category was perceived as most important by Air Force officers in today's environment.

Methodology

Based on a power analysis, a stratified random sample of 501 Air Force officers was selected from a target population of officers currently serving in the Communications and Information career field (Hluska, 1997). Due to time and cost considerations, the sample population was limited to officers currently stationed at bases in the United States. A questionnaire utilizing five-point Likert scales derived from previous Air Force research was utilized. The skills were extracted from the existing IS and IRM literature and a consolidated list was refined, containing the 24 skills most frequently found in the literature. Respondents were asked to provide demographic data, as well as rate the importance of the core IRM skills to their current job and the primary source of training (if any) for that skill. Additional data were gathered to assess how well that training prepared them for their IRM duties. Officers were promised anonymity and were given 3 months to complete and return the survey. 242 usable surveys were returned within the timeframe for a response rate of 48.3%.

Results

Based on the responses received, 19 of the 24 skills (79 percent) were identified as being "very important"; a mean score of 3.0 or higher. The remaining 5 skills had slightly lower mean scores between "somewhat important" and just short of "very important", ranging from 2.35 to 2.89. It is interesting to note that four of the top five skills belonged to the interpersonal skill group, while the technical skill group had the lowest eight mean scores. Table 1 illustrates the ranking of the 24 skills based on their mean score. This method of ranking skills based on their mean scores, derived by utilizing a Likert scale, was used in several prior studies in this area (e.g., see Young and Lee, 1997; Trauth et al., 1993; Lewis et al., 1995; Leitheiser, 1992).

The three skill areas (interpersonal, managerial, and technical) were also analyzed by aggregate mean score. The interpersonal skill category had the highest aggregated mean score (4.31), which correlates with the current literature indicating that interpersonal skills are the most important skill group to an IRM professional. Managerial scores had an aggregated mean of 3.91, while technical skills had the lowest aggregate mean score at 3.07, which also corresponds with the current literature (e.g., see Young and Lee, 1997; Lee et al., 1995; Leitheiser, 1992; Longenecker et al., 1996.

To shed further insight into the results and provide data to the Air Force CIO about each of these skill areas, several additional analyses were completed. Respondents were also asked to state the primary source of their education or training for each of the 24 core skills identified. The eight sources included no training, self-taught, on-the-job training (OJT) in the Air Force, correspondence courses, Air Force technical training, undergraduate degree program, Master's degree program, and other. Surprisingly (and alarmingly), while some formal training had been provided for each of the 24 skills, "no training" and "self-taught" (combined) was identified as the primary training source for 19 of the skills (79 percent). When aggregated to into the three primary skill sets (interpersonal, managerial, and technical), no training/self-taught is the primary training source for all three of the groups indicating a gap in the training needed and the training received.

Despite a clear lack of formal training received by most officers in this sample, the researchers thought it was important to further analyze the adequacy of formal training for those who had received it (an obvious minority in this sample). The results of the analysis for the formal sources of training are important to this research effort, as they demonstrate how effective formal Air Force training resources are in preparing the officers and indicate whether these avenues should be pursued for those who had not attended such training. Mean scores derived when only the formal sources of training were used in the analysis are slightly higher than the mean scores derived for the non-formal sources of training. Table 2 illustrates the mean scores derived for the formal, as well as the non-formal sources of training. The skills are ranked by mean score (formal methods) within their respective skill groups. Mean scores shown in the table were derived from the responses to how well the respondents perceive they had been trained in each skill. The mean scores illustrated for the "Non-formal" sources of training were calculated from the responses which indicated self-taught as the primary training source. The column entitled "Formal" represents the formal sources of training only and is presented to reveal how well the formal training methods are preparing people to complete the IRM mission.

The table headings are identified as follows:

Skill Rank: This column identifies the skill ranked on importance of criticality to IRM

Mean score: The mean score is the average score (for adequacy of training) of the responses received for each skill.

Mean score (non-formal): This represents the mean score for each skill using the category self-taught as the training method.

Mean score (formal): This represents the mean score for the formal methods of training only..

Highlighted cells: The cells highlighted in the columns entitled non-formal and formal indicate which category was selected most often by the respondents as the primary training source for that skill. As indicated in the table, only one skill, "Networks (LAN, WAN, Corporate-wide, etc)", has a non-formal mean score higher than the mean score of its formal counterpart. As a measure to verify if the source of training was a determining factor in the adequacy mean scores between the formal and non-formal sources of training, a t-test was performed to test for statistical significance. These tests illustrate that 14 of the 24 skills have mean scores that are significantly different. Table 3 illustrates the t-test results. The skills whose mean scores are significantly different have been highlighted in the table for easy identification.

Conclusions, Recommendations, and Suggestions for Future Research

Despite the central and obvious role of technology across all career fields in the Air Force, it was interesting and surprising to find that interpersonal skills were most highly valued, while technical skills were seen as less important. This suggests that current Air Force education and should attempt to focus on interpersonal and managerial issues with respect to technology vs. focusing on the technology itself (except, perhaps, in several key areas). This is not to say that education and training in technical areas is not important—clearly it is. However, the results of this study might suggest that in an era of constrained training resources, that interpersonal and managerial areas should receive the greatest attention.

From a human resources standpoint, it is troubling that none/self taught is the primary training source for 19 of the 24 skills. Based on the data reported in this study, Air Force technical training centers may be able to refine their current curricula to better pinpoint the training towards the specific needs of the career field. While the individuals participating in this study indicated that at least some formal training had been provided for each of the 24 core IRM skills listed, a review of the Basic Communications Officer Training (BCOT) course curriculum provided to most Air Force officers reveals coursework almost entirely geared towards technical skills (www.kee.aetc.af.mil/ACOT/bcot/curr.htm). Unfortunately, as established in this research and the literature, technical skills may be the least important set for today's IRM professional. On a somewhat encouraging note, the results indicate that the formal training, when it is received, is adequate or better. This suggests that systemically, the primary training issue for Air Force IRM managers is one of access (vs. quality, for example). Qualitative comments further suggested that officers desired to attend formal courses; however, there were not enough slots to accommodate the number of interested officers.

Thus, it appears that Air Force needs to consider reorganizing formal training programs for IRM. Four suggestions are offered: (a) create more formal training slots, (b) establish training that goes into "the field" and teach at various locations, (c) create distance learning programs designed to increase throughput through more formalized training sources, or finally (d) recruit personnel who already have the required training via their undergraduate (primarily) degree programs.

Suggestions for Further Research

While this research examined critical IRM skills and training, there appear to be important and interesting avenues for further research in this domain. For example, this study sought to acquire the perceptions of officers currently serving in the field. It would be interesting to duplicate this study, but at different levels--assessing the perceptions of supervisors or communication squadron commanders. The research completed by Scott (1990) investigated the undergraduate degrees of officers serving in the Information Management career field. If a study similar to this were completed for the Communications and Information career field, deficiencies could be identified, and new recruiting techniques could be developed or training could be altered to fill in the gaps.

Conclusion

This study has identified both "good" and "bad" news for Air Force IRM professionals and managers. While the study was not designed to provide a comprehensive look at all aspects of IRM education and training, the authors hope that it provides a useful first step in improving both the effectiveness and efficiency in developing successful Air Force IRM officers.

Table 1. Core IRM Skills Ranked by Mean Score

Rank	Mean	Std Dev	Min/Max	Group	CORE SKILL
1	4.4896	0.6838	2/5	I	Ability to work closely with customers and maintain a productive user or client relationship
2	4.3817	0.7328	2/5	I	Ability to communicate verbally, one-on-one and group briefings
3	4.3444	0.7258	2/5	I	Ability to plan, organize, and lead projects (project management)
4	4.2324	0.8241	2/5	I	Ability to write clearly, succinctly, and purposefully
5	4.1625	0.8978	1/5	M	Ability to learn and implement new technologies
6	4.1083	0.8991	1/5	M	Information and system security
7	4.0958	0.8935	1/5	M	Ability to understand technological trends and potentials
8	4.0250	0.9459	1/5	M	Ability to plan and set standards for corporate-wide information system technology plan
9	3.9916	1.0433	1/5	T	Networks (LAN, WAN, Corporate-wide, etc)
10	3.9544	0.8956	1/5	I	Ability to train/teach others to include end-users
11	3.8750	0.8969	1/5	M	Ability to interpret and solve business problems
12	3.7637	1.0552	1/5	T	Office automation (e-mail, schedulers, etc)
13	3.7542	1.0400	1/5	M	Contingency planning/disaster recovery
14	3.6203	1.0164	1/5	T	Systems integration
15	3.5252	1.1351	1/5	T	Telecommunications (hardware, phones, modems, cables, satellites, etc)
16	3.3933	1.0105	1/5	M	Establish/monitor corporate data structure
17	3.3655	1.1273	1/5	T	Systems life cycle management
18	3.0297	1.0931	1/5	T	Systems analysis/structured analysis (formal method)
19	3.0168	1.1324	1/5	T	Operating systems for mainframe, minis, micros, networks
20	2.8950	1.0482	1/5	T	Relational databases
21	2.8723	1.0463	1/5	T	Distributed processing
22	2.7966	1.1113	1/5	T	Decision support systems
23	2.4231	0.9959	1/5	T	CASE methods or tools
24	2.3460	1.0846	1/5	T	Expert systems/artificial intelligence

Key for "Group": I = Interpersonal, M=Managerial, T=Technical

Table 2. Mean Scores for Adequacy of Training

Skill Rank	Mean Non-Formal	Mean Formal	Core Skill
			Interpersonal Skills
2	3.5714	4.0452	Ability to communicate verbally, one-on-one and group briefings
5	3.4390	4.0355	Ability to write clearly, succinctly, and purposefully
1	3.6364	3.8915	Ability to work closely with customers and maintain a productive user or client relationship
3	3.4590	3.8274	Ability to plan, organize, and lead projects (project management)
9	3.3218	3.6846	Ability to train/teach others to include end-users
			Managerial Skills
11	3.1803	3.4254	Ability to interpret and solve business problems
7	2.9450	3.4227	Ability to understand technological trends and potentials
6	2.9474	3.3950	Ability to learn and implement new technologies
4	2.6410	3.2373	Information and system security
8	2.7442	3.1197	Ability to plan and set standards for corporate-wide information system technology plan
12	2.8387	3.0786	Contingency planning/disaster recovery
16	2.7037	3.0568	Establish/monitor corporate data structure
			Technical Skills
13	3.4444	3.7685	Office automation (e-mail, schedulers, etc)
18	2.8167	3.2171	Operating systems for mainframe, minis, micros, networks
19	1.9167	3.1879	Systems analysis/structured analysis (formal method)
17	2.3636	3.1453	Systems life cycle management
15	2.7083	3.1429	Telecommunications (hardware, phones, modems, cables, satellites, etc)
10	3.1154	3.1056	Networks (LAN, WAN, Corporate-wide, etc)
20	2.7097	3.0073	Relational databases
14	2.6216	2.9185	Systems integration
21	2.4333	2.8362	Distributed processing
24	1.5000	2.6604	Expert systems/artificial intelligence
22	2.6154	2.6204	Decision support systems
23	2.0625	2.5981	CASE methods or tools

Table 3. Comparison of Formal and Non-Formal Training

Skill Rank	Formal Better?	t-stat	crit-t	p-value	Core Skill
					Interpersonal Skills
1	No	-1.5862	1.9730	0.11	Ability to work closely with customers and maintain a productive user or client relationship
2	Yes	-2.3711	1.9893	0.02	Ability to communicate verbally, one-on-one and group briefings
3	No	-1.9340	1.9901	0.06	Ability to plan, organize, and lead projects (project management)
5	Yes	-2.7903	2.0129	<.01	Ability to write clearly, succinctly, and purposefully
9	Yes	-2.1339	1.9752	0.03	Ability to train/teach others (e.g. end-users)
					Managerial Skills
4	Yes	-3.3371	2.0017	<.01	Information and system security
6	Yes	-2.6650	1.9720	0.01	Ability to learn/implement new technologies
7	Yes	-3.1130	1.9718	<.01	Ability to understand technological trends and potentials
8	Yes	-2.1270	1.9897	0.04	Ability to plan and set standards for corporate-wide information system technology plan
11	No	-1.3012	1.9820	0.2	Ability to interpret and solve business problems
12	No	-0.9375	2.0195	0.35	Contingency planning/disaster recovery
16	No	-1.5216	2.0281	0.17	Establish/monitor corporate data structure
					Technical Skills
10	No	0.0708	1.9876	0.94	Networks (LAN, WAN, Corporate-wide, etc)
13	Yes	-2.1187	1.9704	0.04	Office automation (e-mail, schedulers, etc)
14	No	-1.4581	2.0032	0.15	Systems integration
15	Yes	-2.1784	1.9930	0.03	Telecommunications (hardware, phones, modems, cables, satellites, etc)
17	No	-1.8566	2.2281	0.09	Systems life cycle management
18	Yes	-2.1926	1.9850	0.03	Operating systems for mainframe, minis, micros, networks
19	Yes	-3.9094	2.1788	<.01	Systems analysis/structured analysis (formal method)
20	No	-1.3283	2.0181	0.19	Relational databases
21	Yes	-2.3986	2.0017	0.02	Distributed processing
22	No	0.1693	2.1448	0.87	Decision support systems
23	Yes	-2.3498	2.0860	0.03	CASE methods or tools
24	Yes	-6.5096	2.2281	<.01	Expert systems/artificial intelligence

References

Available upon request from the authors.

Partnering With ORACLE
An Example of an Academic and Industry Partnership

Gregory Neal, James N. Morgan, Alden C. Lorents
College of Business, 15066 Northern Arizona University
Flagstaff, AZ 86011

Abstract

The quality of CIS/MIS programs are enhanced through partnerships with industry. There are many examples of partnerships that have been done for years with companies like IBM, Texas Instruments, Microsoft, Sun, Sterling Software, SAP, Micro Focus, and various smaller companies. ORACLE's first program allowed academic programs to use their software for the cost of the annual maintenance which was about $1500 per year. ORACLE lowered the total annual fee to $500 in 1995, which was the total software cost for using most of ORACLE's packages for an academic program. ORACLE introduced the "ORACLE Academic Initiative" program in 1997 in an attempt to foster more coordination between the objectives of database courses in academic programs and the objectives of ORACLE's education program. Included in ORACLE's objectives is a program to encourage students of CIS programs to move toward ORACLE certification shortly after graduation. This paper describes the experiences and status of the initial stages of a program that is a partnership with ORACLE to achieve some of the objectives set forth by ORACLE's Academic Initiative Program.

Introduction

A partnership was entered into between ORACLE and the College of Business (CBA) at Northern Arizona University in the Fall of 1997 with the objectives of 1) enhancing the database curriculum and 2) providing graduates of the CIS program an opportunity to prepare for ORACLE's certification program. The partnership has put together a plan that includes a number of tasks and activities that are currently in process through 1998. These tasks and activities include: a) ORACLE training and certification for 2-4 faculty, b) a review of texts and syllabi used in database courses from a sampling of curriculums, c) a mapping of academic course content in a sampling of CIS curriculums with ORACLE training course content, d) designs for potential database course content that can be used, given different curriculum plans for database coverage, e) designs for providing content needed for the certification program that could not be covered in traditional academic courses, and f) the development of a prototype WEB based delivery system for the first database course. ORACLE's commitment to the partnership is to provide some of the resources, their curriculum materials, and some of the expertise to assist us with the content of all the courses that are developed. Our CIS program currently has two database courses with a plan to implement a third course in Database Administration.

Purpose And Objectives

The purpose of any partnership is to work together to build on the strengths of each other. We see this partnership as a win for the CIS program, for ORACLE, for the students, and for other CIS programs that can benefit from the work that has been done. Examples include: **CIS Programs** (Enhanced curriculum content, current technology skills, up-to-date database server capability), **Faculty** (Opportunity for additional training and upgrading), **ORACLE** (Opportunity to expand relationships with the academic community, increased exposure to ORACLE's technology for students and faculty, and a response to the IT personnel shortage by expanding the ORACLE talent pool), **Students** (Ability to reinforce database concepts using industry database systems, increased student marketability through certification, increased assess to industry based software for their own PC's).

Challenges

We recognize a number of challenges that are a part of this project and the ongoing initiative. The first challenge is the ability to integrate more material into our curriculums. We all face a limited number of credit hours for the major. Another concern is balancing the teaching of concepts (education) with tools (training). Some faculty may have concerns in patterning the course too much around a specific vendor. A second challenge is maintaining a program that is affordable to the student. This program could require a traditional textbook, training materials for each course, software, workshop fees and certification costs. A third challenge is obtaining the resources necessary to get faculty trained and up to speed to teach the courses. Very few schools have budgets of $5000 per year to send their faculty off to weeks of training. This is one of the areas where we need to get more industry partners to help. A fourth challenge is putting together the resources to develop the curriculum and WEB based material.

Mapping ORACLE Training Materials To Traditional Course Content

Our analysis of how ORACLE's Academic Initiative program fits into a University curriculum involves three main steps. First, we need to examine the content of database courses in the IS major curriculum and establish broad categories of coverage. Next, we need to map target ORACLE training course content to these categories. Finally, we need to compare the ORACLE training course content to the content of typical database textbooks on a detailed topical basis within each category. This process will allow us to get a feel for areas where the content of the ORACLE training courses is not adequately covered by academic texts or where the ORACLE training content will require substantially more course time than is available in the typical course.

To get a feel for the typical database course, we surveyed course outlines for database courses available on the Internet, and then requested additional syllabi for selected schools. A preliminary summary of the results of this process is shown in Figure 2. Our results thus far suggest that there are database courses with at least three distinct flavors. In addition to general courses that attempt to provide a broad and balanced overview, there are courses that have an application thrust and courses that place a strong emphasis on data modeling and the analysis component of the systems development cycle. Figure 2 provides estimated hours of coverage in each category for each type of course based on judgmental allocation of the surveyed syllabi to categories.

Detailed analysis of the training manuals for ORACLE courses included in the Academic Initiative program was used to determine how the topics covered, fit with the categories identified in the university course syllabus analysis. In some cases, topics in the ORACLE materials did not fit any of the categories in typical database courses and additional categories were created. A sample of this data for the Introduction to SQL and PL/SQL ORACLE training course is shown in Figure 3. Notice that there are considerably more detailed "topics" identified within each category in this figure. Comparing Figure 3 with Figure 2 it is clear that the volume of material relating to Database Application Development would be difficult to cover in a university database class with a general or modeling thrust.

A similar detailed analysis of topical coverage was performed for a set of commonly used database textbooks. Figure 5 shows a comparison of ORACLE training materials coverage and typical textbook coverage for topics in the "SQL SELECT & VIEWs" statements category. Analysis of this type of information across categories provides an additional means of identifying holes in the coverage of topics.

All of the data gathered has been placed in a database to facilitate flexible analysis. By examining the relationships among the coverage required for ORACLE's certification program, and that provided by typical university courses and texts, we should be able to address a number of important issues, such as: Which ORACLE content can be delivered with minimal change to courses? Which content might be handled by changing existing courses or by supplementary assignments for those interested in certification? Which content might require an additional course or companion mini-course to cover the most product-specific elements? Which content is inappropriate within the academic environment?

Web Course

Northern Arizona University has the distance education mission for the State of Arizona, so a natural step is to implement CIS 310 as a Web course. CIS 310 is the first course in the database sequence, and is targeted for including the ORACLE SQL and PL/SQL content. This approach will eventually provide access to the greatest number of students and demonstrate, through an example, the integrated CIS 310/ORACLE courseware. Initially CIS 310 was to be deployed on Western Governors University, however, changes in policy and questions concerning load deferred this decision. A decision was made to offer the course as a CBA Web offering with the enrollment limited to twenty students. The size of twenty was somewhat arbitrary, but a limit was needed because of resource constraints. Each student will be required to install and configure Personal ORACLE on their own workstation in order to complete assignments. From previous experience with on-campus courses, the installation of Personal ORACLE requires some support. It was determined that twenty students could be supported with available resources.

Another resource issue was the communication between students and the faculty member. CIS 310 includes group projects, which means that students will need to confer with each other to complete the projects. In addition, correspondence with the professor is essential. It was estimated that professor interaction would take about one to two hours per day. The collaboration will be facilitated through the use of the Northern Arizona University's Virtual Conference Center. Since this will be the first time the Conference Center software had been used there will be some training required for both students and faculty.

Faculty Training

Sending faculty to ORACLE Training courses had several objectives. First, it was necessary to determine the content and approach used in ORACLE delivered courses. Specific ORACLE content coverage was especially important. Topics like database administration and performance tuning were very product specific and outside the scope of the traditional database classes offering. The training helped faculty determine how and what to integrate into course material. Another important factor is the determination of what should be excluded from the course and kept as supplementary or self learned material.

Faculty were selected for training based on what grant component they would be working on and their planned teaching assignments. The proposed training coverage is shown in Figure 4. A significant issue was the cost of training.

Each ORACLE course is offered through the ORACLE Academic Initiative program at about $200 per day. This is a discount off the normal price which is about $400 per day, but this is way too expensive for most academic budgets. Fortunately Northern Arizona University had just adopted ORACLE as the student information system platform. The Chief Information Officer, who had negotiated training credits as a part of the platform change, was kind enough to give the CIS area faculty free training credits for eight courses. This was extremely helpful and allowed several faculty to obtain training early in the project.

The original timeline for training was constructed so that faculty received just-in-time delivery. Each professor took a course from ORACLE just prior to merging the training content with their course. The schedule was accelerated in the actual implementation so that an understanding of certification testing could be achieved.

Taking the training in advance proved valuable and caused a downward revision in course delivery expectations. Total course content was reduced, and more material was moved into problems or tutorials to be used outside of class.

Oracle Certification

ORACLE has rolled out their certification in stages. Figure 1 shows what is defined as of this writing and what has been proposed. What was learned from the training and the certification tests was a detailed knowledge of how tests were constructed and administered. Each test was linked heavily to ORACLE course material. Also, tests contained mostly multiple choice and true/false questions that were highly dependent on the memorization of course material rather than a conceptual understanding of that material.

We have concluded that students must be given access to ORACLE specific training material as a supplement to the standard course material. Also, if students are to successfully take the exams, a prep-session or review course will substantially improves their chances.

Summary and Conclusions

This project is in process with a lot of tasks to be completed over the next several months. We have insight on a number of preliminary findings at this point. There will be considerable content that cannot be covered in the traditional courses that will be required to pass the exams. The exams contain a lot of detail that comes directly from the ORACLE course materials. We will have more information on the progress of this project including the development of the Web course by October, 1998.

Figure 1 ORACLE Certifications Available

ORACLE 7.3 Certified Database Administrator	
Introduction to SQL and PL/SQL	(available)
ORACLE Database Administration	(available)
Backup and Recovery Workshop	(available)
Performance Tuning Workshop	(available)
ORACLE Certified System Analyst	
Introduction to SQL and PL/SQL	(available)
Data Models and Design Databases	(proposed)
Deisgner/2000: System Modeling and Tools	(proposed)
ORACLE Certified Forms Professional	
Introduction to SQL and PL/SQL	(available)
Developer/2000 Foundation	(proposed)
Developer/2000 Forms 4.51	(proposed)

Figure 2
Alternative Course Content by Topical Category

Course	Topical		Class Hours
Database I Applications			
	Relation Model		3.0
	Database Administration and Control		3.0
	SQL - DML & DDL		4.0
	Normalization		2.0
	Introduction / Basic Database Concepts		3.0
	ER Modeling		3.0
	Distributed & Data Warehousing Databases		3.0
	DBMS Systems Architecture		2.5
	Database Planning & Development Process		0.5
	Database Application Development		12.0
	SQL - SELECT & VIEWs		7.0
		Sum	*43.0*
Database I General			
	Network / Hierarchical Models		1.5
	Introduction / Basic Database Concepts		3.0
	Database Administration and Control		3.5
	Database Application Development		6.0
	Database Planning & Development Process		1.5
	DBMS Systems Architecture		2.5
	Distributed & Data Warehousing Databases		1.5
	Normalization		3.0
	Object Oriented DBMSs		2.0
	Physical File & Index Structures		2.5
	Relation Model		2.0
	SQL - DML & DDL		3.0
	SQL - SELECT & VIEWs		5.0
	ER Modeling		6.0
		Sum	*43.0*
Database I Modeling			
	Database Planning & Development Process		5.0
	SQL - DML & DDL		3.0
	Physical File & Index Structures		2.5
	Object Oriented DBMSs		3.0
	Normalization		5.0
	Introduction / Basic Database Concepts		3.0
	ER Modeling		10.0
	DBMS Systems Architecture		1.5
	SQL - SELECT & VIEWs		5.0
	Database Administration and Control		3.0
	Distributed & Data Warehousing Databases		2.0
		Sum	*43.0*

Figure 3
Intro to SQL & PL/SQL ORACLE Course

Topic	Manual Pages
Category *Database Application Development*	
PL/SQL Assignment Statements	14
Creating PL/SQL program units & subprogs	29
Data Retrieval & Manipulation in PL/SQL	21
Declaring Variables in PL/SQL	23
Error Handling in PL/SQL Blocks	23
ORACLE PL/SQL Structure & Environment	17
PL/SQL Cursors	33

	PL/SQL Looping and If Statements	29
	Procedure Builder PL/SQL Environment	45
	Rules and Conventions for PL/SQL Coding	14
	SQL*Plus Interactive Reporting	25
	SQL*Plus Reporting Commands	41
	SQL Transaction Control in PL/SQL Blocks	6
	SQL*Plus Overview	12
	Sum	*332*
Category	*Database Planning & Development Process*	
	Data Modeling Overview	39
	Sum	*39*
Category	*DBMS Systems Architecture*	
	ORACLE Arch. SQL & PL/SQL	33
	Sum	*33*
Category	*SQL - DML & DDL*	
	Altering Table Structures	23
	Controlling User Access	29
	Creating Views	19
	ORACLE Sequences	21
	Indexes in ORACLE SQL	21
	ORACLE Data Dictionary Views	17
	Using Views to Perform DML operations	6
	SQL INSERT, UPDATE & DELETE Statements	33
	SQL Create Table Basics	35
	SQL Transaction Processing Concepts	16
	Sum	*220*
Category	*SQL - SELECT & VIEWs*	
	Single Row Functions	
	Advanced Table Joins	10
	SQL Select Subqueries	23
	SQL Select Group Fns.	32
	Conversion Functions	23
	Basic Table Equi-Joins	18
	Basic SQL Select Queries	61
	Sum	*167*

Figure 4 Faculty Training Matrix

Designer/2000 Certified System Analyst	Faculty 1	Faculty 2	Faculty 3	Faculty 4
Introduction to Oracle	X		X	X
Data Models & Design Databases	X		X	X
Designer/2000: System Modeling & Tools		X		X
Developer/2000 Certified Forms Professional				
Developer/2000 Foundation	X			X
Developer/2000 Forms 4.51	X	X		X
Oracle 7.3 Certified Database Administrator				
Oracle 7.3 Database administration	X	X	X	
Backup and Recovery Workshop	X	X	X	
Performance Tuning Workshop	X	X	X	

Figure 5
Details of ORACLE Training Materials & Textbook

SQL - Select Statement and Views Topics

Topic	*ORACLE Training Materials* Pages	Reference	Description of Coverage	*Typical Database Textbook* Pages	Reference	Description of
Advanced Table Joins	10	3-18 - 3-27	Non-Equijoins, Outer joins, Self joins for intra-table relationships	6	238-240, 248-250	Outer-Joins and Implicit joins.
Basic SQL Select Queries	61	1-1 - 1-61	Fundamentals of the SQL Select statement, column specifications and formatting, where clause search criteria, order by clause.	14	199-213	Description of fundamentals of SQL Select statements including basic projection and selection operations.
Basic Table Equi-Joins	18	3-1 - 3-18	Joining tables in a SELECT statement using the equi-join to retrieve related records.	8	217-220, 234-237	Basic equi-Joins of two tables and of more than two tables.
SQL Select Group Fns.	32	4-1 - 4-31	Use of group functions - Avg, , count, max, min, sum stddev, variance. Us of the having clause in group faunction select statements.	6	240-245	Use of group functions (SUM, AVG, MAX,MIN, COUNT) and the associated HAVING clauses.
SQL Select Subqueries	23	5-1 - 5-23	Basics of subqueries with single row and grouped subqueries.	5	248-252	Use of singel and multiple row subqueries including correlated subqueries.

Promoting Careers in Computing: A Multimedia Approach

Sally K. Scott
skscott@ilstu.edu

Carol Chrisman
cachrism@ilstu.edu

Applied Computer Science Department
Illinois State University
Normal, Illinois 61790-5150

Abstract

This paper describes a multimedia approach used to provide information on computer-related career options and to encourage students to consider computing careers. A presentation, titled ***Careers in Computing***, was developed to give an overview of trends in the computer industry, highlight some of the new technology that is creating new career opportunities, and feature in-depth information on the wide diversity of computer-related job categories and job titles available today. Targeted for high school and university students seeking information about careers in computer and information technology, the presentation can be used individually or by counselors and recruiters in group settings. ***Careers in Computing*** makes use of a full range of multimedia features including video, audio, animation, and graphics.

Introduction

The computer world has become amazingly complex in the last decade. Technological advances have rendered landmark changes in industry structure and competition, product applications, and career paths. As production has grown and diversified, so have the types and varieties of computer-related careers. Some job titles, such as Webmaster, were not even heard of a few years ago.

All of this growth has been difficult to follow, even for the industry insider. It is especially difficult for students contemplating a computer career to understand the many choices and make college and career decisions. Career counselors and those advising students similarly have a difficult time understanding and explaining the possible computer career choices.

Students often find themselves needing to make college and career decisions without enough information to form opinions for these decisions. Being barraged with well-meaning suggestions concerning their future direction, they become frustrated by not fully understanding the careers and job titles that they often hear. Sometimes students have a familiarity with a job title but do not understand the specifics of that position. Moreover, some stereotypes continue to exist regarding computer careers. For example, females often feel excluded from what they perceive as a highly technical male-dominated field. Also, some students perceive computer careers to solely involve writing programs. As a result, through their lack of information and confusion, students may shy away from choosing a computer-related major.

More information needs to reach students at an earlier age to make them aware of the possibilities and to encourage them to consider computing as a career. There is a huge demand for knowledgeable employees in this field. Recent trade publications have highlighted industry-wide concern about the expected shortfall in college graduates (Barlas, 1996). There is also considerable concern about the shortage of women and minorities seeking computer careers. More students need to be encouraged to consider a computer-related major.

A Multimedia Presentation

To address some of these concerns, a multimedia presentation, titled ***Careers in Computing***, was developed to help in our department's recruiting efforts. The two main objectives for this presentation are: (1) to promote awareness of computer-related career options and (2) to encourage students to consider computing careers. The presentation highlights the wide diversity of computer-related careers available today. Because our department houses undergraduate programs in Computer Information Systems, Computer Science, and Telecommunications Management, the presentation also helps students determine which general type of college program would best prepare them for specific careers.

Users for ***Careers in Computing*** include university advisors and recruiters, high school counselors, and students. The student users consist of four types: (1) high school students who are considering their options for college (2) community college students selecting a transfer institution (3) current university students who are undecided about their major, and (4) students already enrolled in a computer major or minor. Advisors and counselors will typically make ***Careers in Computing*** available to students. The presentation is designed to be used individually, although it can be shown in a group setting or as a display at a job fair.

One of the main features of ***Careers in Computing*** is that it provides students with an organized framework of careers and job titles. Students may use this information at several levels, seeing an overview of career possibilities at the highest level, or accessing more specific information about specific jobs at the lowest level. Moreover, the presentation ties the degree paths that are typically available in a university to the job descriptions.

Careers in Computing was developed with IconAuthor version 5.1. To hold the users' attention, it makes use of a full range of multimedia features including video, audio, animation, and graphics. To be appropriate for the target audience, the presentation had to be easy to understand and use, interesting, and interactive, and yet needed to contain in-depth content. Users will find the multimedia interactive presentation superior to more traditional means of obtaining career information.

Content of *Careers in Computing*

In developing the overall content of ***Careers in Computing***, several challenges had to be met. One of the greatest challenges came from the sheer volume of information that needed to be conveyed. In order for the presentation to be useful, very little information could be left out, yet it had to be organized in such as way that it was easy to navigate and find information. For this reason, the content is organized into four distinct sections, moving from general to more specific.

Determining a structure to organize the many, many jobs involving computer professionals was a particularly difficult challenge. After several attempts, a framework that organized the more than thirty job titles into six broad categories was selected. Each category is based on the similarity of work tasks. Categories include: System or Application Development, Technical Specialist, User Support, Hardware Manufacturing and Sales, Operations, and Other. Job titles were then assigned to each category. Table 1 shows this framework. Another challenge was to provide the information so that a student with very little background in computers could understand it. This meant that technical jargon and buzzwords had to be either carefully avoided or explained.

The first section of the presentation, titled ***World of Computing***, provides an overview of the growth in computing. Using an interactive graphic, significant advances in computer usage reflect the changes in job descriptions. Continued job demand is shown in a chart based on Board of Labor Statistics projections for computer occupation growth from 1992-2005 (as reported in Stair, 1996). Graphics are used to point out job location trends nationally and locally. Videos of alumni from our program discuss their satisfaction with their career choices. The goal of this section is to give students a better understanding of computing as a career possibility.

The purpose of the second section, ***New Directions***, is to showcase some of the newer technologies in an effort to tie the changing technologies to a changing career environment. This section is meant to attract interest and is the section best suited to be used in a job fair booth. Featured topics include virtual reality, the Internet, software engineering, multimedia and graphics, object-oriented development, parallel processing, and telecommunications. This section is constructed in such a way that topics can easily be updated or changed as they become outdated. Figure 1 shows the main screen for this section when Object Oriented is selected.

Section 3, ***Today's Careers***, moves into an in-depth look at computer occupations. Topics for this section cover desirable characteristics of computing professionals, work environments, career paths, and job descriptions. Desired characteristics such as problem solving ability, technical skills, business knowledge, and good communication skills are among those discussed. The work environments subsection describes differences between working for a hardware or software company, working for a business or government agency that makes use of computer technology, and working for an independent consulting company. Figure 2 shows a sample page from this section illustrating a typical project team structure. Typical career paths for management, programming, and consulting are graphically illustrated.

Within the job descriptions subsection, not only are the most well-know job titles discussed, but some of the newer, more specialized areas are also included. A student first selects a category, then a job title. For each of the thirty-two job titles there is a page detailing the work tasks, work settings, personal qualities required, education and skills required, and similar job titles. See Figure 3 for an example of the Systems Analy job description page. Many of the pages contain either photographs or videos of someone who is in that job discussing their work. By using women and minorities in the graphics and videos, it is hoped that more people from these groups will be encouraged to consider a computing career.

Also included in ***Today's Careers*** is a short quiz entitled "Does It Fit Me?". In this quiz students are given questions pertaining to personal work styles and skills. There are no right or wrong answers, rather feedback is given for each response. Many of the questions help to differentiate between different types of jobs or employers. By going through this quiz, students have the opportunity to consider how their individual characteristics fit into different computing careers. For example, the question "Do you have good math skills" may be answered with "Yes, I think so" or "No, I'm concerned about that". With the "No.." answer, the student learns that while some areas of computing require very strong math skills, there are others such as computer information systems where problem-solving skills are more important than math. In another example, one question asks "Would you prefer to work for a large company or a small company?" Feedback to this question points out the advantages and disadvantages of each size of organization. See Table 2 for a complete list of the questions.

College Major, the last section, introduces the students to our university and the programs offered by our department. Some general facts along with photographs feature the campus. A short movie with music leads students through the department and labs. Finally, there is information about applying and being accepted into the university and department.

Use and Distribution

The purpose of ***Careers in Computing*** is to reach high school and early college students with information that will assist them in their college and career decisions. Achieving this goal necessitates display of the presentation in a prominent location at the appropriate time. Because of its large size, the most efficient way to distribute ***Careers in Computing*** will be on CD-ROM. IconAuthor allows the creation of a runtime version and free distribution of its presentation software so that no additional software will be required.

Our department plans to use ***Careers in Computing*** in several ways. As a recruiting tool, it can be used by department recruiters as well as high school counselors. Departmental recruiters often go to open houses where they are able to set up a booth and talk to prospective students. Selected sections such as the ***New Technology*** section can be used to first attract students to the booth. When these students wish to find out more about computer careers and college majors, they can then further explore the program. Another planned use is to offer it to high school and community college counseling offices. Discussions with area guidance counselors indicated that this would be welcomed. Finally, ***Careers in Computing*** can be used by students at a computer set up in the department advising office. This will help students who are interested in the computer field, but unsure of their direction.

In addition, ***Careers in Computing*** can be used in courses to deepen students' understanding of computer careers and confirm their major direction. Our department has two courses where this presentation will be especially beneficial to students. Both our first course for majors and our preparation for internship course have a unit that focuses on careers. Faculty can demonstrate a particular section or subsection in the classroom and have students work with the presentation individually in the department labs.

A multimedia presentation can make a large quantity of information available to the user without the user initially being confronted with too much. The navigation paths available in ***Careers in Computing*** allow both linear and non-linear exploration of the topics. Students can make use of it at their own convenience, allowing more time for the topics that interest them, skipping over the topics that do not serve their needs, and returning to topics as needed. By using interactive multimedia, special training will not be required for interaction with the system. The users will only need to understand the basics of navigating through a graphical interface.

Limitations and Future Direction

In developing a project of this size several considerations come into play. Because of the wide variety of media involved, the development was a very time intensive operation. While this project was developed by one individual as a master's project, a team approach where specialization can occur would be more efficient.

A particular problem with this project was locating affordable images and video clips that could be incorporated into the presentation. First of all there are not very many sources, and secondly, usage fees are too expensive for an educational institution. Therefore, backgrounds and images had to be created from scratch or scanned in from photographs. Videos were even more of a challenge. Video clips were shot at advisory board meetings and other alumni functions and then digitized. The resulting video quality is less than professional. Since images and videos require large amounts of memory, size and portability of the product were hard to manage during development and in the finished product.

One future plan is to replace the current videos with professionally produced ones and to expand the number of videos included. Another consideration for the future is migration to the World Wide Web. This would certainly increase its availability but may involve substantial redevelopment, given the version of IconAuthor used.

Conclusion

There is a clear need for computer career information that guides students in their decision making at several levels. Students must first decide to pursue a computing major, then choose an emphasis within their major, and upon graduation decide on a type of job and company. The presentation described in this paper provides an overview of the job market as well as comprehensive information on the variety of choices that exist. The framework of job categories and job titles provides a useful organizing structure. By combining the advantages of multimedia with the quantity of career information included, ***Careers in Computing*** delivers a valuable resource for both students and the department.

Bibliography

Association for Computing Machinery. (1992, February). The No-Nonsense Guide to Computing Careers. New York, NY.

Barlas, S. (1997, May) How critical is the shortage of IT workers? Computer, pp. 14-16.

Brown, C. M. (1993, February). What's new in high-tech careers? Black Enterprise, pp. 159-166.

Burns, J. K. (1996). Opportunities in Computer System Careers. Lincolnwood, IL: VGM Career Horizons.

Computer Salary Survey, 32nd ed. (1994). Irving, TX: Source EDP.

Computer scientists and systems analysts. (1996, March 5). Occupational Outlook Handbook Bureau of Labor Statistics. URL stats.bls.gov/oco/ocos042.htm

Computer systems analysts. (1993). Occupational Outlook Handbook (pp. 80-82), Lincolnwood, IL: VGM Career Horizons.

Data Processing Management Association. Computer Careers. [Pamphlet], Parkridge, IL.

Stair, L. B. (1996). Careers in Computers. Lincolnwood, IL: VGM Career Horizons.

1996 Career Guide (Oct. 30, 1995). U. S. News and World Report, pp.76-108.

1997 Computer Industry Salary Survey. Datamasters. URL www.datamasters.com/survey.htm

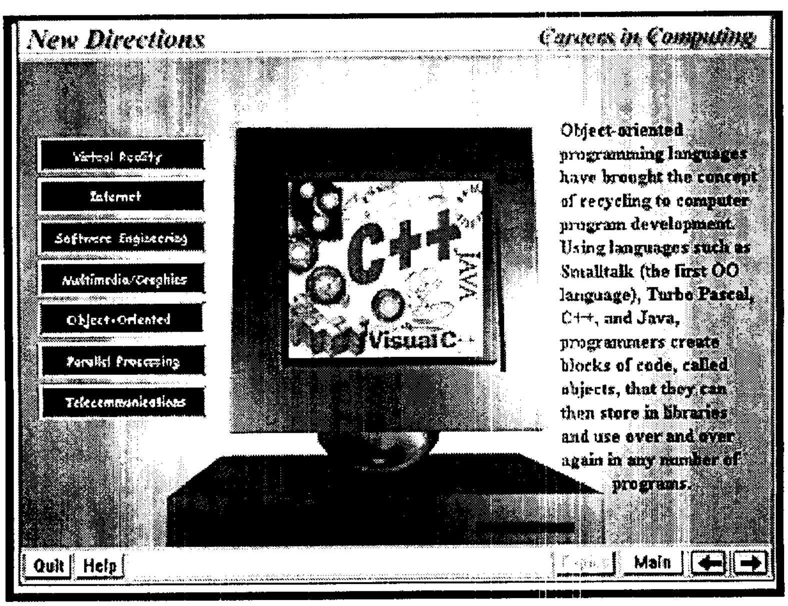


Figure 1. New Directions Section: Object Oriented

Table 1. Framework of Job Categories and Job Titles

System or Application Development
- Systems Analyst
- Programmer/Analyst
- Software Engineer
- Application Programmer
- Multimedia Developer
- Graphics Developer
- Client/Server Developer

User Support
- Trainer
- Information Center Specialist
- Technical Support Analyst
- Security Specialist

Other
- Consultant
- Computer Educator - Primary & Secondary
- Computer Educator - College Level
- Information & Data Services

Technical Specialist
- Database Specialist
- Network Specialist
- Telecommunications Specialist
- Systems Programmer
- Data Specialist
- Webmaster
- Security Specialist
- EDP Auditor
- Quality Assurance Specialist

Hardware Manufacturing & Sales
- Computer Engineer
- Vendor Systems Analyst
- Sales Representative
- Field Service Engineer

Operations
- Computer Operator
- Production Control Clerk
- Librarian
- Technical Support Manager

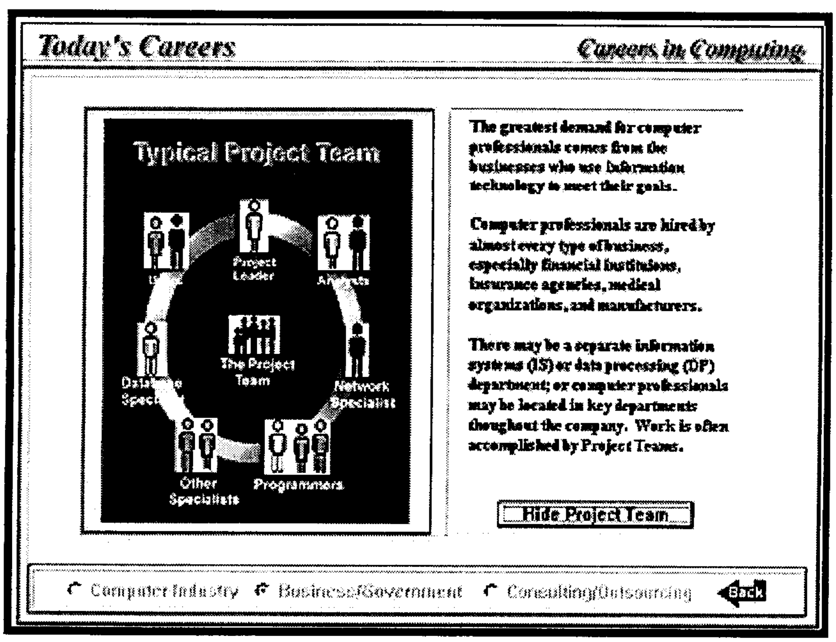


Figure 2. Typical Project Team Structure

Table 2. Questions & Responses for *Does it fit me?*

Q1. Which do you prefer most of the time? • Working in teams on group projects • Working alone on a project	Q5. Would you prefer to work for a large company or a small company? • Large company • Small company
Q2. Would you like a job where you interact with many different people daily? • Yes • No	Q6. Do you have good written and oral communication skills? • Yes, I think so • No, they are not that great
Q3. Do you like to analyze problems and come up with plans for solutions? Yes • No	Q7. Do you enjoy taking classes and learning new things? • Yes • No
Q4. Do you have good math skills? • Yes, I think so • No, I'm concerned about that	Q8. Are you an organized, detail-oriented person? • Yes • No
	Q9. Do you have a lot of creativity and artistic ability? • Yes • No

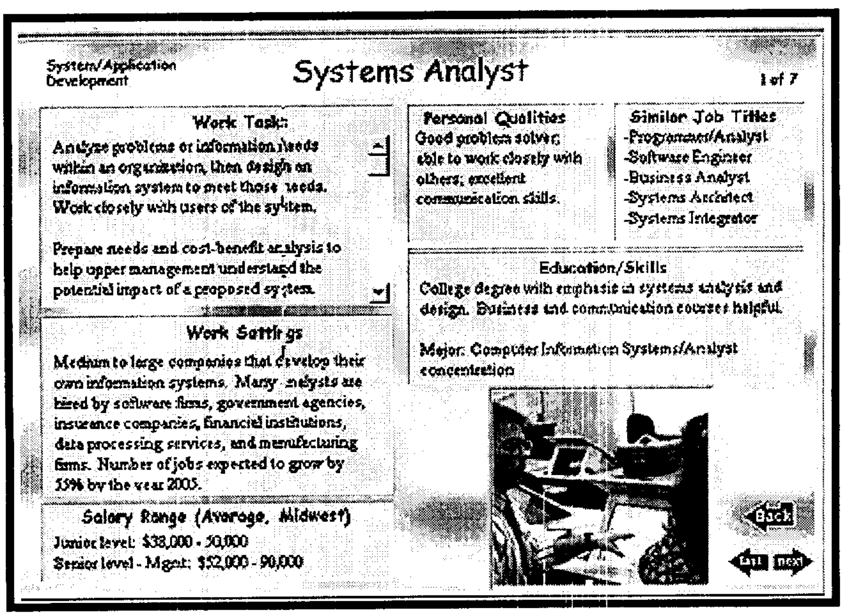


Figure 3. Systems Analyst Job Description Page

Design of A Novel CIS Curriculum for Educating the Information Systems Developers of the 21st Century

Andrew L. Wright, Assistant Professor of CIS
S. Srinivasan, Professor of CIS
Jian Guan, Associate Professor of CIS
College of Business and Public Administration, University of Louisville, Louisville, KY 40292

Abstract: The rapid development of information technology presents both challenges and opportunities to educators of computer information systems (CIS) professionals. Many educational institutions are trying to cope with the advancements by enhancing their curricula. In our case, we were provided with a unique opportunity to redesign our CIS curriculum. In this paper we describe our innovative design process and the resulting curriculum.

§0. Introduction

The rapid development of information technology presents challenges and opportunities to educators of computer information systems (CIS) professionals (Tye, 1995) (Davis, 1997) (Lee, 1995) (Reynolds, 1996). Programs in CIS are faced with the task of teaching emerging technologies while the number of credit hours and funding remain relatively fixed. In response to this situation, the faculty of Computer Information Systems at the College of Business and Public Administration, University of Louisville, have taken a proactive initiative to redesign its undergraduate program in CIS. The result is a new program for educating the information systems developers of the 21st century. This paper describes both the process and results of this curriculum development effort and its initial implementation.

The entire process of curriculum redesign was completed in one year. The outcomes on which the new curriculum was based were developed closely with our Corporate Partners. Decisions were made in the redesign process to use innovative solutions to address both the problem of limited faculty resources and the problem of covering topics with rapidly evolving content. For example, teaching personnel from a Corporate Partner doing professional training teach our skills development courses. The new curriculum emphasizes current information systems technology and development tools while still providing the foundation of knowledge needed to adapt to each successive generation of technology. Two major themes are found in the new curriculum: client/server computing and object-oriented methodology. Given the rapid changes in information technology, the enhanced curriculum has adopted a flexible structure to respond promptly to new technology developments as well as more fundamental curriculum changes. The curriculum offers a unique blend of technical and management perspectives for a business school program, but it is significantly different from a traditional MIS program. Besides the general education requirements, the technical orientation in the enhanced curriculum requires 45 hours of course work in computer information systems principles and skills development. The business orientation includes 38 hours of business courses. A critical component of the curriculum is the requirement for a six-hour cooperative work assignment during which a student gains practical work experience. To ensure the full and successful implementation of the curriculum, a state of the art CIS computer laboratory has been developed. Since its completion in 1996, the enhanced curriculum has undergone about two years of implementation.

Section 1 describes the process of curriculum redesign enhancement, section 2 focuses on the curriculum structure and content, and section 3 discusses the initial implementation. Finally, section 4 provides conclusions and discusses the continuing effort to further enhance the program.

§1. The Process

The CIS curriculum was redesigned around a single vision: educating the information systems developers of the 21st century. Assessing current trends and looking towards the next century, it is clear that the information technology field has advanced considerably and will continue to do so. These advances have prompted profound changes in the ways information systems are developed and deployed (Tye, 1995) (Davis, 1997) (Lee, 1995). Our curriculum was redesigned to reflect these changes.

The specific goals at the heart of the new curriculum include a new focus on client/server applications and object-oriented development. This represents a shift away from more traditional mainframe application development using COBOL, towards a more modern approach that addresses the importance of networks, graphical user interfaces, and Internet computing. Development tools have also changed, with more object-oriented approaches in use. C++, Delphi, Visual Basic, and others are now being used to produce the applications of today and tomorrow. Our desire is to prepare students to embrace emerging information technologies, yet provide a fundamental understanding of legacy systems and their roles in business computing. To achieve this, we enlisted the help of our Corporate Partners.

The twelve Corporate Partners represent a wide range of businesses in the community. Some of them are multi-billion dollar global companies while others are smaller software development companies. The members representing these companies range from CEOs, CIOs, and unit managers. During curriculum development we met with Corporate Partners on a quarterly basis while a subcommittee of the Corporate Partners interacted more frequently. Curriculum alignment with industry needs in the information technology field is particularly important (Tye, 1995).

This close cooperation with the user community is an important feature of our curriculum redesign process. Formation of the CIS Corporate Partners was viewed as essential providing a means of integrating the CIS program within the business community. In order to obtain the necessary feedback we developed a set of learning outcomes, summarized below in Table 1.

Area	Knowledge, Skill, and Ability
Information Systems Foundation	COBOL programming on mainframe computers; Object-oriented programming (C++) on PCs and networks; Systems Analysis and Design using CASE tools; Relational Database theory with applications, including distributed databases and client/server; Telecommunications and Networking with applications; Operating Systems (Windows 95, Windows NT, UNIX, MVS/JCL).
Information Systems Specialties	Graphical User Interface (GUI) development on PCs and networks; Telecommunications (WAN, LAN, voice, telephony).
Business Practices	Business Foundations and Principles; Quantitative Analysis (mathematics and statistics); Business case preparation; Total Quality Management (ISO 9000); Time Management; Project Management.
Interpersonal Practices	Communications (writing, speaking, listening, presenting); Leadership; Teamwork.

Table 1. Learning Outcomes

Outcome Category	Course Title
Database Design and Development	Client/Server Development Systems Analysis and Design
Delphi Programming	Rapid Application Development GUI Development
LAN Design and Support	Cooperative Assignment

Table 2. Learning Outcomes Grouped by Outcome Category

We used this set of outcomes to obtain a mapping of the courses, a sample of which is shown in Table 2. The Corporate Partners carefully examined the learning objectives and the outcomes. We took feedback from them into account in our curriculum design, which met with wide spread support from the advisory group.

We realized that we would not be able to deliver all the courses ourselves given our limited faculty resources and our responsibility for service courses. A capable faculty is the first required resource for delivering a curriculum (Davis, 1997). A critical decision made in the curriculum redesign process was the use of for-profit software training providers in covering certain courses for us. This would enable the CIS faculty to concentrate on the core courses of the new curriculum. With this flexible structure we were finally able to develop a curriculum that we could deliver with our existing resources.

It is widely recognized that CIS programs require specialized laboratories (Davis, 1997) and both the CIS faculty and the Corporate Partners saw the importance of hardware and software support for the new curriculum. During the curriculum redesign process the development of lab for the exclusive use of CIS students was seen as a critical component in ensuring the success of the new curriculum. This lab would be upgraded every two years and would be funded in part by our Corporate Partners.

§2. Curriculum Structure and Content

The new CIS curriculum is fairly unique. It is a complete Bachelor of Science in Business Administration degree with the full complement of accounting, finance, management, and marketing courses. Students graduate with an understanding of a corporation's "big picture" and the role that information systems play in the business. Unlike traditional MIS programs, however, our curriculum reflects a stronger technical foundation incorporating courses more typical in a computer science program. Figure 1 shows how our CIS program fits in the typical degree offerings found at most universities.

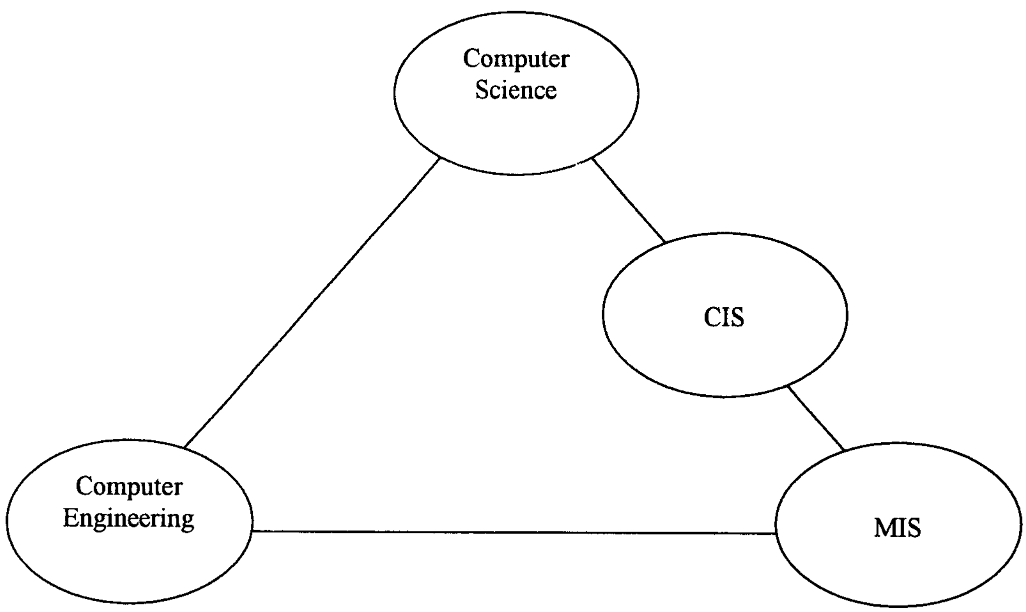


Figure 1. Relative fit of our CIS curriculum in traditional offerings

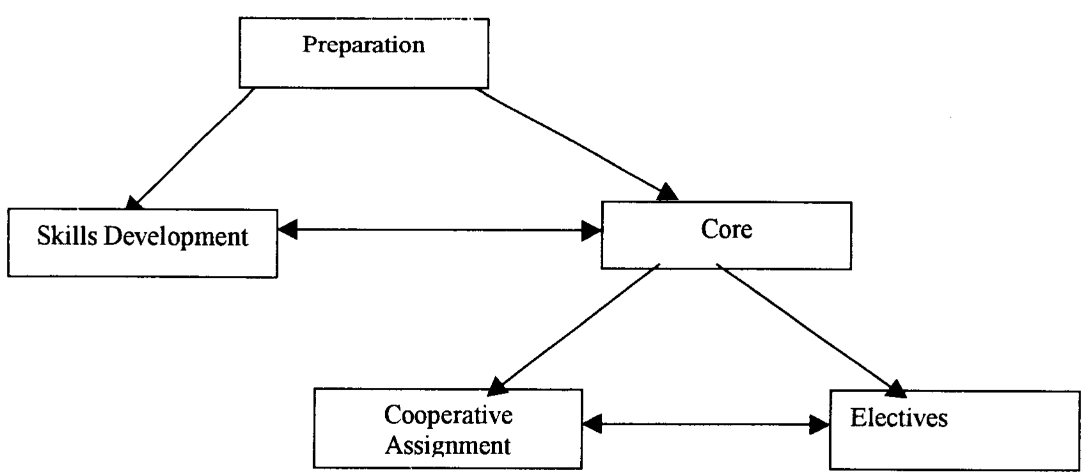


Figure 2. Curriculum Organization

The curriculum is structured into five sections (see Figure 2). Students begin with the Preparation section, which consists of C++ programming. This replaces Pascal as our introductory programming language. The use of C++ was a hard sell to some faculty because of the degree of difficulty associated with its use. There were legitimate concerns that many students would have a hard time keeping up with the pace of the material that needed to be covered.

In the first course, students are introduced to both a structured approach and an object-oriented approach to programming. The second C++ course is more like the traditional data structures class. This represents a fairly comprehensive coverage of C++. Another difference between our previous curriculum and the current one is in COBOL coverage. We now offer the introductory COBOL course every semester and the Advanced COBOL course once every two years. Also, the project course in COBOL was replaced by a more comprehensive Client/Server Development project course.

Also included in the **Preparation** section is the first of three Careers in Information Systems courses. These one hour courses are taught in the students' freshman, junior, and senior years. These courses have several goals, including a general introduction to the field, an exposure to possible career paths, and coverage of ethics.

Structure	Content
Preparation -- Tools and Foundation *(16 credit hours)*	1. C++ Programming 2. Data Structures and Abstractions 3. Careers in Information Systems I (1 hr) 4. Microcomputer Applications 5. Legacy Systems Programming -- COBOL 6. Operating Systems
Skills Development *(3 credit hours)* Students must complete 2 modules, each at 1.5 credit hours, for a total of 3 credit hours	7. Novell NetWare Administration 8. Windows NT Administration 9. Rapid Application Development (using Visual BASIC, Delphi, etc.) 10. WWW Development (web page development, including forms)
Core -- Principles *(17 credit hours)* Client/Server Computing as the Program Theme	11. Relational DBMS 12. Careers in Information Systems II (1 hr) 13. Systems Analysis and Design 14. Management of Information Systems 15. Careers in Information Systems III (1 hr) 16. Client/Server Development Project 17. Telecommunications and Networking
Cooperative Assignment -- Practical Experience *(6 credit hours)*	One six-month assignment is recommended. The cooperative assignment may be completed any time after admission to the upper division.
Electives -- Applications *(3 credit hours)*	18. GUI Development 19. Object-Oriented Methods (OOA, OOD OOP) 20. Computers and Society 21. Legacy System Support -- Advanced COBOL 22. Internet Computing 23. Special Topics in CIS
Total Credit Hours: 45	

Table 3. The new CIS curriculum courses

The primary purpose, however, involves the development of a portfolio that is used to assess the outcomes of the program. In the first course, students are introduced to the CIS outcomes and how they might demonstrate their mastery in the portfolio. For example, students might include completed design projects and programs, among other things. In the second course, students have their portfolios spot-checked, while learning about teams and project management. The final course in the sequence is where students actually have their portfolios formally evaluated, while also honing their resume writing and interviewing skills in preparation for job placement.

The second part of the curriculum is the **Skills Development** section. This piece was designed to be highly flexible, with need-specific course offerings. The subjects covered will be more skill-oriented than knowledge-based and are generally offered as 1.5 credit hour modules. Current examples include Novell NetWare and Microsoft NT Administration, and Visual BASIC programming. Another interesting feature of these courses is that they are taught by one of our Corporate Partners that do corporate training. For every course taught by a Corporate Partner a full-time faculty member attends the course to ensure quality control and appropriate coverage. The students take these courses in two modules at the training facility owned by this Partner. Each module is offered over four days in eight-hour sessions per day. This kind of intensive training gives the students an opportunity to pursue additional courses that lead to Novell or Windows NT certification on their own.

The next section of the curriculum is the **Core**. The courses are similar to ones found in most information systems degrees, what is different is the emphasis on the client/server theme. The database course, for example, involves projects where the students build a database, using Oracle for the back-end and PowerBuilder or Visual Basic for the front-end. The Systems Analysis and Design course is immediately followed by the Client/Server Development Project course, both of which center on a real project for an industry partner. Another change is the inclusion of the Telecommunications and Networking course in the core.

The final sections of the curriculum are comprised of the **Cooperative Assignment and Electives**. The six-month cooperative assignment is required of most students not already working full-time in the field. This gives the students another chance to apply what they have learned on practical assignments in the real world. The companies for whom they work during their cooperative assignments offer many students jobs upon graduation. This experience helps produce graduates with employable skills so that they may begin contributing immediately to the organizations that hire them. Although many of our students may eventually move into a more management-oriented career track, few would be ready immediately upon graduation. These students must be able to make meaningful contribution to the organization when hired without significant time investment in training. As they gain experience, they will advance into management positions.

All students are required to take one elective, down from two in the previous program since we strove to keep the number of credit hours the same in the new curriculum. The offerings here include some exciting courses such as Graphical User Interface (GUI) Development and Internet Computing. The GUI course is important because of the greater abundance of systems being built that utilize a graphical interface and the ease of their development with today's tools. The Internet Computing course focuses on the tools and techniques used in developing useful sites for intranets, extranets, and the Internet. Coverage includes Java, scripting, and web database connectivity. The arrangement of these courses was listed earlier in Table 3.

§3. Initial Implementation

We started offering the new curriculum courses in fall '96. In this section we will briefly discuss the following aspects of the new curriculum implementation: the CIS lab, the implemented part of the new curriculum, the use of clinical faculty, and faculty development.

In order to support the new curriculum, we knew that a separate computer laboratory would be required. Unlike existing labs, the CIS lab needed to be state of the art, offering the same tools students will see in the field upon graduation. With fifty- percent financial support from our Corporate Partners and the rest from the college, we have funded a 28-station Windows NT lab. The lab is operational with one faculty member serving as administrator, supported by student assistants. Our goal is to keep the hardware current, by replacing each machine every two years. Currently, the lab consists of 14 Pentium Pro and 14 Pentium II computers, each with 32 MB RAM and 17" monitors. In addition, we have a dedicated server running Windows NT, configured with a Pentium Pro (scalable to dual processors), 128 MB RAM, and a RAID 5 SCSI array. Software development tools are also very current with licenses for Visual Studio, Oracle 7.3 and Designer 2000, PowerBuilder, Rational Rose, Delphi, Dreamweaver, etc. Availability was also a consideration for the lab, so only CIS students are issued door codes and NT accounts. This prevents other students from taking up valuable time on these high-end machines in order to do basic computing tasks that are better suited to a general lab. We also installed a modern security system with video surveillance that allows us to keep the lab open 24 hours a day.

We have offered the courses in the Preparation section and the Skills Development section of the new curriculum at least once. Some of the core courses have also been offered once. We have experienced a 30 to 40 percent attrition in the C++ course sequence. We have come to realize that part of the attrition problem is due to poor advising. We are taking steps to correct this situation. After the second C++ course about 60 students decide to pursue CIS as their major. This has resulted in the need to offer double sections of all the core courses, which is about 100% increase from the past. The attrition rate beyond the C++ course sequence is very low. For the other courses we have been able to implement the new curriculum. For example, in the database course the students are required to develop client/server projects using Oracle 7.3 and Visual Basic 5.0. Many local companies are very interested in hiring our students as part of their cooperative assignment program since they have been exposed to the current client/server database technology.

We have working with one of our Corporate Partners to offer most of the sections of one introductory service course. Since this partner is in the corporate training business we have good built-in quality control in delivering this course. This university-private industry partnership is working well for us. This enables us to maintain the high quality in our program and at the same time free up full-time faculty to concentrate on our main courses. Another way that we are easing staffing problems is by exploring the use of clinical faculty -- professionals whose experience qualifies them to teach in the program. For example, one of our Corporate Partners has supplied us with an experienced alumnus to teach a section of our Client/Server Development Project course. The project for this class came from the Corporate Partner, so it is very realistic. The instructor has direct experience with the development environment needed and serves as liaison between the students and the company. The instructor does this with the full support of the Corporate Partner. For example, when they decided that they needed to use another database as the backend (to match the delivery environment), the Corporate Partner donated additional funds to cover the cost. We are actively working with the college to formalize this clinical faculty relationship, since it is very different than the use of a typical part-time instructor. We consider this staffing practice similar to the use of clinical faculty in medical schools.

We have several courses in the new curriculum that we are yet to offer. Since several of them come under electives and since we require only one, we have time to keep offering additional courses from the list of electives.

The rapid increase and changes in knowledge in the information technology field require that faculty continuously upgrade their skills (Davis, 1997). To ensure the successful delivery of the new curriculum, the CIS faculty has engaged in professional development. First, over 30% of the faculty over the past two years have participated in a program where a faculty member works in a corporate environment over the summer. Second, almost all faculty members have taken formal training courses in one or two areas of emerging technologies. Third, several faculty members have been retooling themselves so that they can teach in the core technical areas of the new curriculum.

§4. Conclusion

The CIS program is one of the most highly visible programs in the college. The program is in very high demand at this time. At present we have over 200 majors in the program. Starting the '98-'99 academic year we have started to offer two sections of each of the upper level core courses to meet the demand. We are also exploring offering some courses over the Internet. We strongly believe that the university - industry partnership is going to be one of the main stays of our program in the years to come.

§5. References

Davis, G. B., et al, (1997). "Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems," Association of Information Technology Professionals, Park Ridge, IL.

Gorgone, J. T., et al, (1994). "Information Systems' 95 Curriculum Model," *DATA BASE*, v. 25, # 4, 5-8.

Lee, D. M. S., et al, (1995). "Critical Skills and Knowledge Requirements of Professionals: A Joint Academic/Industry Investigation." *MIS Quarterly*, September, v. 19, # 3, 313-340.

Reynolds, C., et al, (1996) "Requirements for a Computer Science Curriculum Emphasizing Information Technology." *SIGCSE Bulletin*, v. 28, # 1, 247-251.

Tye, E. (1995). "Information Systems Skills: Achieving Alignment Between the Curriculum and the Needs of the IS Professionals in the Future," *DATA BASE*, v. 26, # 4, 47-61.

Introduction to Computer Course Large Class Size Small Class Atmosphere

Beverly E. Amer
Senior Lecturer
Beverly.Amer@nau.edu

William B. Cone
Lecturer
William.Cone@nau.edu

Craig A. VanLengen
Associate Professor
Craig.Vanlengen@nau.edu

Computer Information Systems
College of Business Administration
Northern Arizona University
Box 15066
Flagstaff, AZ 86011-5066

Abstract: Difficulties of teaching the introductory computer course are discussed. An implemented solution, which includes large lectures, group projects, student interns, and critical thinking development is presented.

Introduction

Ask any computer information systems or management information systems faculty member what is the most difficult course to teach or the one course they do not want to be assigned to teach in the CIS/MIS area and the response will typically be the introduction course. It's like a wild animal, given a choice they do not want to tame it because previous attempts have caused many conflicts with respect to organizing constantly changing content, developing instructional delivery systems that sustain student interests and motivation, and promoting skills of critical thinking.

Over the last twenty years, this course has seen the gamut of numerous redesigns to keep current with technology, industry, and student needs. A course initially designed to introduce prospective majors to the field now must provide an overview of computer and information systems concepts, which continue to be dynamic, and training or hands-on use of current software productivity tools with limited resources. Any attempt to accomplish the wide array of course objectives causes many conflicts and frustrations.

The Conflicts

One notorious conflict is how to provide a quality and viable educational experience for students with diversified backgrounds and experience in the computer field and address the needs of a wide variety of major fields of interests. The introduction to computer course at Northern Arizona University (NAU) is a core requirement for all majors (including CIS) of the College of Business Administration and can also be used to meet liberal studies requirements for all non-business majors. Obviously, this causes major problems in determining how to package materials to be presented, including the level of depth and designing relevant activities to encourage critical thinking skills.

Another conflict is how to support and manage large numbers of students with limited resources. At NAU, course enrollment varies from 600 to more than 800 students each semester. There is an economic feasibility for institutions to organize this course in a large lecture format. The traditional arrangement of 50 students per section would require 12 to 16 individual sections for 600 to 800 students. At an institution that requires faculty to publish, the normal teaching load is 9 hours or 3 course sections per semester. With NAUs enrollment base, 4 to 6 full-time faculty would be required to staff this one course. For many institutions, this would consume the majority of faculty resources.

Other issues in staffing the course include a lack of a doctoral program in MIS so doctoral graduate teaching assistants are not available. We have also chosen not to have numerous faculty teaching the course. The greater the number of individuals teaching the course could cause problems in quality and content of the course.

Whether small or large sections are used for the course most schools are struggling with ways to provide a more dynamic learning environment, develop critical thinking skills, and promote intellectual development as part of the course content. For the past two years, faculty at NAU have concentrated their efforts on addressing these issues in the introduction to computers course.

The Arena

At NAU, the Introduction to Computer Information Systems course is divided into two components. The first component schedules students to meet twice a week for 50 minutes each in a large lecture environment (150 to 190 students). The second component is a once a week (one hour and 45 minute) laboratory activity. Students meet in a computer lab with an average enrollment of 40 to 45 students per section. Computer and information concepts are presented in the lecture sections. Hands-on training for word processing, spreadsheets, database management, presentation software, and Internet applications is covered in the lab sessions.

Strategies for Taming Conflicts

The first component, large lectures, was selected to be tamed at NAU with respect to designing new strategies and delivery systems for promoting intellectual development, developing critical thinking skills, establishing competency performance standards, and providing a dynamic learning environment.

Intellectual Development

An academic internship program for students enrolled in the introduction to computers course was implemented to recognize students who have demonstrated proficiency in the computer field and to provide an opportunity for these students to extend their computer skills and knowledge beyond the classroom experience. Qualified students earn course credit in exchange for meeting certain technical requirements and working in various computer-related jobs in the College of Business Administration.

Students who feel that their computer background is greater or equal to the content of the course may apply for the internship program. Student applications are reviewed and evaluated by the lecture and lab faculty. Interviews of selected students determine their major computer strengths and to what degree course content might be redundant for the student.

In a recent semester, 58 students out of an enrollment base of over 800 students applied for the internship program. Twenty-six students were selected for interviews and 18 were offered a one-semester intern position within the College of Business Administration. Student interns were assigned positions in computer labs, technical services, data communications, multimedia systems, and administrative support services.

Instead of attending the concepts portion of the course the student interns work in their assigned areas four hours each week. They are still required to complete all computer related projects and a PowerPoint presentation on assigned concepts material. At mid-semester and the end of the semester, the intern is evaluated by their supervisor and the coordinator of the internship program. The criteria used for this evaluation include: attendance and punctuality, improvement of communication skills, willingness and ability to assist others in assigned duties, ability to follow directions, and preparedness. This strategy has promoted interest in further study in computer information systems for these outstanding students and has greatly contributed to networking these students into a major in CIS, salary based assistantships, and dual courses of study in CIS and their chosen field of study.

Critical Thinking Skill Development

Critical thinking skills are developed with four "Collaborative Learning Community" projects required for the lecture portion of the course. Students are organized into teams of four or five students and meet every five weeks during class (lecture) to orally walk through possible solutions for an assigned project. Each team plays the role of a consulting company. A project packet introduces students to useful techniques for designing applications pertaining to word processing, spreadsheet, database systems and presentation software, and describes a project related to each application. Additionally, the packet describes models for application software that use real data to produce real output.

The central idea behind this project assignment is to show students that selected computer applications can be reliably analyzed, designed, and refined if one pays careful attention to design techniques. Most importantly, the projects are designed to provide students with two major "real-world" skills: to learn how to design user applications that will lead to improved individual effectiveness and to, prototype a working system to test design concepts. The students also learn how to work in a group. This is important since many of the upper-division College of Business Administration courses require students to work in groups.

The overall goal is to examine selected productivity tools (Word, Excel, Access, and PowerPoint), to help students really understand them, and to give students an opportunity to ask questions, in a word, to encourage critical thinking. The students enjoy the project activities and formally express positive opinions on course evaluations, at the end of the semester, about being provided an opportunity to acquire real-world skills.

Competency Performance Standards

A "Common Body of Knowledge" (CBK) has been implemented which has put a new, exciting emphasis on competency-based teaching and learning. Student outcomes for each chapter in the text are identified and communicated to them weeks before a scheduled exam. The outcomes identified are then used to prepare examinations and other measurement materials.

Each lecture is started with "Latest News", which are current events in the computer field. This helps to generate discussion and set the stage for the text material.

One interesting observation with this strategy is that students acquire a sense of a universal need to understand basic computer and information systems concepts. The skills and understandings are important, regardless of geography, to building a competitive edge professionally, as well as personally.

Dynamic Learning Environment

A dynamic learning environment is provided with changes in course presentation and modifications of the lecture facility. Multimedia technology is used for visual and audio presentation of the course material. The multimedia workstation is equipped with high resolution color graphics, CD-ROM, video tape, and a high resolution projection device. Sound and video clips are used to enhance the presentation of textual material. The lecture facility has surround sound, large projection screen, and tiered seating. The instructor is equipped with a cordless microphone to increase mobility. Students are able to hear and see the presentation from any seat in the lecture facility and the instructor with the cordless microphone can be within a few feet of any student in the lecture facility.

The use of text, video, graphics, animation, and sounds to communicate the concepts portion of the course has added an exciting dimension to the delivery system. The learning environment is significantly enhanced, student motivation is sustained and student curiosities about the subject material are aroused.

Summary

The strategies described have helped to tame the concepts portion of the introduction to computer course at NAU. They have allowed both students and faculty to promote intellectual development, develop critical thinking skills, establish performance standards, and create a more dynamic learning environment. A top priority is to get students excited about computer information systems, arouse their curiosities about computer applications, and to educate a thinker who can naturally flow into further learning about the pervasive computer technology.

Articulated Programs Of Study: A Modular Information Systems Curriculum

Paul M. Leidig
Computer Science & Information Systems
Grand Valley State University
leidigp@gvsu.edu

Abstract

A new opportunity presents itself for information systems and computer science programs as academic units outside of the discipline attempt to provide students with computing skills necessary for their profession. The concept of offering a standard one-size-fits-all approach to the I.S. or C.S. curriculum is rapidly becoming insufficient. In addition, an opportunity exists to tailor a student's course selections to better prepare for a wider variety of careers. Concurrent with an increase in popularity of one of our undergraduate minors, other academic units are requesting, or offering, courses specifically tailored to their programs. Recognizing a trend of I.S. and C.S. programs becoming less autonomous, this paper proposes a method of re-engineering the curriculum to better match a variety of needs. By creating a core module of courses, combined with a superset of courses designed specifically for other academic programs, it becomes easier to provide an articulated path of study that better meets the needs of students in non-computing programs.

Introduction

Over the past several years we have noticed an increasing demand from other academic units at our university, for clear, specific skills and knowledge sets to be provided via computer science courses. Primary to this trend was an increased demand for microcomputing skills such as spreadsheet analysis, database theory and practice, desktop media creation, and programming for the Windows environment. This demand became evident with increasing requests (from both students and other academic departments), for more sections of courses in spreadsheets, microcomputer databases, and Visual Basic. Our first response was the creation of a minor in Microcomputer Applications, beginning with the Fall 1991 semester.

The Microcomputer Applications minor (since renamed Microcomputer Systems) offered core courses in computing concepts, programming, spreadsheets, and databases, along with electives in microcomputer operating systems, communications, expert systems, and desktop media.

The current Microcomputer Systems minor consists of at least 24 hours, as follows:

All of the following:

- CS 150 Introduction to Computing
- CS 160 Programming in Visual Basic
- CS 231 Spreadsheets
- CS 233 Microcomputer Database Management
- CS 339 Microcomputer Systems Project

Elective courses (select three of the following courses)

- CS 162 Computer Science I (C++)
- CS 230 Microcomputer Operating Systems
- CS 235 Expert Systems
- CS 237 Microcomputer Communications
- CS 238 Desktop Media
- CS 331 Advanced Spreadsheet Development

This minor has become quite popular with students in several programs, primarily with those majoring in business, public administration, political science, and the health sciences. Sections of these courses quickly fill, with lengthy lists of students requesting closed class permits and additional sections. Enrollment has more than doubled in the past four years, limited only by the lack of resources to staff an adequate number of sections.

As departments evaluated the computing skills of students in their programs, we began receiving requests to tailor courses in the microcomputer systems minor to better meet the needs of specific programs. A potential drawback to modifying courses for differing requests, could be courses that no longer meet the needs of the general population. One alternative would be to offer separate sections of a course specifically designed for different majors. Although this solution appears to answer the needs of multiple departments, it creates a potential scheduling and staffing problem for the computer science faculty. Another potential problem is confusion among students about the difference between sections.

There are several curriculum paradigms that offer suggested patterns as a solution. The IS'97 Model Curriculum [1] specifically address the development of multiple discipline relevant skills. Clear [2] presents several curriculum scenarios that attempt to couple the computing disciplines, in which the Shared Model and Integrated Model provide a mechanism for cross-discipline programs. Lee et al. in [3] advocate the need for more discrete programs focused on offering differing graduate profiles aimed at career outcomes instead of learned skills. Integrating programs often take more work then simply modifying an existing program, however in many cases may offer our students and their prospective employers a better education.

This paper proposes a cooperative approach, wherein the Computer Science & Information Systems department and other interested departments jointly offer a minor tailored to specific sets of knowledge areas. With this structure, students would take a common set of core classes to ensure consistency among the various minors, and a superset of classes, some offered by the CS & IS department and others by the cooperating unit. We refer to this approach as an articulated minor. Each articulated minor would be cross-listed in the computer science program, and also in the associated unit.

A Model For An Articulated Minor

For descriptive purposes of this paper, an articulated minor will be referred to as one in which a student takes a prescribed set of courses in his/her major area of study, as well as a specific set of courses in another field that provides a set of functional skills in addition to the major. By specifying a set of courses in the major area of study, and a complementary set of courses in another area, it is convenient for students in both majors to elect the articulated minor. For example, we offer a minor in Computer Engineering. This minor consists of a core set of courses, plus two separate groups of courses; one group of computer science courses taken by engineering students, and a set of engineering courses taken by computer science majors. Figure 1 illustrates the requirements for a Minor in Computer Engineering. In this example, a student majoring in engineering, must take eight courses; the four courses in the minor core (c) and the four courses in computer science depth courses (a) to receive a minor in Computer Engineering. The sum of the required courses (a, b, and c) therefore make up the minor, although one of the two additional groups of courses (b) would be taken as part of the major.

The Minor in Computer Engineering consists of:
- A common core (c)
  - EGR 226 Intro. to Digital Systems
  - EGR 326 Adv. Digital Systems
  - CS 162 Computer Science I
  - CS 262 Computer Science II
- Minor subset (a)
  - CS 362 Data Structures and Algorithms
  - CS 451 Computer Architecture
  - CS 452 Operating Systems
  - CS 457 Data Communications
- Minor subset (b)
  - EGR 214 Circuit Analysis
  - EGR 424 Design of Microcontroller Applications

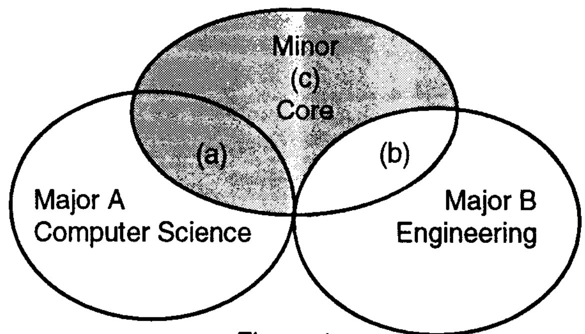


Figure 1

The above minor serves as an excellent example to describe a model to use in the creation of an articulated minor. The application of this model when creating a new minor will be of assistance in alleviating the problem mentioned in the introduction of this paper, namely the accumulation of a series of disparate and dissimilar minors. This model will be used to redefine the existing Microcomputer Systems minor, and serve as the basis for future similar articulated minors.

Applying The Articulated Minor Model

As an example of the application of the proposed model, we will first redefine the Microcomputer Systems minor described in the Introduction. The modified Minor in Microcomputer Systems consists of a rearranged list of courses. The current list of courses have been separated into two groups; those that would constitute a required, or 'core' set of courses, and a set of elective computer science courses. Each minor will be completed with a capstone project course. The revised Minor in Microcomputer Systems consists of:

Revised Microcomputer Systems Minor Core courses: CS 150 Introduction to Computing CS 160 Programming in Visual Basic CS 231 Spreadsheets CS 233 Microcomputer Database Management CS 237 Microcomputer Communications Elective courses: (select three of the following) CS 162 Computer Science I CS 230 Microcomputer Operating Systems CS 235 Expert Systems CS 238 Desktop Media CS 331 Advanced Spreadsheet Development CS 339 Microcomputer Systems Project

Drawing from the revised Microcomputer Systems minor, we have now identified a core set of courses that would be required in any similar set of articulated minors. We can define future minors as this core, plus the articulated list unique to that minor. This core group of courses may now be used as the basis for maintaining consistency among any future proposed minors.

Using this model, we can now describe two articulated minors; a Healthcare Information Systems minor offered with the School of Health Sciences, and an Accounting Systems minor proposed with the School of Business. Among the various academic units that have requested courses that better meet the needs of their students, these two minors provide good examples of applying this model.

The Articulated Minor in Healthcare Information Systems consists of courses from health science, bioethics, sociology, computer science, and a capstone project course.

Articulated Healthcare Information Systems Minor CS 150 Introduction to Computing CS 160 Programming in Visual Basic CS 231 Spreadsheets CS 233 Microcomputer Database Management CS 237 Microcomputer Communications HS 111 Medical Terminology HS 220 Health Care Delivery HS 222 Introduction to Public Health HS 320 Healthcare Provision & Payment HS 340 Health Care Management BIO 336 Bioethics SOC 356 Sociology of Health Care CS 340 Healthcare Information Systems CS 493 Healthcare Information Systems Project

The Articulated Minor in Accounting Systems consists of courses from accounting, management, computer science, and a capstone project course. The complete list of courses is shown below.

Articulated Accounting Systems Minor CS 150 Introduction to Computing CS 160 Programming in Visual Basic CS 231 Spreadsheets CS 233 Microcomputer Database Management CS 237 Microcomputer Communications ACC 212 Financial Accounting ACC 213 Managerial Accounting ACC 314 Intermediate Accounting ACC 340 Accounting Systems ACC 414 Auditing MGT 368 Management Information Systems CS 331 Advanced Spreadsheet Development ACC/CS 495 Accounting Systems project

At first glance, this complete listing of additional courses could appear quite daunting for a student considering such a minor. By re-ordering the complete list of courses that make up the minor, into the three sets as described in Figure 1, it becomes easier to visualize and describe the additional requirements for a given major. As an example, a student majoring in Accounting who elects to receive the Accounting Systems minor, could view the program in a modular fashion. Instead of looking at 13 courses as his/her requirements for the minor, there would be three modules in the minor. This model shows three modules; the core with five required courses, six accounting and management courses, and two additional courses tailored for the Accounting Systems Minor.

Modular Articulated Accounting Systems Minor Core courses in the minor: CS 150 Introduction to Computing CS 160 Programming in Visual Basic CS 231 Spreadsheets CS 233 Microcomputer Database Management CS 237 Microcomputer Communications Courses included in the accounting major. (b) ACC 212 Financial Accounting ACC 213 Managerial Accounting ACC 314 Intermediate Accounting ACC 340 Accounting Systems ACC 414 Auditing MGT 368 Management Information Systems Additional courses from computer science. (a) CS 331 Advanced Spreadsheet Development ACC/CS 495 Accounting Systems project

By looking at the modular list of courses, the accounting major will quickly recognize the required courses in the major. Using the model in Figure 1, we will refer to this set of classes as set (b). A review of Figure 1 demonstrates the additional requirements of the minor, for the accounting major, becomes a subset of the entire minor requirements. In this example, the additional required courses becomes the combination of sets (a) and (c).

<u>Articulated Accounting Systems Minor</u>
<u>Subset for the Accounting Major</u>

CS 150 Introduction to Computing
CS 160 Programming in Visual Basic
CS 231 Spreadsheets
CS 233 Microcomputer Database Management
CS 237 Microcomputer Communications
CS 331 Advanced Spreadsheet Development
ACC/CS 495 Accounting Systems project

For the accounting major, the Accounting Systems minor becomes a list of seven additional courses. From an advising standpoint, this becomes an easier minor to explain and track. Perhaps more importantly, this view of the minor is a much more attractive option for the student considering the feasibility of such a program. It should be noted however, that the complete list of courses in the minor will appear in the Requirements for the Minor, and on the students' official transcript.

Implications And Practicality

Describing and promoting an articulated minor as described in this article offers the same advantages to many academic units. By creating separate minors tailored for specific majors, departments offering traditional information systems or computer science degrees offer attractive alternative educational opportunities. Looking for a solution to requests for more specific knowledge sets in common service courses, we have found not only a way to respond to those requests, but offer a complete minor in many different programs. The two articulated minors mentioned above are only the first in a series of planned minor proposals.

How practical and attractive is this model? To apply the application of the model to specific majors, we wanted to measure interest in the first such minor being proposed. As part of a proposal for the Minor in Healthcare Information Systems mentioned above, we administered a survey to health science students, the primary target audience for this minor. Responses to the survey indicated that 79.4% of health science students found this an attractive minor. The ability to extend a traditional degree with an articulated minor in a related and complementary field is at least one reason to consider using such a model.

Conclusions

An opportunity is presented whereby information systems and/or computer science serves as the foundation of a model curriculum that caters to the computing technology needs of students in non-computing programs. Offering a standard one-size-fits-all information systems program is often an unattractive option for many students. This paper has proposed a method of re-engineering the curriculum to better match a variety of needs of students outside the discipline. By creating a core module of courses, combined with a superset of courses designed specifically for other academic programs, it becomes easier to provide an articulated path of study that better meets the needs of students. One outcome of this model is a set of additional courses that becomes an attractive enhancement to other non-computer programs.

References

1. Davis G., Gargone J., Feinstein D., Longnecker H., (1997), *IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems*. The DATABASE for Advances in Information Systems, Winter 1997, 28:1, pp. 1-94

2. Clear T., (1997), *Coupling and Cohesion Among Disciplines: Some Curriculum Paradigms*, SIGCSE Bulletin inroads, December 1997, 29:4, pp.14-16

3. Lee D.S., Trauth E., Farwell D., (1995) *Critical Skills And Knowledge Requirements of IS Professionals: A Joint Academic Industry Investigaton*, MIS Quarterly, Sep. 1995, pp. 313-340

The MIS Core Course: Focus on Managerial Needs Not Technology

James E. Novitzki
Director of Information Technology Credit Programs
Johns Hopkins University, SCS
1 Charles Plaza
Baltimore, MD 21201

(301) 294-7103
(301) 294-7106 (FAX)
j_novitzki@jhu.edu

Abstract

This paper discusses the remaking of the MIS Core course in a graduate business degree program. The graduate MIS course has many of the same problems as the undergraduate one, which has been identified in several articles as "the widow maker." The course then underwent a major redesign. The new course does not teach technology, rather students learn about how basic business functions and operations can be impacted through the use of technology. Technical issues are brought up only to the level that the functional discussion requires technical knowledge for understanding about what is happening and why. Initial results indicate significant improvement in student understanding of important concepts, evaluation of the course, and both student and instructor satisfaction.

Introduction

The effectiveness of communicating global MIS and technology concerns to non-technical personnel has on the whole been poor. A survey of the literature reveals numerous articles and papers describing efforts to make the required MIS course effective in undergraduate business programs. The undergraduate business MIS core course has been identified by both students and faculty as being generally unsatisfying and often providing students with little practical information. A similar course has been included in the business core of most MBA programs (AACSB, 1991). The course is called a variety of names including Management Information Systems (MIS), Information Systems (IS), Information Systems Management (ISM), or Information Technology (IT), all of which were identified as course names in a review of various schools' graduate business programs. Although there have been numerous articles discussing the course and various approaches to "fix" the course, the literature indicates that the course remains a problem at many schools. Surveys often reveal that students at the completion of these courses see little purpose for the course, have learned little of what they think as pertinent information and in general feel barraged by facts and information that have little to do with them or their jobs.

Background

Woods (1992) discussed the importance of technology issues and education in the MBA, and a consistent theme noted in early articles (Albin and Otto ,1987, Buckingham et al, 1987, Cheney et al, 1990, and Porter and McKibbin, 1988), is that graduates of MBA programs generally lack understanding of the technology and information systems used in business, and their impact on the organization.

Most programs have added a course in an attempt to provide this technological background, but there is typically little originality or creativeness. This course has a goal to provide knowledge about of Information Systems to students, who for many this will be their only "technology" course. These courses generally use texts which provide a survey of information systems. One section contains chapters on the systems approach, computer hardware, system and application software, and databases. Another describes the operation of the IS systems in the various functional areas, Accounting IS, Finance IS, Marketing IS, Human Resource IS. There is typically a section on networked systems, office automation, and trends for the future.

Texts proclaim that information systems provide managers information faster, more widely available, and that it can be more accurate. All these are good concepts, but they're as general as peace, motherhood, apple pie, etc. From a management standpoint, so what? There are typically few linkages describing the solutions information systems can provide to organizations, though some of the texts are better at using cases to make these points than others. One thing that is not usually discussed, that is critical from a functional manager's standpoint, is what happens if the system goes wrong?

Student response to the MIS course at the graduate level closely mirrors the dissatisfaction noted at the undergraduate level (Padget and Meyers, 1995 and Richards and Pelley, 1994). Twenty schools were surveyed about student views on IS and the MIS course (Novitzki, 1990). Results showed that an overwhelming number of students, 87.3 percent, felt that the IS technology course that they received was not a meaningful course. Students felt that material covered was not relevant to them and focused on issues that were not of interest to them.

Course Development

At our school, the MIS course had been taught following the format suggested in one of the more popular MIS texts. The problem students encountered was that in many cases the key knowledge was either not articulated clearly or was lost in a sea of facts, most of which were memorized for an exam and then forgotten. The result was that there was little concrete the students took away from the course. Many students viewed the course as something similar to the undergraduate general education requirement course of music or art appreciation. Student comments focused on the amount of work required for the course, and the fact that most material did not seem to impact them in the jobs. This last point was a key point leading to the new course development. Information systems did not seem relevant to them or their job, even though it impacts jobs at all levels in almost every organization. Since almost two thirds of students taking the course could see little or no relevance, it was obvious that we were doing something wrong.

Several issues were identified that were important to consider during course development. Chow et al (1994) and Herman (1994) discussed what IS employees lack from the employers standpoint. Although the popular literature (Alexander, 1996, Coffee, 1998, and McGee, 1998) almost weekly highlights problems caused by firms which did not have an effective information system, the texts generally ignore this area. Similarly the role of the functional manager in creating and maintaining these systems is usually not addressed. Interviews with IS professionals and business executives confirmed many of these observations and pointed to three general outcomes that an effective MIS course must give students. First, students must understand that information systems play an important role in every organization. Second, it should convince functional managers throughout the company that they must have a basic understanding of what information systems and technology can do for a company or to a company, if it is not managed properly. Third, having established these concepts, the course should define the role of functional managers in dealing with IT.

As noted above, several problems had been identified with the current course. The present course had little relevance for business students. Students felt that the material presented was more appropriate for technical students rather than managers. Some students felt that the course should provide basic skills in using specific software packages rather than discuss the uses, components , and purposes of information systems. Most students agreed that the course, as formulated, was trying to do too much.

In preparing for the current revision, it was clearly articulated that the course could not be all things to all people. Using these ideas and information contained in Quarstein et al (1994) and Richards and Pelley (1994) several points were identified during the course design phase.

1. The course would NOT be used to teach students how to use application programs. Alternatives would be provided to provide that training.
2. The course would NOT teach students how to do presentations, write papers, or do research. Again, other alternatives would be provided.
3. The course would NOT teach students the intricacies of computer hardware, software, and programming. Business students generally do not need knowledge about specific hardware and software because they change so frequently.
4. A survey approach covering a little about everything in IS would NOT be used.
5. IS issues removed from the context of an organization would NOT be covered. Everything should be tied to how a organization operates. Technical information is presented only as part of what or how something is being done.
6. The course would teach students the impact technology has on the basic functions of business and the role functional managers must play if technology systems are to be successfully implemented and managed.

When all of these various considerations were considered during the development phase, the result was a new course description which was: This course is designed to teach managers the impact technology has on the basic functions and operations of organizations, describe the role that functional managers must play if information systems are to be successfully implemented and managed, and provide the knowledge to empower mangers to assume these roles.

New Course

Based on the decisions discussed above, in the spring of 1997, a syllabus was developed that focused on these ideas and outcomes. Enabling objectives and methods that would get students to the desired outcomes were identified. In general the course describes the functions that managers want done in organizations. It then describes technology as a tool that allows managers to do what they want. For example, the instructor presents the idea of inventory control from a simple warehouse or store to an organization that may encompass thousands of stores and warehouses. The information must be stored somewhere, must be accessible, must be accurate. It could be maintained with paper files, but there are serious limitations. Technology has a tool, the database that can help solve the problem. What is it? How does it work? What are its requirements and limitations. How do you store data that is kept in multiple locations, does it make a difference, why? Suppose not all locations have the same technology, what problems does that create, why? Present examples that show the power of the database in making decisions that can lead to discussions of data warehouses and data mining. Other functions are discussed similarly.

This approach results in a course that looks little like a traditional technology course. It rather looks like a capstone course, in that it largely focused on cases and articles about current organizations. The difference is that it builds on general business knowledge and the functional line manager, but it ties this to strategic IS issues and its role as a managerial tool.

Specific Course Content

Course specifics include:

1. Present a brief history of data processing and Information Systems in organizations. Discussion focuses on how the role, impact, and capability of IS systems have changed. It then highlights the need for line managers to become more involved in technology decisions as computer systems become more pervasive and integral to the operation of the organization. There is no focus on specific changing technology except in passing to explain new or increased capabilities.

2. The main part of the course discusses how technology has been used to solve basic business problems of increased competition, need for better decision making, need for increased information flow, creation of new markets, development of new capabilities, speeding up operations, and improvement of product quality. Use both information system success stories and failures. Use before and after success stories showing how IS was able to allow a company to do something different, better, faster, or cheaper than it could without IS. Include some stories, articles, cases, etc. where IS implementation was abandoned, didn't work, or was a disaster. Again bring in technical elements as needed, but also discuss what caused the project to go wrong.

3. Discuss elements of computers and information systems at an introductory level. When discussing organizations, the instructor identifies the various elements of IS and discusses them at a necessary level. Using the data base example, the instructor must explain what data bases, fields, records, indexes, etc. are, but it is all tied to the managers perspective of proving information. A careful selection of cases or articles allows the instructor to cover most of the technical elements of information systems.

4. Discuss the role of functional managers with Information Systems. For many of the failures, a lack of early functional management involvement is a continuing thread, and the instructor should highlight the consequences of such inaction. The point to stress is that just because a manager does not understand all the nuances involved in IS does not mean that they should abdicate their role as a manager to others when considering IS programs, projects, and time lines.

5. Having laid this ground work, discuss how systems are built and the system life cycle. Emphasize the role functional managers must play throughout the process. The presentation obviously goes through a description of the elements involved, but

focuses on the role managers should play. A key point to be highlighted is the mistakes managers, who don't understand IS, can make, such as development of inappropriate systems, systems with little or no user support, unrealistic schedules, saving money by reducing training costs, or saving time by reducing testing. All of these are management failures that have had major repercussions in the successful development and use of information systems.

6. Have students do a group case analysis. Divide students into groups to analyze a case to explain what the IT elements were, which went right or wrong, and what functional managers did or did not do to ensure the success of the project. Several videos from the IRWIN Information series are used to support discussion and to get students involved.

7. Finally, have student's research their company's information system. Students describe how computer/information systems are used in their company/industry. This often reveals that several companies are either ahead of or behind the average for their industry and for several companies there is a direct link with their competitive position in the market place.

Course Evaluation

Preliminary analysis was reported previously (Novitzki, 1997) and indicated that there were significant differences in the students' attitudes when comparing the old and the new revision of the course. Limitations of the first analysis were that the initial sample size was small, there were only two instructors involved, and there was only one format used.

After the initial offerings of the course, student comments were reviewed, and a few minor adjustments were made on the amount of time and level of coverage of some topics. To validate the preliminary findings, the course has now been taught in all formats by 7 different instructors during the Fall 1997 and Spring 1998 terms. Five questions that are part of the pre-class assessment and that are repeated in the end of class evaluation provide a simple surrogate to measure attitude changes. The questions are measured on a likert scale with 1 being low or total disagreement and 5 being high or total agreement. The questions ask about their feeling of the need for the course, their level of knowledge of IS, the need for functional management involvement in management of IS, the need for functional managers to have knowledge of IS, and finally the value of IS to organizations. This approach had been validated earlier and greatly simplified data collection and analysis, while still providing meaningful information.

The results are summarized in Table 1 below. There was a large numerical difference in the mean answers between the two groups of students. The means show a distinct improvement in almost every case. The only outlyer is question 2 which shows little numerical difference in the means and will be discussed later .

Ques	Mean Old	Mean Rev	Observed t	Critical t	Result
1	3.2	4.1	2.783	2.576	Significant
2	3.8	3.9	1.457	2.576	Not Significant
3	4.1	4.8	3.643	2.576	Significant
4	3.6	4.6	6.140	2.576	Significant*
5	4.2	4.7	3.202	2.576	Significant

*Significant at .005 level of significance.

Table 1
Summary of Means on Post Course Evaluations
and Results of T-test at .05 Level of Significance

A one-tailed t-test comparing the difference in the means was performed. The results are shown in Table 1. They show that in every case the but one, question 2, there was a significant difference between the answers obtained from students in the revised course compared to students in the old course. Question 2 results indicate that students felt that they still learned little about technology.

In an attempt to measure the validity of that result, students who had taken the old course and the revised course were both given the final exam from our IS architecture course, a course that delves quite heavily into the technology hardware and software of information systems. It is taken by IS majors. Nineteen students who had taken the old course took the exam and their mean score was 24.9 percent. Twenty-one students who had taken the revised course took the exam and their mean score was 33.1 percent respectively. With an n of 19 for the one group and 21 for the other, a t test for a significant difference in the means revealed that the difference was significant at the .01 level.

The results seem to indicate that students in the revised MIS course are learning more about technology than they were before. It appears though that the students don't seem to realize it. The question as to why this is occurring is a topic for further study.

Findings

It appears, that at least for our student population, the revised course significantly improves the learning experience. There were no significant difference is results caused by changes in format or instructors. At the end of the course, students felt an increased need to learn more about technology, its capabilities, and its limitations. Most also realized the major role that all functional managers must play in the development of new IS systems. Most also acknowledged that all managers must have some technology knowledge if they are to be effective managers in the twenty-first century. These are obviously just the goals that have been articulated for this course, and if they are repeatable in the following terms, it indicates a pedagogy that deserves further exploration and experimentation.

Conclusions

The addition of a technology course as a simple add on has generally not been effective in achieving increased student awareness about major technological issues. The revised MIS course, as developed, appears to provide the outcomes desired without requiring the major overhaul of an entire program. Initial response from students and graduates indicates that the new articulation of the MIS course may finally do what the course has been expected to do since its creation. It appears to make business students aware of the importance of IS in organizations, provide students with basic understanding of the elements of information systems, and make students aware of the critical role all managers play in the success of IS projects in an organization. Many issues still remain to be resolved. There is no text book that fits this course model. As a result, the course relies on extensive handouts. Cases that fit course requirements and examples have not been fully developed and need frequent update to remain current. The course is instructor work intensive. If full implementation continues to produce comparable favorable results, then effort must be made to develop suitable materials to reduce workload and make the course more consistent with other courses in the program. With this further validation of favorable results, other schools should experiment with the course to verify improved results in other settings with a larger base of students.

Bibliography

AACSB Accreditation Information Packet, American Assembly of Collegiate Schools of Business, St. Louis, MO, March 1991.

Albin, M. and Otto, R.W. (1987), The CIS Curriculum: What Employers Want from CIS and General Business Majors. The Journal of Computer Information Systems, Summer, 15-19.

Alexander, S. (1996). A Buyer's Market: Jobs Abound for IS Professionals with the Right Skills, Computerworld, January 8, 1996.

Buckingham, R.A., Hirschiem, R.A., Land, F.F. and Tully, C.J. (1987) Information Systems Education: Recommendations and Implications. Cambridge University Press, Cambridge.

Cheney, P.H., Hale,D.P. and Kasper, G.M. (1990) Knowledge, Skills and Abilities of Information Systems Professionals: Past, Present, and Future. Information and Management, 19, 237-247.

Chow, J., Dick, G. and Edmundson, R. (1994) Industry Satisfaction with IS Graduates in the 1990s: An Empirical Study. Proceedings of the Ninth Anual Conference of the International Academy of Information Management, 153-174.

Coffee, P. Buying into E-Commerce, PC Week. February 2, 1998, 27-32.

Herman S.J. (1994) Hiring Right. Thousand Oaks: Sage Publications.

McGee, M.K. (1998). School Daze, Information Week. February 2, 1998,44-52.

Novitzki, James E. (1990), Scheduling and Content of MIS Courses at the Undergraduate Level, Interface, The Computer Education Quarterly, Vol. 12, No. 2, Sum, pp 41-42.

Novitzki, James E. (1997), The MIS Core Course: A Revolutionary Look, Proceedings of the Twelfth Annual Conference of the International Academy of Management, 78-91.

Padgett, Thomas C. and Martha E. Myers (1995), The IS Curriculum From The Perspective Of The Student, Proceedings of the Tenth Annual Conference of the International Academy of Managment, 40-50.

Porter, L.W. and McKibbin, L.E. (1988). Management Education and Development. New York:McGraw-Hill Book Company.

Quarstein, V.A., Ramakrishna, H.V., and Vijayaraman, B.S. (1994). Meeting the IT Challenges of Business, Information Systems Management. v11 n2 62-70.

Richards, Martin and Pelley, Lee (1994), The Ten most Valuable Components of Systems Education, Information and Management, 27, 59-68.

Woods, R.E. (1992), Information Technology and the MBA. Proceedings of the Seventh Annual Conference of the International Academy of Management, 205-213.

Teaching and Learning MIS Using IS Tools

Nancy S. Thomson
Computer Science/Information Systems Department
Northwest Missouri State University
Maryville, MO 64468

Abstract

Using technology to teach requires a redefinition of our roles as faculty, the role of the student in learning, and the methods of assessment of the learning—both in process and content. Traditional methods focus on outcomes with limited inputs and outputs. Using Information Systems tools to teach Information Systems concepts involves larger amounts of inputs, sorting and segmenting appropriate content, as well as a shift in the classroom focus from teaching to learning. The power of the student increases and that of the faculty member shifts. Redefining these balances with both process and content as experienced in an MIS course is the focus of this paper.

Introduction

An introductory Management Information Systems course often includes the teaching of technologies like the World Wide Web, operating systems, and business software (e.g., spreadsheets, word processing, databases). This course was designed so as to use as many of these technologies as possible in the learning processes itself. Using these technologies to produce the content and setting up the classroom environment requiring the use of them to retrieve and learn the concepts allows the student greater control and flexibility in their learning processes. The teacher's role becomes one of mentor, guide, or coach to help the student negotiate through the learning process. Thus, in the MIS course, this methodology becomes both the means and the ends to the learning activity.

Development of this experientially focused learning environment is a daunting task in a variety of ways. A tremendous amount of time and significant resources are necessary in order to acquire, negotiate, develop, build and disseminate appropriate information in multiple formats using multiple tools.[i] This paper describes those resources, processes and outcomes in an attempt to share what we have learned with others who may wish to embark on a similar journey.

Technology and Interactive Content

The MIS course is a required course in the Common Professional Component for a variety of business related majors. Students at a minimum have had the required computer literacy course and beginning management course prerequisites and generally tend to be juniors and seniors with some experience with other business courses. Accounting and finance majors tend to have had more spreadsheet experience than the typical student. Office Administration majors tend to have had more experience with various types of word processing.

This experiential course design encompasses the available campus technology including a pervasive network, client/server architecture, and abundant microcomputers. The software delivery focus for content included Windows 95 and MS Office, access to the World Wide Web via Netscape facilitating an intranet, and local VAX services providing e-mail, and personal accounts for each student. The textbook also provides a CD, which contains the complete version of the text plus a summary version with additional items such as videos and audio supplements as well as quizzes and interactive practice exercises. The authors of the text have provided a web site for additional study activities and cases.

Resources used in the learning processes of the course include the standard textbook, a password protected and locally developed intranet website, the book on CD, the author's website hotlinked to appropriate resources, a local server for storing transient files, and online quizzing. Students receive information and some class instruction via e-mail, notes from the local server and website, and are required to communicate with the instructor and send assignments via E-mail and attachments. The web site is designed to follow the format of the text, with the chapters as the major sections. Each chapter has the following choices:

Objectives - Students can read what learning outcomes are expected of them for each chapter. (Identical to text and CD)

Notes - Students can access chapter outlines. (Provided by author and edited by instructor and past classes)

Slideshow - Students can view PowerPoint files developed by the instructor and contributed by students in prior classes.

Internet Connection - Students can link to the author's site for supplementary information and online cases, course-specific helps developed by our local library staff, and related links to useful sites related to content.

FAQ - Students can view some of the most frequently asked questions and their corresponding answers.

Quiz - Students can take a 10 question self-check for each chapter.

Audio - Some chapters have an audio introduction.

In addition, students can access the current syllabus for any section (which is updated as needed), report guidelines, files needed for lab exercises, and other related content. A weekly banner message is posted to the home page of the web site for "hot news" or reminders. This message usually refers to upcoming tests and projects.

Living the new paradigm -- in the class

Students each have a computer during class and are required to multitask their desktops for viewing resources on the network, from the website, and have a note-taking document available. Activity includes checking email, copying notes from there, from the notes page, the slideshows or other resource. CDs are loaded for viewing of films or audio files during class discussions. This rather complex learning environment causes some major stress for many that do not want or cannot appreciate the challenge. Students tend to limit their use of resources to a few key items and ignore the rest. (Data is being collected each term on the actual type and consistency of resources used)

More time than was initially anticipated has been needed to reduce the earlier learned behavior and create an acceptance of the new methods. Much more resistance was encountered and much less excitement was generated as students perceived these new methods to be multiplying their workloads rather than giving them control over the learning process. Class time had to be spent in talking about and testing for learning styles,[ii] presenting the components available, describing their content and value to different learner styles, and showing the similarities, differences, and interrelationships between them.

Approximately one chapter was covered each class meeting time, therefore, online chapter quizzes were given at the beginning of each period. Class discussion was then guided by the feedback from the daily quizzes. Students were more prepared for class, asked better questions, and would come early to take quizzes and get their machines readied. Students seldom complained about taking that many exams as they could be done in less than 5 minutes and immediate feedback allowed them to review what they missed before being called upon in class. Bad questions were evaluated and points adjusted immediately. Students took more responsibility for questioning the validity of a quiz question than had been experienced with paper quizzes.

Slideshows projected in class are converted to a learning tool, a permanent outline of the lesson. In the time it takes to demonstrate re-sizing the text and adding personal notes to the file, students begin transferring old pen-and-pencil skills to the new media. Once familiar with how to view, bookmark, and navigate the Web, they quickly see the value of the capacity to download this information to their own floppy disk.

Completing collaborative activities in class helped students to gain confidence in assessing and creating content. For example, two-person teams would take a concept from the chapter such as "gaining competitive advantage via information technology" and research the websites of specific companies looking for information that would verify them as leaders or followers. The example noted in the text or from other class studies were often found to be different from the image created by the text or other example. In addition, this evaluation and collaborative comparison highlighted the important relationships between marketing, production, and information systems.

The multitasking capabilities and use of two computers simultaneously allowed for dynamic exploration and production of output in the form of a "quick and dirty" report or first impression of the comparison between the "text" and "real life." This opened discussion to critically analyze why and how these differences occur. Minimizing writing time by using cut and paste allowed students to put the appropriate example pieces together to support their ideas. Often students would revisit a site on a later assignment and find that it had changed, reinforcing the dynamic nature of firms in today's global environment.

Student work becomes part of the legacy system of the course. Later in the semester they develop multi-media projects to correct the weaknesses of the course content or delivery. The best work is included in the web site for future classes. A sense of ownership over the course material goes a long way toward removing the technological timidity of some students. The chance to leave their name and something behind to improve the quality of what is learned keeps interest active in the subject and review of previously learned subjects. They also relook at the quality of the content and critically analyze the both it and the processes in order to select and justify an appropriate topic.

New interactions between student and teacher

Students perceived that this class would be "hard" because they were moved into a learning environment unlike any other in their past or present college experience. Subsequent classes have been more accepting--possibly due to self-selection via the reputation of the course as well as increased computer skills of students in general. One strong contributor to easing use of the technologies/tools to learn the MIS concepts and tools was the campus decision to move from VAX terminals to PCs in all residence halls and laboratories. This standard increased the student's exposure to a singular form and structure for the baseline technology.

Accepting the fact that the students themselves had more control meant accepting a broader responsibility for their own learning and blasted the old paradigm—you teach, I learn. The new paradigm—you show me, I select, evaluate, and control my learning process is a scary scene for most young college students. They have trusted the "sage" to give a limited amount of information and gear them to precision learning. Now they have multiple sources of information and must evaluate and discern the best one for their needs and then begin to learn the concept. They have to turn the trust inward and begin thinking critically about not only the content, but also the process itself.

In doing that, students are often seen to lack the confidence to challenge or question what they see in the printed word or hear from an "assumed" expert. With the WWW resources, discerning fact from opinion becomes part of the responsibility of the learner/retriever of information. The traditional models for assuring quality are missing and new ones only in the birthing stages. Therefore, the learner must develop some reasoning and judgement--critical thinking processes as they are learning or learning about the content of that information.

The locus of power that has been held by the faculty member is often hard to give up for both teacher and students. There is a position of esteem and an expectation of decision making that has a long established hierarchical tradition. To move the student into the game as a learning team member with the faculty as mentor or coach requires new commitments and understanding of expectations from each. Some students view this shift as the faculty member "abdicating" their assigned role. Some faculty refuse to give up that position of power for the one of facilitator. This experience has shown this to be true and a difficult obstacle to effectively handle.

For the undergraduate student whose concerns are more closely geared to their personal needs and sometimes their pre-professional goals—graduating and getting a job—they do not often take kindly to such diverse "opportunities" for learning how to learn differently. They have become accustomed to the traditional model, which often requires little more of them than listening and regurgitation. It is a simple, efficient method for handling large number of students. The student can usually be as visible or invisible in this type of environment as they choose depending upon their level of desire and interest. The new paradigm does not allow them this type of anonymity.

Even for those few students who are somewhat familiar with or especially interested in the subject of Management Information Systems, learning to learn in a totally new classroom environment has proven to be rather daunting. The new student-centered learning paradigm requires attention to both the process of learning and the content to be digested. It requires more intellectual commitment from the student to glean information, assess its value, organize its content, and relate it to other media. While this focus on critical thought processes is inherently a goal in most rigorous college courses, adding the technology factor tends to imply an increased complexity. Trying to accomplish this in one semester in one class when the rest of the world operates in the traditional mode has been challenging to both the undergraduate students and their instructor. A significant amount of time was required to gain acceptance and build confidence. Much discussion about process and less discussion on content became the norm during the class time.

In this course, the same material, the core of the subject, is presented in many different forms. For the student, especially at first, it all looks different. "Overwhelmed" is a word frequently heard in the first weeks of class. Therefore, an important first step is the introduction of the different elements as just that, different elements of the same course; similar or related material presented in multiple formats. A student learns to view multi-media as welcome alternatives, not additional requirements.

A required text and class attendance helps anchor the transition to the use of e-mail, the course Web site, Power Point, and online note taking and exams.[iii] These different formats are both the subject matter and the methods, not just a collection of formats presenting content. The question now facing the student is not what is there to study, but where to begin, and where to focus and concentrate and how to organize all the different resources and select those that best fit their preference and individual learning style.[iv] In addition, they also have expectations about what a teacher is and does. These assumptions appear to be very difficult to alter. Since the traditional model is comfortable and widely accepted as how learning is done, the shock of so much information causes students to realize the need for an effective means of handling it.

Perhaps the easiest way to make this new environment work for the class is to let each student make the crucial decision of how to approach the course material by individually working through the formats in which a module is presented. At first, the sheer volume of the media can indeed appear overwhelming, but soon one distinguishes the similarity among the concepts presented in class, in the text, and on the Web site. Terms used in discussion and concepts outlined in class are also reviewed via audio, CD-ROM, multi-media activities, and applied to real life situations in video clips. Recent news items as well as hot-links to sites which put into practice the concepts discussed in the module serve to bring the subject matter to life. The student is thus faced with the easier-to-digest job of ranking these different applications in order of personal preference.

A student who does not learn easily from reading a textbook has alternatives, reinforcements and interpretations of the subject matter through a variety of options. For those who do not take notes well in class, Powerpoint lecture outlines can be a excellent source for review, and downloading the text onto disk prior to class provides an easy outline which utilizes the personal computer in the classroom. Examples are noted of individuals who devise or create effective, efficient, or innovative methods of making their learning more productive.

Students are encouraged to participate in an evaluation of learning styles and revisit it periodically during the class. These tests are generally based on the Felder five-dimension model of learning and are available through many testing sources.[v] It has become apparent through observation in this course that most students know very little about how they learn. These observations suggest that students need help and guidance as to which methods can be most useful to them. The learning styles pre-test provided by Course Technology[vi] has been helpful in giving students some insight. Knowing and accepting are two entirely different things as anecdotal comments in assessment instruments indicate that behaviors we not actually changed. Rather, this type of course was considered more of an aberration, not the threshold of a new method of learning.

Costs

With such a course providing so many presumed benefits to the learning process, why aren't these sections overflowing with prospective students? Because there is a direct relationship between the cost to the student and the benefit thereof.[vii] Cost here refers not only to the fiscal aspect but also to a thoughtful time commitment. It is of immense benefit to the student to have a computer at home (they do have this if they live in the residence halls--but most juniors and seniors prefer to live off campus) with Internet access so the Web site is available whenever needed. This implies that a relatively fast modem be used to minimize downtime in connecting to sites and downloading information. High speed, high density formatted disks are a necessity, and CD-ROM access highly desirable. Of course, a good quality sound card and high-resolution monitor only add to the sensory stimulation of the presentation, which aids memory.

But, perhaps, the highest cost of the course is less readily measurable, that of time. In order to sort through all the available information, prepare for class discussion and note taking adequately and utilize the on-line quizzes, one must prepare ahead, and then review. This all takes time, and not every student is dedicated enough to their own education to put that kind of time into the learning process.[viii] Some would even feel they made the wrong choice by not taking a more comfortable class that uses the traditional methods—their opportunity cost appears quite high.

Additionally, the challenges of rethinking the learning process and using new methodology come at a cost of redefined learned behaviors and expectations. Having only one or perhaps a few courses that offer these opportunities may tip the balance negatively. The commitment to develop successful new methods may appear to be so short-lived they do not appear to the student to provide a significant benefit.

And what happens on the days the network crashes, modem lines are jammed, and yes, the computer ate my disk with all my notes on it (otherwise known as I KNOW I saved it to this disk, but it's not there now!). In a way, this is preparation for the business world. In "real life," the hard drive crashes, e-mail can't be accessed, and carefully prepared presentations are not compatible with conference room equipment. It is learning from the experience of using all of types of resources in the relatively safe environment of the classroom that can help students realize the thought processes and attitudes necessary to circumvent these problems. The costs of invested time; both from the aspect of student preparation and on-the-spot classroom problem solving due to non-functioning technology translate into long term benefits.[ix]

Benefits, Outcomes and Lesson Learned

A student who has experienced a variety of technologies in the learning process, from note-taking and saving on a disk to searching for relevant information and designing a web page, is more likely to be prepared for technology in the business world. Thus, an important part of student learning becomes utilization of the technology in the classroom on a personal level. Students learn to use the tools as a process activity rather than just a production output tool. Student growth as a consequence of working with computers is demonstrated as an effect of computers on human cognition.[x] They also see that the tool they are using is what people all over the world are also using and their home university is just as strong a presence in this electronic world as any other place or entity.

Faculty with access to appropriate technology should consider reevaluating and rethinking how learning takes place in their interactions with students. New methods may involve the sacrifice of content for inclusion of process. This is, however, more readily justified when one is teaching a course such as MIS where the technology is part of the content. Those teaching other subjects more peripheral to the technology, could be much more reluctant, and rightfully so, in adapting these kinds of methodologies which may or may not be appropriate for their field of study.

One major contribution of this experiential course was the testing of online resources in preparation for offering off-site distance learning classes. Lessons learned within this on campus (captured audience) structure enhances the understanding of how such class information and resources are viewed and utilized by students. Good feedback from students about design, navigation, access, and content gave the development team a better understanding of the applicability of this course for off-site use.

The positive feedback for the online quizzes and exams indicated that students like testing themselves to see if they understand and that they like to practice. They would come early to class to take quizzes before class and would have their machines ready for multitasked activities. They expected class to be more relevant as they could see how some topics were eliminated and others focused upon based upon the demonstrated knowledge as reported by the quiz results.

The more interested students would preview the notes and have their cut and paste preparations ready. The less interested students would be surfing or emailing while waiting for class to begin. In either case, they were using the tools they were supposed to be learning about for communicating or collecting information. One would expect that practice of any kind could be considered useful.

The requirement to check email at the beginning of each class allowed the instructor to set the tone or give assignments or announcements without taking class time. Individual students could not hide in the group as questions were asked that required a response from each student. Group mailings for team activities eliminated the excuses of "I didn't see that, or I forgot my notes"--they were always accessible on the network. Individual students would spend less time writing a quick note than coming to the office. Good pertinent questions were answered and forwarded together in group mailings or put on the FAQ board resulting in the minimizing of misunderstanding and misinformation.

Student feedback was acted upon and changes were made immediately. For example, students appreciated the ability to quickly change the size of the input box on the essay exams to fit their viewing and writing needs. The instructor learned to be more dynamic in providing improvements and making changes in the way the course activities were conducted. If students didn't see why they were doing something, they became more willing to say it in an email or put a note at the bottom of the team document. They were rewarded for critical thinking by having their ideas acted upon while the issue was impacting them. They learned to be drivers of the technology rather than being driven by it.

In general, the student comments at the end of the course indicated they understood the value of using the tools and demonstrating their proficiency each time they came to class. They were very willing to share their knowledge and became a rather cohesive group by the end of the term. The sense of teamwork in sharing the responsibility for learning MIS and the learning of concepts using IS technologies appears to have been worth the anxiety and frustration encountered in the early stages of the course.

Young people have the reputation for being more adaptable than older people. However, not even young people can be expected to take to multi-media learning like a duck to water. Just as there are students who do not learn easily from a lecture-and-text format, many do not adapt quickly to technology. If we measure success not by what the class is currently doing, but by how far they progress toward acceptance and use of an alternative learning environment in the span of the term, we hope we have an accurate measure of achievement. Removing computer fears and phobias and replacing them with knowledgeable technology users that view the tool as a vehicle rather than an end will hopefully translate into an attitude to help facilitate quality lifelong learning.

Society is fast moving away from paper and pen and into computerized record keeping of all sorts. Already more material is available to the student via computer than is readily accessible in the printed word, and the technological field is still growing.[xi] When a college course is introduced in which the traditional boundaries of lecture notes, textbook readings, and written tests are removed and material appears in very new and different forms, it is truly imitating today's business world. The student who masters this new process of learning should be better prepared for the business environment.

---

[i] Preliminary site research conducted in 1995 and 1996 prior to building the technical components was done at University of Illinois with Dr. Alfred Hubler who was developing Cyberprof, and at The United States Military Academy, West Point, N.Y. with Dr. Curtis Carver using a proprietary in-house application in engineering courses. (This was prior to having Web-based capabilities available on our campus.) Since that time, the WWW browsers have evolved into the primary delivery method for most content activities in the course.

[ii] for further information on learning styles see: University of Minnesota - Duluth site: <http://www.d.umn.edu/student/loon/acad/strat/lrnsty.html> and others such as http://www.learnersdimension.com/learners/literature.html#sdichar

[iii] See MIS Course Syllabus, <www.nwmissouri.edu/~0500460>

[iv] Research is being conducted in the course in order to further refine the relationships between the course components and learning styles and so as to eventually provide greater assistance to students who have less self-awareness.

[v] Dr. Sylvia Charp, "Multiple Media for the Classroom & Media Center," ***T.H.E. Journal***, February, 1997, 6.

[vi] An online test is available at Course Technology's site: <http://www.course.com>

[vii] Dr. Carl Smith, "Pursuing the American Cultural Imagination," ***Educators' Tech Exchange***, Winter 1994, 21, arrived at similar conclusions in a multi-media humanities application.

[viii] Dr. J. Raymond Albrektson, "Mentored Online Seminar: A Model for Graduate-Level Distance," ***T.H.E. Journal***, October 1995, 104, also discussed the need for student participation.

[ix] Barry Richmond, "Simulating the Business Experience," in ***Teaching Materials***, Harvard Business School Publishing, Fall 1996. 3. Business simulations are a core feature of the MBA curricula.

[x] Facciola, Peter C., "Building an Effective Computer Learning Environment in the Dynamic learning Classroom," ***Syllabus***, Vol. 1, No. 2, September 1997.

[xi] New Zealand Education study completed by Learning Enhancement Associates (NZ) Ltd. <http://www.lea.co.nz/whoisl~1/leainfo.htm>

Using Groupware to Facilitate Group Learning

by

Judy Caouette, Ph.D.
Pace University
School of Computer Science and Information Systems
Office Information Systems Department

Abstract

This paper describes a successful new course on groupware furnished by the Office Information Systems (OIS) Department at Pace University's School of Computer Science and Information Systems (SCSIS) in the spring of 1997. Under the course entitled "Special Topics," following our national model curriculum where the module's aim is to introduce emerging technologies in the field, this course required student groups to investigate various tiers of groupware taxonomy supporting networked teams and group decision making in the workplace. Additionally, students collaboratively assessed the effectiveness of each system studied and analyzed its potential impact on end-users and their organizations. The course was managed in a facilitated-learning style encouraging student teams to explore groupware and share their discoveries with each other. This proved an extremely effective way for them to develop understanding and experience with groupware as well as to prepare for the collaborative work environment that awaits them.

Introduction

Expanding global competition, organizational restructuring, and other economic trends are pressuring companies to increase productivity. Today's workplace is characterized by "few people doing more with less" (Coleman, 1994, p. 4). One way employees can boost their efficiency is to work in teams, especially teams supported by collaborative technology. This technology is often referred to as "groupware."

Groupware is an umbrella term used to describe those technologies that support teamwork and collaboration among people, whether they are located in the same room, in different parts of the same building, or miles apart. Many organizations, both domestic and international, are adding groupware to their repertoire of technological tools as ways to increase productivity.

Because groupware is a relatively new tool in the business world, definitions--especially vendors definitions--abound. Most would agree, however, that groupware refers to "computer and telecommunications tools [that] help teams collaborate more effectively" (Johansen, Sibbet, Benson, Martin, Mittman, and Saffo, 1991, p. xix).

More important than defining groupware is focusing on its underlying aim--to encourage teamwork and collaboration in the quest for an organization's overall goals. O'Hara-Devereaux and Johansen rightly remind us that the "proper emphasis [is] on the human side. The 'group' is always more important than the 'ware'" (1994, p. 18).

As more organizations have come to rely on collaborative technology, Pace University offered this new course in groupware to students as another way of building their skill set through the acquisition of team skills for group learning and group decision-making tasks supported by collaborative technology. Therefore, this study sought to answer the following question:

Does groupware facilitate group learning?

Exploring groupware through a "Special Topics" course

The Office Systems Research Association (OSRA) recently remodeled its national curriculum for undergraduate education in information technology (O'Connor, 1996). Within this model curriculum are 11 specific modules, one of which is called Special Topics. This module allows for introducing and exploring new and emerging technologies. Following our national curriculum, we use Special Topics to introduce and explore various new technologies such as HTML and the designing of websites, WWW and the Internet, and, more recently, groupware. Just as some of these technologies have become common tools in the workplace, they have also become common tools in the classroom. In fact, one specific groupware described below is currently used as an electronic tool to support other courses including our Technical Writing course, the Organizational Training and Development course, and the Cases course.

Design of the room including ergonomic and software considerations

In 1996, new computer teaching labs were built in SCSIS on the Pleasantville campus. These labs were designed for the seamless integration of computers and multimedia for student, faculty, and/or guest demonstrations, as well as the use of student teams engaged in collaborative learning. The OIS Department has a dedicated lab for its students and courses. Twelve recessed microcomputers are arranged in a conference-like setting--a traditional face-to-face meeting environment where participants easily see and talk to each other. This arrangement naturally promotes participation, teamwork, and the sharing of information among peers. A public screen is available for software demonstrations and for viewing comments and ideas participants make anonymously via the electronic meeting software. Students sit in ergonomically designed chairs. Other important ergonomic considerations include appropriate lighting, correct window treatments, anti-glare screens, and noise-reduction devices.

Software for the course focused on four specific types of groupware, from the most familiar and simplest to the most powerful.

The Internet: Considered by some to be part of groupware because of e-mail and messaging capabilities, students used the Internet for research purposes. By traveling to various websites, students gathered information about groupware and collected material for their groupware research papers. Some students went to Singapore. Others visited a site that provides a chatboard for groupware enthusiasts.

GroupWise 4: An integrated application furnishing e-mail, calendaring and group scheduling capabilities, this program also provides ways to assign tasks, attach existing documents (word processing, spreadsheets, etc.) to messages, as well as track and monitor messages through the system. Using the Remote feature, distant users can stay connected through modems.

Lotus Notes 4: This popular textual database package enables distributed workgroups to collect and share information. Along with e-mail capabilities, Notes has a messaging system (including bulletin boards), and a solid development environment. An important feature of the program known as "threading" provides linkages between an original (parent) document and all the response (child) documents it begets in subsequent generations. Documents can be organized under such as categories as author, topic, and date/time.

Group Systems for Windows (GSW): Also called electronic meeting software (EMS), this technology provides a suite of tools fostering consensus and group decision making such as conflict resolution, peer reviews, and strategic planning, etc. by adding structure from a preset meeting agenda. Whether assembled face-to-face or located far apart, members submit their comments and ideas anonymously and simultaneously (parallel input) in a shared meeting environment. Since all input is captured and stored by the system, these organizational minutes can easily be referred to at any time during or after the meeting. The minutes can be saved to members' disks and/or immediately printed out.

The student population

Standard business software training practices generally limit 10-12 trainees for each trainer. Accordingly 10 students were enrolled in this upper-division course; each held senior-standing status. All had completed the necessary prerequisites which included courses in programming and various software programs, and everyone was comfortable with the Internet. While none had any familiarity with either Group Wise or GSW, several students worked for organizations where Notes was being implemented into their departments. All had e-mail accounts.

Course organization and instructional methods

According to various adult learning theories (Brookfield, Dirkz & Prenger, Galbraith, Knowles, Merriam & Brockett, etc.), the role of a teacher is changing from the primary dispenser of knowledge to a *facilitator* of learning--providing a rich learning environment encouraging students to be active participants in their own learning process. In fact, in a recent New York Times article (Bronner, 1997, p. B8), one university president attributed the success of his school to working with adult students in teams in a facilitated learning environment:

> . . . and since these were adults with little patience for lectures, the instructors had to act more as facilitators than traditional professors. The students had a great deal to offer not only to one another but to the instructor. The students loved it. . .

The Chinese philosopher, Lao-Tse's definition of a leader as facilitator can be applied to the classroom.

> A good leader is best when people barely know that he leads. A good leader talks little but when the work is done, the aim fulfilled, all others will say, 'We did this ourselves' (Kayser, 1994, p. 36).

This definition supports the notion that "the effective facilitator does the job so well that his or her presence is hardly noticed" (Dirkx and Prenger, 1997, p. 41). To this end, the course was organized so that as faculty-led teaching was intentionally decreased, student team-teaching naturally formed and took over. The need for an all-wise instructor faded. As the students acquired confidence and comfort with teamwork and the technology, they assumed ownership for their learning.

Bolstering the facilitated-learning environment, teamwork and the collaborative effort replaced the traditional stand-up and lecture method. While *short* lectures were used to either introduce a new concept or set guidelines initiating a direction, the students were encouraged to be active participants--working together to develop a body of shared knowledge about groupware and group work. In fact, students took responsibility for their own learning as well as for overall group learning. Each student became a resource for everyone else to draw upon. Through hands-on exploration of groupware, students directly experienced the power of teamwork and group learning supported by collaborative technology. As they collaborated, they "grew" new knowledge. They learned by doing together. Synergy was achieved.

Throughout the term, students were offered a buffet of resources and material relating to groupware from which they selected that which they felt would help them learn best.

Resources

Various resources were made available to the students. These included guest experts, written materials (manuals, articles, and books), and websites. Experts presented and demonstrated each of the software programs. Two of the three guests worked for organizations using Group Wise or LotusNotes. The third guest was an independent GSW consultant. The experts discussed why their organizations selected the particular program(s) and what benefits (and drawbacks) these brought. Current as well as time-honored printed materials (these resources are identified by an * in the Reference section) were made available throughout the term. A sampling of visited websites include www.collaborate.com, www.lotus.com, www.novell.com, www.ventana.com, and listserve@wvnwm.wvnet.edu.

Course outcomes

Course outcomes included group demonstrations of the various software, a group collaborated newsletter, and individual research papers. Student teams selected one groupware package and at least two features to present, demonstrate, and train the class on. In these peer-to-peer teaching episodes, everyone was engaged in hands-on learning. Using one of the technologies, the students collaboratively wrote an article about the course that appeared in the school-wide newsletter. Finally, each student wrote research papers on the technologies investigated. Some of their comments:

> Groupware seems to create new relationships--whether you want them or not! This was fine in our class, but I'm not sure I want this at the office.
>
> Will all these products really create true collaboration. It worked well here, but I work for a cut-throat, competitive company--if they won't share verbally, they won't share electronically.
>
> Trust has to be established before groupware can work.
>
> Lotus Notes looks very different from what I have at work. There must have been heavy customization done there. Who did all that?
>
> Information is power. I'm not sure I'm going to share that with anyone. Information got a lot easier to get.
>
> I was very confused about what groupware was all about until now. Now I'm clear about the programs we studied. Two were similar and one was very different. I don't think the vendors have done a very good job about educating the public on the various groupware and what each does.
>
> I work for an organization where I can tell you no one will ever feel safe enough or brave enough to conduct an electronic meeting--even with anonymous input.
>
> The electronic meetings saved time.
>
> My company recently introduced Notes, but there's been resistance as we've been given little or no training. . .and this program isn't so easy to learn.
>
> This is expensive stuff.
>
> We all became accountable.
>
> Using groupware--the power shifts.

How students collaboratively evaluated the course

Several of the students suggested we use GSW for the course evaluation. Since the course fostered teamwork supported by groupware, this seemed like a wonderful idea. In the past, only faculty and administrators have seen students' evaluations--and only after the term ended. This time all students saw all the evaluations in real-time. (I left the room so as to provide them complete freedom.) Using one of the tools called Categorizer, students brain stormed throwing out as many positive and negative reasons they could think of about this course. At the end of 10 minutes, they were asked to discuss and review the list. They compressed the list by merging similar comments, eliminating duplicates, and, occasionally introducing a new comment. There was a good deal of conversation as they responded to what they saw on the public screen. Once the list was pared down, using the Vote tool, they chose the top five positives and negatives of this course. They all had a powerful voice for they knew that their collective comments would be used to improve the next groupware course.

Top five course positives:

1. Class learned as a group--teamwork was encouraged and supported.

2. Appreciate the high level of experts who introduced and demonstrated the various programs.

3. Better understanding of the differences between the programs as well as their impact on organizations. See groupware as important tools.

4. Greater appreciation for the technographer (system administrator) and meeting facilitator roles used in the electronic meeting software.

5. Appreciate wide variety of resource materials.

Top five course negatives:

1. Want more time to 'play' each session.

2. Too short a time frame--want a longer session or spread over two sessions.

3. Prefer to purchase one text that covers all groupware applications. *[none exist]*

4. Rearrange grade weights--too much weight given to individual research paper.

5. Want more groupware applications to investigate.

My response to students' electronic evaluations

The course will be offered again using a similar format encouraging group work and group learning through groupware. Guests will again be invited to share their expertise with us. More time will be given to students for "playing." More time will be spent on learning and coordinating the electronic meeting facilitator and technographer's roles. Fresh resource material will be made available. The lab will be opened earlier before class officially begins. Investigation of web-type collaborative technology (e.g. www.picturetalk.com, etc.) has begun as well as inquiry into the new Group Wise 5 for possible inclusion in the next course. While no one text covers all groupware applications, instructor-designed and student-designed materials may be created. Grade weights have been readjusted with more emphasis given to group projects and less to individual research papers. (The students were right--this is a class promoting teamwork, not solitary learning.)

Students' evaluations of the various groupware

(See Table 1)

Conclusion

Technology is not an end in itself, but a means to an end. In this case, the end is the ability to work collaboratively--traditionally and electronically. Because the learning experience itself was organized around teamwork and group projects using groupware in a facilitated learning environment, this course helped students understand the end and the means of attaining it.

Students learned how to work in groups; they also learned how to objectively evaluate assorted collaborative technologies. Through comparison they discovered that while groupware share similarities, they are also different--with varying effects on end-users and their organizations. Additionally, a student's comment seems to answer the research question originally asked.

> Learning was easier because the entire class began at a knowledge base of zero. We explored and walked through the programs together. . .and since this course investigated groupware, it seemed appropriate to learn as a group--and we learned so much more that way.

To a substantial degree, the course successfully tapped the kind of innate curiosity that sparks students (and their instructor) to explore and undertake a new course as co-inquirers--as well as learn how to jointly solve problems and make decisions. The students completed the course with considerable knowledge about groupware and, more importantly, with a body of direct, hands-on experience of how team members can work together in decision-making tasks whether they are meeting traditionally or electronically. Both kinds of knowledge and understanding will serve them well in the team-oriented, networked workplace awaiting them.

References

Alsop, S. (March 3, 1997). "Why Lotus Notes Is a Software Fantasy," *Fortune Magazine*, pp. 183-184. *

Blum, C., Reber, S.L. and Thompson, M. (1996). *Lotus Notes, Release 4,* New York: PC Learning Labs, Macmillian Computer Publishing. *

Bronner, E. (October 15, 1997). "University for Working Adults Shatters Mold," *New York Times*, pp. A1 and B8.

Brookfield, S.D. (1990). *The Skillful Teacher.* San Francisco, CA: Jossey-Bass Publishers.

Brooks, S. (1995). "Comparison of Lotus Notes and Group Systems for Windows," working paper, Group Productivity Center, Windsor Locks, CT. *

Coleman, D. and Khanna, R. (Eds.) (1995). *Groupware: Technology and Applications*, Upper Saddle River, NJ: Prentice Hall PTR. *

Dirkx, J.M. and Prenger, S.M. (1997). *Planning & Implementing Instruction for Adults,* San Francisco, CA: Jossey-Bass Publishers.

Galbraith, M.W. (1990). "Attributes and Skills of an Adult Educator," *Adult Learning Methods*, Malabar, FL: Robert E. Krieger Publishing Co., Inc., pp. 3-22.

Jessup, L.M. and Valacich, J. (Eds.) (1993). *Group Support Systems: New Perspectives,* New York, NY: Macmillian Publishing Company. *

Johansen, R., Sibbet, D., Benson, S., Martin, A., Mittman, R. and Saffo, P. (1991). *Leading Business Teams: How Teams Can Use Technology and Group Process Tools to Enhance Performance*. Reading, MA: Addison Wesley Publishing Company. *

Kayser, T. (1994). *Building Team Power*, New York: Irwin Professional Publishing.

Kirkpatrick, D. (July 8, 1996). "IBM and Lotus: Not So Dumb After All," *Fortune Magazine*, pp. 62-69. *

Knowles, M. (1984). *The Adult Learner: A Neglected Species*. Houston, TX: Gulf Publishing.

Kranz, M.E. and Sess, V.I. (June 14, 1994). "Meeting Makeovers," *PC Magazine*, pp. 206-212. *

Kreisle, B. (1996). *Teach Yourself...Lotus Notes 4*, New York, NY: MIS Press. *

Merriam, S. B. and Brockett, R. G. (1997). *The Profession and Practice of Adult Education*. San Francisco, CA: Jossey-Bass Publishers.

O'Connor, B.N. (Ed.). (1996). *Organizational and End-User Systems Model Curriculum*. Springfield, Mo: Office Systems Research Association.

O'Hara-Devereaux, M. and Johansen, R. (1994). *GlobalWork: Bridging Distance, Culture & Time,* San Francisco, CA: Jossey-Bass Publishers. *

Pompili, T. (May 27, 1997). "Groupware: Multiple Personalities," *PC Magazine*, pp. 117-165. *

Rogers, S.B. and McTague, R.H. (1996). *GroupWise 4 User's Guide*, San Jose, CA: Novell Press. *

Ventana *GroupSystems for Windows* manuals and technical reference materials. *

Weatherall, A. and Nunamaker, J. (1995). *Introduction to Electronic Meetings,* Great Britain: Electronic Meetings Services Limited. *

*printed material used as resources/class material

Table 1

Students' collaborative evaluation of the various groupware

Topic	GroupWise	Lotus Notes	Group Systems for Windows
User-friendly?	yes	less so	yes
Anonymous Environment?	no	no	yes
System modifications required?	possibly	yes	no
Threaded messages automatically link documents?	no	yes	no
Able to retract unread e-mail?	yes	no	-
Need discussion leader or overseer of data or meeting facilitator?	no	yes	yes
Smooth integration to/from other programs?	yes	yes	yes
Need "technographer" to work system while in use?	no	no	yes

[Technographer manipulates the software while electronic meeting is in session.]

Benchmarking the Use of the Web for Teaching Information Systems Courses

Kregg Aytes
Assistant Professor
CIS Department
Idaho State University
Campus Box 8020
Idaho State University
Pocatello, ID 83209-8020
Email:
Aytekreg@isu.edu
Phone:
(208) 236-3357

The availability of the Internet is providing IS faculty with opportunities to use the World Wide Web as a tool to support teaching. Perusing the web sites at various universities, one finds a wide range of web pages used in courses. Some faculty are teaching entire courses over the web, some are using the web as a means of providing easier access to information for traditional classroom courses, and some are not using the web at all for teaching. While the debate regarding how best to assess the effectiveness of this use of the technology will continue for some time (e.g., Ehrman, 1995), it is apparent that many IS faculty are forging ahead with integrating the web into their courses. Conversations at department faculty meetings and conferences often revolve around how various faculty are using the web, and how it is helping them teach more efficiently or effectively. At this time, however, there is a lack of systematic research on this same topic, leaving faculty with only small samples and anecdotes regarding how they might either begin using the web or improve their current use. To help shed some light on this topic, a research project to investigate this issue has been undertaken.

The purpose of this research is to 1) systematically describe IS professors' use (and non-use) of the web for teaching purposes, and 2) determine from those same professors which uses of the web they feel are most effective. This research does not attempt to objectively assess the web as a teaching tool, although it may indicate what factors should be more closely studied when attempting to perform such an assessment.

The two issues addressed by the study will be investigated through different means. Professors' use of the web will be determined by viewing the web pages of a sample of at least 200 faculty from approximately 100 different institutions. The sample is taken from the University of Minnesota Management Information Systems Research Center Directory of MIS Faculty (published by McGraw-Hill and available online at the ISWorld web site) and the ISWorld *listserv* distribution list. Additional web sites found through the Microsoft Academic Cooperative (http://academicoop.isu.edu/) and through the ISWorld Teaching and Learning web site (http://www.cba.bgsu.edu/amis/facstaff/smagal/teaching/) will also be surveyed. A survey instrument has already been developed and used in a similar study of Finance faculty (Hackert and Byers, 1997). This survey instrument has been modified to fit the IS discipline, and will be used to gather information on the following issues:

1) Level of usage:
   A. No usage of the web for teaching purposes
   B. Web pages used for course syllabi (standard classroom course)
      - Course description/objectives
      - Course schedule
      - List of assignments
      - Assignment solutions
      - Course (lecture) notes
      - Links to course-related materials

C. Online web course
    - Web-based presentation software (e.g., Placeware, etc.)
    - Conferencing systems
    - Email
    - Web-based conferencing
    - Desktop audio or video conferencing

2) Does usage differ by:
    - Type of institution
    - Country
    - Rank of faculty
    - Courses taught

The issue of perceived effectiveness will be addressed through the use of an email survey sent out to all those who were included in the first part of the study. While email surveys have notoriously low response rates, it is hoped that by including explicit references to the professor's web site, the response rate will be increased. For those professors for which a web site cannot be found, email and postal mail surveys will be used to a) confirm that they are not using the web, and b) investigate their reasons for not using it.

The first part of the study is underway. Sample faculty have been identified, and over eighty web sites have been surveyed. Preliminary data collection indicates that the questions raised above associated with web usage can be answered by viewing the web sites. Insufficient data has been collected for analysis at this time, but data collection will continue throughout the spring and into the summer of 1998, with results available by the early fall of 1998. The survey investigating perceived effectiveness of using the web for teaching will be distributed in the early fall of 1998, with analysis completed by the end of the year.

The results of this study should help IS faculty benchmark their own use of the web against what colleagues at other universities are doing. Besides the summary descriptions of web usage, links to particularly innovative uses of the web will be included in the results. In addition, the follow-up survey will collect information regarding the perceived effectiveness of using the web in the educational process. IS faculty should find the information provided helpful in guiding their efforts to incorporate use of the web into their teaching. Finally, the factors perceived by faculty to be related to using the web effectively will provide a starting point for further research designed to more objectively assess the effectiveness of the web as a teaching tool.

References

Ehrman, S.C. (1995). "Asking the Right Questions: What Does Research Tell Us About Technology and Higher Learning?" *Change* 27(2) 20-27.

Hackert, A.M., and Byers, S. (1997) "Evaluating the Presence of Finance Faculty on the Internet" *Proceedings of 1997 DSI Conference.*

Enriching the Learning Experience: Creating A Virtual Community

Carol Young Carver
Associate Professor
cyoung@gsu.edu
404-651-3893

Department of Computer Information Systems
Georgia State University
Atlanta, GA 30303

Abstract

Educators have expressed a great deal of concern that campuses are being wired for electronic communication without regard for pedagogy. Many of the programs which have been established as part of the movement towards virtual universities are electronic versions of a correspondence course. There is an urgent need to use technology is a way that will enhance, not degrade the learning experience. This paper will describe one effort to create a virtual community within a university classroom, that will enhance the learning process.

Introduction

Virtual communities are social aggregations of people that have emerged from the widespread use of the Internet. A sense of community can improve individual morale and productivity. Thus, the establishment of a sense of community can enhance the operation of business and contribute to the smooth flow of systems. A community provides a variety of important factors. Some of these factors include sociability, emotional support, and a sense of belonging. In addition, a virtual community has the potential of "superconnectivity." "Superconnectivity" is the ability to make any link available when needed, and the ability to expand the number of possible relationships one can have at least ten-fold.

While the phenomenon of virtual communities has been widely documented, this paper addresses the question of how a virtual community can be established where none has existed before in the setting of an urban university. This paper describes the various technologies used in virtual communities, how virtual communities are currently occurring, and how virtual communities are being established at a variety of universities throughout the country. This paper will also describe an experiment that attempts to motivate and to establish a virtual community at Georgia State University.

At Georgia State University, there are some unique opportunities. Most of the graduates of Georgia State University do not leave Atlanta when they graduate. Approximately 300 students graduate from the College of Business each quarter. There are a total of 5 colleges within the university. This means that the Atlanta business community contains a large number of Georgia State University graduates. For people who are looking for a new position, or for employers who are looking for someone to hire, the potential contacts constitute an enormous opportunity.

Georgia State University reflects a common urban setting. The average student is 27 years old, working full time and supporting a family. There are typically long commutes to and from work, demanding jobs and little time and opportunity to build a substantial social structure. In the modern high-stress environment, a sense of community and the advantages it provides are critically important.

The use of technology provides the students and faculty at Georgia State University the opportunity to establish a virtual community, and to greatly enrich the university experience. However, students do not appear to have done this, even though the technology is generally available to them. This study is a first attempt to motivate students to establish a virtual community, to determine why the technology has not been successfully deployed in the past, and to establish a setting in which a virtual community can be established.

Description of the Experiment

This experiment is currently being conducted in 2 undergraduate telecommunication classes. Thus, with the virtual community experiment, students are both learning about the technology and being encouraged to actually use the technology as well. The experiment will run for the duration of a quarter: from September through December.

The experiment was begun by giving students a description of the concept of a virtual community and the advantages that can be achieved. Students were given a questionnaire to determine the extent of their relationships with other students at Georgia State University, and the extent of their access to and their use of various technologies at the beginning of the quarter. At the end of the quarter, students will be asked to identify the technical and non-technical obstacles to establishing a virtual community.

Each student in the class is required to create a personal web page. The personal web page introduces the student to the rest of the class. Each personal web page is required to have a link to electronic mail, so that identifying a student in the class and communicating with him or her is quite easy.

A web page has been established for each class that contains the name and picture of each student. The web page is designed so that you can click on each student's picture and link to that student's personal web page. From the student's web page, an email can be sent.

The students have been given an assignment to use the technology to establish a virtual community. They are required to make an effort to get to know their classmates, share information, and to begin to build a personal network. Students are required to maintain a journal of their use of the technology throughout the quarter. The assignments are evaluated on the basis of the student's use of the communications technology and the extent to which the student was able to become part of the virtual community of the class.

The students are also given group discussion topics. They are evaluated on their ability to communicate throughout the quarter on the group discussion topics.

The Course

The course is a junior-level communications course that includes both technical and business issues in networking. All course materials are available on the web: schedule, lecture notes syllabus, answers to problems, etc.

The Students

The students in the class were between 25 and 39 years of age. Most students were working either part-time of full-time and carrying between 10 to 20 hours of courses. 75% of the students reside in Atlanta, although they live and work in widely dispersed areas throughout Atlanta. 10% of the students live in dormitories. 15% of the students come from a variety of countries including Laos, Bangladesh, India, Thailand, Egypt and the Republic of Russia. The Students could be described as widely divergent in terms of age, status, race, and nationality. 40% of the students had already developed a web page. Most of the students were familiar with the Internet and were frequent users of the Internet.

Bibliography

[1] Brain S. Butler, The dynamics of cyberspace: an interdependent public goods model of electronic group development, Dissertation Proposal, Carnegie Mellon University, August 1997.
[2] Global Institute, Virtual Universities, http://www.edgorg.com/vu.htm.
[3] L. Harasim, and T. Calvert, The Centre For Systems Science Simon Fraser University Burnaby, BC Canada V5A 1S6 604-291-3455.
[4] Star Roxanne Hiltz, and Barry Wellman, asynchronous learning networks as a virtual classroom, CACM, September 1997 vol 40 no 9, pp 44 - 49.
[5] Star Roxanne Hiltz, and Murray Turoff. The network Nation: human communication via computer. MIT Press, Cambridge, MA: 1994.
[6] S. House, A report by the Seton Hall Virtual University Task Force , Seton Hall University, http://www.shu.edu/~houseste/virtual.html.
[7] K. McCollum, Colleges sort through vast store of tools for designing web courses, The Chronicle of Higher Education, Oct 21, 1997.
[8] Steven Jones, "Introduction: from where to who knows?, understanding community via computer, MIT Press, Cambridge, MA: 1994.
[9] Rosabeth Kanter, , Commitment and social organization: a study of commitment mechanisms in utopian communities, American Sociological Review 33:4 (August, 1968): 499-516.
[10] James E. Katz, and Philip Aspden, A nation of strangers? CACM, Dec, 1997 vol 40 no 12. 81 -86.
[11] Jayes Lapachet. "Virtual Communities: The 90's mind altering drug or facilitator of human interaction?" School of Library & Information Studies University of California Berkeley, CA: 1994. http://bliss.SIMS.Berkeley.EDU:80/impact/students/jaye/jaye_asis.html
[12] C. Romm, N. Pliskin, R. Clark. Virtual communities and society - toward an integrative three phase model, in : Information Management 17(1997) 4, p. 261-270.
[13] Rheingold, Howard . The virtual community: homesteading on the electronic frontier (Menlo Park, CA: Addison-Wesley Publishing company), 5.
[14] UCLA Center for the Study of Online Community http://www.ssscnet.ucle.edu/soc/csoc/CSOC_Dashboard.htm
[15] Marc A. Smith , Voices from the WELL: the logic of the virtual commons, Padre Productions, March 1986.

Information Systems Education: Looking Back and Looking Forward

Gordon B. Davis
Honeywell Professor of Management Information Systems
Carlson School of Management
University of Minnesota

Looking back at formal degree programs in information systems covers over 30 years; looking forward can only be speculative beyond five to ten years. However, certain trends can be observed. The technology changes are significant and remarkable. Of significance is the increased scope of information systems in organizations. Information Technology (IT) affects products and services, organization structure, inter-organizational systems, communications, collaborative work, productivity of individuals and groups, nature of knowledge work, and management processes. IT has changed the nature of competitive behavior and provided new forms of commerce through the Web. IT introduces management of an IS function and new problems of security and privacy. Matching the IS curriculum to the technology advances and increased scope of the field has been a challenge in the past; it presents interesting opportunities for the future.

Using Internet Technologies for Business-to-Business Communications - The Extranet

Mike Michalski, IT Manager
BELMARK inc

While the World Wide Web is commonly used for entertainment and advertising, another use may forever change the structure of our business organizations. Companies can save thousands of dollars and enhance productivity by implementing internet technologies for business-to-business communications. Known as an Extranet, the same technology used to create advertising sites like www.pepsi.com and entertainment sites like www.disney.com can be used to facilitate customer- supplier communication.

What makes it even more remarkable is that small companies like BELMARK inc can offer an extranet on the same level with Fortune 500 companies such as Federal Express and United Parcel Service(UPS). This session will include a discussion of current technology and its potential, employing a live "extranet" demonstration.

On-line Distance Learning for Introductory Computing

Kris D. Powers
Department of Computer Science and Information Systems
Bradley University
1501 W. Bradley Avenue
Peoria, IL 61625-0167
kdp@bradley.edu

Introduction

The standard paradigm for distance learning has been evolving for many years. The current proliferation of the Internet and World Wide Web (WWW) has made yet another a new paradigm for distance learning possible: the on-line course. In such courses a WWW site serves as a repository of course materials, providing access to expository material, interactive labs, and exams. Students interact with both the instructor and classmates via email, bulletin boards, and/or chat rooms. (See, e.g., [1], [4], [5]) In this paper we describe novel approaches for adapting an introductory course in computing for on-line distance learning. These approaches were motivated by two fundamental goals. First, in light of the obvious educational disadvantages of distance learning, we decided that the on-line elements of the course must effect offsetting educational advantages. This meant creating positive educational experiences not possible in other formats. Second, we wanted the course to be as accessible as possible, keeping the economic and related technological requirements to a minimum. The course should require neither sophisticated equipment nor expensive software; any off campus student with access to merely a PC, a modem, and a suitable connection to the Internet should be able to participate, for about the same expense as any other course. Our challenge then is to provide an enriched educational experience on-line, subject to these limitations.

The original course

The course we chose to adapt to Internet delivery is an introduction to computing with no prerequisites. Students study the history of computers, their limitations and impact on society, and standard applications, especially those related to the Internet and WWW (e.g., email, search engines, and WWW navigators). Students are also exposed to basic computational problem solving using, for example, the BASIC programming language. Current on-campus versions of the course are taught in a discussion/lab format. Discussions address historical and societal issues, and provide an opportunity for the instructor to introduce technical subject matter. The technical subject matter is extended through instructor guided, hands-on experience in the labs. Student work in the course typically includes written themes on societal aspects, the creation of WWW pages, assorted artifacts of WWW browsing (e.g., electronic postcards to the instructor, links to *credible* WWW reference material, etcetera), and programs. The course is also distinguished as a junior level elective serving a bimodal student population. One population taking the course is Computer Information System (CIS) majors for whom the course satisfies an upper level elective requirement. The second population consists of non-majors, for whom the course fulfills a university-wide "Science and Technology" requirement.

The on-line course

Instructional strategies

In considering how the Internet could be used for distance learning, we identified three major instructional strategies which would be unique to the on-line version of the course, and would offer a quality educational experience not otherwise possible.

1. <u>Class cybersociety</u>

One of the major societal impacts of the Internet is the development of online "cybersocieties," societies defined in and by a virtual environment. [3] Students in the course would develop an understanding of the effect of cybersocieties on human interactions by actually participating in one. For instance, through on-line class discussions students would experience firsthand how the anonymity factor inherent to this kind of communication effects their interaction. [7] In fact, each student's class identity would be established *entirely* on-line. (Unlike an on-campus exercise to simulate the effect.) Class interactions with the professor and classmates would only occur via email, bulletin boards and (at scheduled times) meeting in chat rooms. Fostering a vital electronic community is better facilitated by intense involvement. For this reason, we have decided to run the course in a shortened (5-week) time frame, similar to the summer school sessions at many institutions.

2. <u>On-line student portfolios</u>

Students would not just create a page or two, but develop an entire electronic portfolio as a web site. Each individual student portfolio would include links to papers, programs, and other assigned WWW pages. Students would access each other's sites for peer review and as a basis for discussions. A student's portfolio would not only establish their identity in the class cybersociety, but would also be a significant element of their course assessment. The additional benefits afforded by portfolio assessment are well documented. (See, e.g., [2].)

3. Self guided on-line labs

Using computing as the instructional medium for a course about computing seems exceptionally appropriate. Indeed, the students' experience with the technology that supports the on-line course (e.g., standard Internet applications) is part of the requisite subject matter. This objective of the course becomes a self-fulfilling prophecy. Initial lab work must facilitate students downloading and installing any needed software. Further labs must address the variety of Internet tools that are used. For example, in addition to the class interactions previously described, students will download software across the Internet, use search engines, and navigate to class notes and other materials on the course WWW site.

Resources

In keeping with our goal of accessibility, we decided that the course would be offered requiring as little computational power as seemed feasible. Obviously taking a course on-line requires a computer, a modem, and a connection to the Internet. For ease in initially developing the labs, we decided that we would start by supporting only PC's. The requisite software will dictate the requisite computational power of the machinery. For the economic considerations previously mentioned, all course software was to be public domain. We selected Netscape Composer™ 4.1 as our basis for Internet software services, including browsing, email, and ftp. We also intend to use Netscape for html editing. A more difficult issue was that of the computational problem solving aspect of the course. This portion of the course had frequently been taught using languages that required access to departmental machines with the necessary translators. However, one version of the course was notable in that it had used a programming language that avoided this requirement: the PostScript printer programming language.

All of the basic constructs of computational problem solving are readily accessible in the PostScript language. "About one third of the PostScript language is devoted to graphics. The remainder makes up an entirely general purpose programming language" including variables in the most common data types (reals, booleans, arrays, and strings), procedures, and control structures like loops and conditionals. [6] While PostScript programs are usually generated by application programs, these programs are ordinary text files of printable ASCII characters, and can also be generated by human programmers. Using the PostScript language offers a number of advantages. First, no translator program is required. And, for that matter, neither is a PostScript printer required. Students can examine their output graphical images using public domain software like Ghostview. Second, the graphical nature of the output has been found to be more gratifying to the students than textual results. Finally, PostScript is an interpreted, stack-based language similar to FORTH. This programming model is quite different from the C++ world in which our CIS majors do the bulk of their course work. This fact has a couple of happy consequences. Often the computational problem solving portion of this course suffers from the bimodal nature of the student population. Either the CIS majors in the course end up bored, or the other students end up confused. Because PostScript is so dissimilar to our typical CIS major's previous experiences, this problem is avoided, and our CIS majors have the added benefit of extending their experience base in programming languages.

Conclusion

The most challenging hurdle to establishing the course will be the development of the labs for installing and using the electronic resources. In addition to student portfolios, we also intend to assess student performance using items developed in CyberProf. The creation of these items will also be a major part of this course's continued development. The course will be offered for the first time in the summer of 1998.

References

[1] ACCESS/NJIT Distance Learning, < http://www.njit.edu/njIT/Directory/Admin/Distance_Learning/ >, 18 Feb. 1998

[2] Adams, Dennis and Mary Hamm, "Portfolio Assessment: It's not just for artists anymore," *The Science Teacher*, May 1991, pp. 18-21.

[3] Bruckman, Amy, "Finding One's Own Space in Cyberspace," *Technology Review*, January 1996, pp. 48-54.

[4] California Virtual University, <http://www.california.edu/>, 20 Feb. 1998.

[5] The GEMBA™ Pro- -m - The Fuqua School of Business, <http://www.fuqua.duke.edu/programs/gemba/index.htm>, 12 Feb. 1998.

[6] Reid, Glenn C., *PostScript Language Program Design*, Addison-Wesley Publishing, Inc., New York, 1988.

[7] Turkle, Sherry, "Session with the Cybershrink," *Technology Review*, Feruary/March 1996, pp. 41-47.

Information Systems-Centric Curriculum (ISCC '98)

Panelists:
Jimmie Haines, Boeing Corp.
Doris K. Lidtke, Towson University
Michael C. Mulder, University of Nebraska at Omaha

The panel will present the curriculum developed by a taskforce made up of half representatives from industry and half academic. The project was funded by the National Science Foundation, NSF/DUE 9455450. The industry representatives developed the "Profile of the Graduate," which describes the skills and knowledge they desire in new hires, the curriculum was then developed so that students may acquire these skills and knowledge. Drafts [or the final version] of the curriculum will be available for each session attendee. The main body of the report contains an executive summary of the project, the process of the project, and the major results and conclusions. The appendices include complete course descriptions for each recommended course, with suggested learning activities, pedagogy, references and a list of required support materials. Several possible implementations are included. The curriculum emphasizes and integrates communications skills, collaborative and group experiences, and ethics in the profession.

Incorporating Integrative Learning Experiences in a College-Wide Environment

Dr. Dale D. Gust, Professor, Business Information Systems
Dr. Patrick A. Okonkwo, Professor, Marketing & Hospitality Services
College of Business Administration
Central Michigan University
Mt. Pleasant, MI 48859

Abstract

Survival in today's competitive business environment depends on access to real-time information. Computer software systems continue to emerge that provide for integrative application processing across functional lines. Students graduating from Colleges of Business need to leave with knowledge of how these systems function to provide for enterprise resource planning (ERP). This paper describes how one college is meeting this challenge through an alliance with the SAP Corporation.

Introduction

In today's business world, words like downsizing, rightsizing, resource planning, business process reengineering, supply chain, and enterprise networking present a unique challenge to business schools throughout the world. The objective of this paper is to present how one College of Business has accepted the challenge to become practitioners by integrating these new and emerging technologically oriented concepts into its curriculum through a college-wide approach.

Referring to the terms as technologically oriented concepts means that all of them have something to do with the application of technology toward the solution of a problem. For example, if we examine business process reengineering, we find that technology is used to provide a more efficient and productive means of processing work. However, the work to be processed is analyzed first before application of the technology to solve the problem.

The Problem

When one examines the traditional structure of a College of Business, the analysis reveals that built-in barriers exist which hinder the implementation of emerging technological concepts on an enterprise-wide (college-wide) basis. We concentrate on teaching principles of marketing, finance, logistics, human resources, accounting, and information systems in isolation of one another. We treat them as "islands" without allowing for the natural and logical network connections to be made among them. We often fail to provide a strategy for integration of information among these disciplines as we prepare our students for the business world.

The Background

Central Michigan University is located in Mt. Pleasant, Michigan. It serves a student body of nearly 17,000 students with another 10,000 students being served through its Extended Degree Programs. The College of Business Administration consists of six departments—Marketing, Accounting, Business Information Systems, Finance, Management/Law, and Economics.

In the early 60's, the College of Business Administration had two departments. All majors and minors were offered through those two departments. Then followed the era of departmentalization and the college expanded at one time to seven departments. With restructuring, the number decreased to five; and, just last year after a 15-year separation, Economics rejoined the College of Business Administration.

The Mission Statement

In 1992, the College developed a Mission Statement to provide direction in the preparation of undergraduate and graduate students for professional careers in business, nonprofit, educational and other organizations. Included in that mission statements are the statements of commitments we, as faculty, have to serve our students, the employers of our students, and the community. Our mission is to honor those commitments by offering academic programs of superior value, by providing a professional faculty, and by creating an environment which is learning centered and business connected.

The driving force critical to the success of the college is the synergism of the two dimensions of our mission statement—learning centeredness and business connectedness. Within this framework, the college is endeavoring to provide an environment for student learning that will assure success in meeting the two dimensions.

To promote an environment that is learning centered, emphasis is focused on active student learning. In addition, faculty are rewarded for shifting from a teaching model to a learning model. Emphasis is also focused on maintaining a curriculum which demands and supports active student learning. Another method to help achieve an active learning centered environment is to seek to provide state-of-the-art facilities and technology.

To support the second dimension of our mission statement—that of being business connected—an environment must be provided to assure the integration of real world business practices with college experiences. Students will be provided with practical experiences that are integrated experiences.

The development of a college-wide mission statement had, in itself, many benefits. First of all, it brought together departmental representatives and charged them with the responsibility of developing a mission statement that would serve the needs of all of our students regardless of their majors. The process forced traditional "island" departments and faculty to think about student learning from a college level perspective rather than isolated departmental focuses. It caused faculty to identify integrative learning experiences that could be incorporated into any number of courses across the curriculum. It forced faculty to focus on developing cooperative and collaborative student learning environments and to focus less on departmental competitiveness and politics. The end result was overwhelming support for passage of the mission statement.

A Strategy

With a mission statement in place and specific goals identified, one remaining element was to develop a plan that would serve as a basis for providing our students with knowledge of global integration and enterprise-wide business operations experience. Needed was a mechanism that would enable faculty to teach integrative planning concepts from any number of different perspectives. For example, faculty could teach integrative planning concepts from a logistics viewpoint or from other viewpoints such as accounting, human resources, or finance. Also, a technology architecture/framework was needed that could be used as the facilitator or mechanism for teaching enterprise resource planning.

The Solution—An Alliance

Central Michigan University entered into an alliance with the SAP (Systems, Applications, and Products in Data Processing) Corporation that would provide the mechanism needed by the College of Business Administration to implement its mission and goals. One part of the alliance program provided for utilization of SAP software for the administration of the university in the areas of human resources and finance. Both systems were implemented in December, 1997.

The second part of the alliance program provided the College of Business Administration with access to SAP software to be used as the facilitator or mechanism whereby integrative resource planning concepts could be presented to students within numerous subject matter areas.

The Alliance Vision

To provide direction for the alliance program, the following vision statements were identified:

- To give our students a better understanding of how real-world technology-enabled companies operate.
- To use SAP technology to help teach business concepts.
- To provide our students with more global, integrated knowledge of business operations.
- To integrate business theories with business applications.
- To enhance knowledge, skills, and abilities of students and develop competencies in the integration of business functions.
- To cultivate visionary, creative thinking and learning for efficiency, quality, and responsiveness to customers across the globe.
- To promote our mission of being business connected.

SAP—The Company

The SAP (Systems, Applications, & Products in Data Processing) Company started in Mannheim, Germany in 1972. In 1978, it moved to Walldorf. Its sales exceeded $2.6 billion in 1997. SAP gained 500 new customers in the first six months of 1977. In addition, SAP controls one-third of the $5.2 billion client-server enterprise applications business. It is the 5th largest software vendor in the world.

SAP is emerging as a worldwide standard in software applications that automate and link critical business processes, such as accounting, billing, human resource management, logistics, materials management, purchasing, and manufacturing control. It has a worldwide presence in over 40 countries. SAP specializes in Enterprise Resource Planning (ERP) and is the industry leader in ERP software.

What is ERP?

Enterprise Resource Planning is a collection of software programs which ties all of an enterprise's various diverse functions (finance, manufacturing, logistics, human resource management, etc.) into a cohesive database. ERP also provides for the analysis of the data to plan production, forecast sales, analyze quality, etc.

SAP's Products, Users, and Components

The main products of SAP include SAP R/2 which is a mainframe based system introduced in 1978, SAP R/3 which is a client-server based system introduced in 1992, and SAP R/3 which is an object-oriented upgrade introduced in 1998. Many of SAP's users are among the Fortune 500 companies including Microsoft Corporation.

Typical ERP components supported by SAP are:

- Finance/Accounting
- Manufacturing Planning/Scheduling
- Human Resources
- Distribution Management
- Customer Order Management
- Customer Management
- Shop-floor Management
- Inventory Management
- Procurement Management
- Production Control
- Treasury Management
- Quality Management

Why Users Choose SAP

Here are some of the reasons users give for why they have selected SAP to help them with their ERP needs:

- Provides integrated enterprise resource planning through a suite of software modules.
- Provides real-time database update for integrated applications.
- Supports organizations with multiple companies in different organizations.
- Solves the year 2000 problems.
- Provides a better return on information.

Developing a Framework of Student Users

SAP believes in alliances, and its long-term goal is to develop at least 100 alliances with universities. At the present time, five established university alliances exist in the United States. Arrangements have begun to establish alliances in England with future ones to follow in South America.

CMU's Developmental Plan

The team approach is frequently utilized in the systems development process. Also, users involved in the implementation of SAP software do so in a team environment. Therefore, our college adopted that format in the preliminary planning phases. Departments were asked to identify faculty members who wanted to become the initial players in implementing the alliance relationship. The Dean of the College selected a team of faculty to receive the initial training in SAP.

The participating faculty decided that the team approach was the only way that success of the alliance could be assured. The team needed to focus on integrative applications that would cross departmental boundaries or walls. Team members were selected on the basis of interest and perceived ability to follow through on the initiative. Team participation would require many hours of study, preparation, developmental activities, and cooperation.

Team members selected represented the areas of Accounting, Marketing/Logistics, Finance, Human Resources, and Management Information Systems.

The Model Chosen

The team decided to use a training company software called Motor Sports International that was developed by and is supported by the SAP Corporation. Therefore, as transactions were developed and entered into Motor Sports International's system, the effect on all aspects of the value chain could be determined. While instructors will continue to teach the basic concepts in each of their respective courses, they will be able to utilize SAP's training software, Motor Sports International, to track and retrieve information throughout the enterprise.

In addition, each instructor will be able to utilize the software in the class to assist in teaching enterprise resource planning concepts. The ultimate goal, of course, is to help students better understand integration of business processes.

Each faculty member selected to serve on the team is responsible for developing course material to be used in his or her classes. Four of the courses are graduate level while the other eight are undergraduate courses. At the present time, the following courses will include integrated ERP concepts using SAP:

- Accounting Information Systems and Control
- Human Resource Management
- Purchasing Management
- Logistics Operations Management
- Working Capital Management
- ABAP/4 Programming

- Systems Analysis and Design
- SAP Enterprise Software
- Management Information Systems
- Information Resource Management
- Accounting Information for Managers
- Administrative Control and Analysis

The Spring Semester of 1998 was the first semester in which ERP concepts were integrated into the course material. Much learning took place by the students as well as the faculty team members. The team continues to develop assessment tools to use for checks on effectiveness of systems delivery.

The model chosen also encourages other faculty members in the College to be trained. The Team has already sponsored two introductory sessions to ERP. Later in the semester, a series of six, four-hour hands-on introductory SAP Faculty Workshops were offered. The eventual goal is to have all faculty in the College participate in some form of training.

Benefits to College of Business Administration

Within our mission statement, we emphasized learning centered and business connected. Within this context, then, we look for the benefits derived from the approach being used. Our goal is to help students learn how simple business transactions entered into a system will affect business processes throughout the entire supply chain. As students move from one class to another, they can analyze the effects of that transaction on different business modules, such as human resource management or accounting.

Another benefit for the college is knowing that our students will leave with a thorough understanding of enterprise resource planning concepts. They leave knowing that their experience through the integrative approach to business process planning will give them that competitive edge when they vie for market share.

Central Michigan University accepted the challenge to move forward with curriculum re-engineering to ensure that its students can learn integrative business systems processes in a variety of business classes. No matter whether a student is a major in logistics, accounting, resource management, finance, or management information systems, he/she will understand how integrative systems planning will increase productivity.

Benefits to Students

The students will be the primary recipients of the ERP. We anticipate that they will have a better understanding of the integration of business processes. During our regular Career Days, many employers have asked for students with some knowledge of SAP. Campus recruiters have shared with us that students with SAP experience will not only have a competitive advantage in the marketplace, but they may also receive a monetary supplement to their starting salary. Students who work in companies where SAP is used will have opportunities for consulting. It will be a win-win situation for the students and for the College of Business Administration.

Where To From Here

New territory has been charted and the process will continue into the future. Faculty members are being challenged above and beyond their traditional assignments. The support and cooperation of the initial team of faculty developers has been outstanding. The team members have been forced to look at their specific subject matter areas in relationship to the entire business experience. The results have been faculty learning and practicing team concepts—the same concepts that we have been fostering in our students.

What's next? At the present time, a limited number of courses within the college have incorporated business process planning concepts through the use of SAP technology. After a one-semester test period, the team assessed its approach to determine changes in the delivery format and has looked into other courses which may be re-engineered. The remainder of the information in this paper describes what has been learned as a result of the one-semester test period and the identification of other program elements being considered for implementation.

Learning How to Work with Each Module

The original intent was to integrate ERP concepts into each of several selected courses within the College of Business Administration. For example, the instructor in Logistics would focus on operational management transactions. The "silo" approach was to be used whereby each instructor would focus on business processes that pertained specifically to the particular course subject matter being taught. However, students were asking, "How does the transaction in one functional area affect the other?" The classroom consisted of students representative of various disciplines. While our goal was on teaching integration concepts across functional areas, individual instructors were focusing on "silo" concepts. Instructors had to consider tradeoffs within their individual areas and consider all possible interfaces with the other functional areas.

Cohorts

The team, in evaluating their strategy, determined that the maximum effect could be achieved through the use of cohort groups. Therefore, integrative application functions and capabilities could be discussed because the classroom environment would be structured to support it. One element of this approach was the formation of a University Alliance Student User Group (UASUG). The group has student representatives from each department in the college and all disciplines. The user group is a test group which meets once a week to solve problems presented to them by members of the SAP faculty. Thus, students can focus on integrative application problem solving involving several SAP modules as opposed to working with one at a time. However, the SAP faculty also determined that each student needed to work through each module individually before engaging in and understanding of the integrated applications.

Also, in the faculty team strategy evaluation process, the consensus was that each faculty team member must understand each individual module's operation before he/she could appreciate, understand, and develop instructional material to support the integration concepts of SAP. For this reason, the team felt that their initial exposure to learning SAP through the "silo" approach was beneficial and should be encouraged as additional faculty are trained.

Classroom Environment Structure

Because there was no classroom with dedicated computers for exclusive SAP usage, students completed their hands-on applications in the computer laboratory. They were to work individually to assure that each student thoroughly understood the functionality of each module. Graduate assistants were available to provide help. As a result of the large numbers of students utilizing the Motor Sports International Company, the faculty had to reconfigure Motor Sports to handle 80 students, 60 more than what the original system could support.

Student Recruitment

For the first semester, no problems existed in finding sufficient numbers of students to enroll in the SAP designated courses. The Alliance Program and courses were well advertised and explained by faculty members throughout the College of Business Administration. Future enrollment demands are expected to exceed space availability.

Lessons Learned

The SAP instructors learned that they must continually work with and understand the SAP transactions; they tend to be very challenging, integrative, and robust. The instructor must be thoroughly versed on each of the modules. The instructor must be thorough in teaching, in providing explanations, in writing of assignments, and in giving directions. Each assignment must explain the specific steps a student must take that will lead him/her to development of the final product.

The instructor can't do it alone. Graduate Assistants must be planned for and utilized extensively for the most effective outcomes. Also, the faculty learned that success must be preceded by team work among all faculty in the functional areas, constant and consistent communications among faculty, weekly meetings to compare notes, and a shared plan of what students need and how we can meet that need. Faculty also need to be meeting with students more frequently outside the scheduled classes.

The team also learned that the SAP faculty team should be exposed to all SAP modules. Faculty from respective disciplines--finance, logistics, accounting, etc., should actively engage in explaining to each other how transaction data entered into one application module affects all other modules. Also, the SAP faculty should make themselves available to other alliance classes to provide backup in explaining the cross functional relationships. The reality of this arrangement becomes more feasible as the team continues to discuss the logistics of utilizing cohorts to more effectively teach enterprise resource planning concepts.

The faculty team discovered that they were unable to cover as much material as originally intended. Also, the faculty team learned that it was difficult for them to keep focused on the teaching of enterprise resource planning concepts rather than teaching SAP.

The students were enthusiastic about learning the integrative applications. Most importantly, the software was reliable—no crashes.

The team learned that they must focus on how to cover more material within the present framework. The first semester represented a test of the SAP software, the testing of the integrative teaching materials developed, and the training of other faculty members. During the next semester, the team will seek to incorporate more ERP concepts into existing courses. The team will continue to investigate the use of a cohort group for more effective presentation of enterprise resource planning concepts across functional areas.

End Note

The authors recognize that SAP is only one of several software packages available on the market which support ERP. SAP works for us. Each college anticipating an alliance or outright purchase of similar software will need to look for what meets their specific needs.

Facilitating Bloom's Level One through Active Learning and Collaboration

Roy J. Daigle and Michael V. Doran

University of South Alabama
School of Computer and Information Sciences
Mobile, Alabama 36688
(334) 460-6390
daigle@cis.usouthal.edu
doran@cis.usouthal.edu

ABSTRACT

Bloom's taxonomy provides a means of structuring learning activities according to levels of comprehension ranging from factual knowledge to the creation of new knowledge. There are problems with presenting factual knowledge in the traditional lecture mode: student motivation, time-to-present, and course priorities. However, in Bloom's taxonomy, Level 1 (factual) knowledge is the basis for knowledge comprehension at higher levels. Therefore, it is essential that the "fact base" comprehension be attained so that higher levels of knowledge can be addressed. Active learning and collaborative approaches have been shown to be effective in promoting learning. How can active learning and collaboration be used to overcome the problems associated with promoting Level 1 comprehension? In our introductory Computer Information Science (CIS) course, we attempt to answer this question for the topic "history of computing": We have combined a student research and collaborative assignment to acquire Level 1 comprehension with a culminating *College Bowl* activity to reach the goal of Level 2 comprehension. In this paper we discuss course organization, course goals, the College Bowl format of quizzing, contest results, and overall observation of the process.

Introduction

"The past is prolog to the future", a quotation engraved on the front of the National Archives in Washington D.C., is a reminder that the study of history is essential to shaping the future: this is no less true in the field of computing. The current state of technology builds upon the successes and failures of innovators and visionaries from the past. The field of computer science is so young that many of these pioneers are still actively shaping current and future directions. A sub-discipline has emerged in recent years to capture this historical information. Likewise numerous WEB site exists which are devoted to historical issues of computing, a noteworthy example is that of JAN Lee at Virginia Tech. (http://ei.cs.vt.edu/~history/index.html)

The emergence of the WEB has created a vast source of information. As could be expected, computing's history and pioneers are highlighted in many locations. Textbooks and "war stories" provide only a brief and limited view of this interesting and fundamental glimpse of our past. ACM, IEEE, NSF, universities and numerous individuals have established sites which capture these past adventures of computing and the founders of our discipline.

The importance that is placed on a "historical perspective" is evident in curricula documents [ACM 1991], [IS 1997]. These documents prescribe an awareness of the significance of historical events so that students are able to understand the current state of technology, to participate in planning for future innovation, and to realize the social/ethical implications of the role of technology. Several problems exist in the accomplishment of this goal.

Sheer volume and pace of new innovation pose problems for educators. The set of historical events for a subject might be characterized by an initial "trickle" in the struggle for self-identity. This is followed by a "great flood" that results in recognition by the community. Finally, there is a "steady stream" with occasional "small floods" that nurtures the subject. Computing has been in the "great flood" phase almost since its inception fifty years ago. The volume and rate of change is so great and continuous that the recording, reflection, and understanding of these innovations is overwhelming. Therefore, the true benefit of placing technological innovation in perspective and its social impact might be completely ignored.

Another problem is that a major attraction to the computing discipline is the use of technology. Students are often moderately interested in the stories of the development of technology; they are more often consumed with immediate use of current tools. Computing and technology are so tightly associated by the general public that they are indistinguishable. Separating computing (theory and practices) from technology and revealing the relationship between the two is a curriculum objective. Planting the seeds of an historical perspective early in the curriculum, with continual nurturing in successive courses, is a means of creating the distinctions.

However, the greatest problems associated with teaching history of computing are not a consequence of content: They are a consequence of the type of comprehension that is needed in Level 1, factual knowledge.

Bloom's Taxonomy of Comprehension

Bloom [1956] has established levels of learning with clear measurable outcomes for each level. Bloom's taxonomy has been used successfully to associate levels of learning with topics in computing courses [Doran 1994, 1995, 1996, 1997; Langan 1996]. At the lowest Bloom level, Level 1, is the recitation of facts. Historical facts as well as computing facts defining control and data structures are included in Level 1 issues. According to Bloom's taxonomy, Level 1 factual knowledge is prerequisite to higher levels of comprehension, and, therefore special attention must be given to insure that the Level 1 foundation is laid. The importance placed on the "fact base" is fundamental to problem-solving methodologies (Polya, Zig Zag, Group Zig Zag [Daigle 1995, 1996, 1998]). From this base of facts, it is possible to move to Level 2, (use) to understand the impact of facts on individuals and society and Level 3, (application) to apply the facts in the appropriate manner. The general principle of Bloom's taxonomy, that fact precedes both the use and the application is not content dependent. In the context of computing, fact: Babbage designed the Analytic Engine in the 1820's; understanding: stimulated by societal need to provide accurate calculations of math tables for navigation; application: general model of computing INPUT-PROCESS-OUTPUT and concept of memory.

Problems with Addressing Bloom's Level 1

The traditional lecture delivery mode encourages a passive and self absorbed behavior on the part of the students. If the volume of factual knowledge is large and the relationships among the facts are complex, in-class delivery consumes much time and competes with major course objectives. In the initial CIS courses the primary objective is the development of effective problem solving and algorithm design/coding skills. The consequence of insufficient examination of complex relationships and issues is an inferior "big picture".

A typical solution to the dilemma described in the preceding paragraph is to "out-source" the Level 1 items in a curriculum to the individual student through reading assignments. However, unless student study groups are self-formed, the reading assignment denies the student collaborative and judgment-forming experiences. In our approach, we describe an alternative to the traditional lecture delivery and to the individual reading assignment approach in dealing with high volume Bloom Level 1 items. This approach incorporates active learning, collaboration, and individual accountability developed and used in the introductory Computing I course at our university. In addition to addressing historical topics, this approach provides a model for cooperation with peers in succeeding computing courses in the curriculum.

College Bowl

College Bowl is an academic competition between two teams from different universities. Each team is made up of 4 players. The game, which appeared on TV in the 50's, 60's and 70's, uses a question and answer format. A toss-up question is used initially to obtain a response from any member of either team who is the first to "buzz" in. A correct response from a participant entitles the participant's team to collaborate to answer a multi-part bonus question. In its purest format, questions cover a wide range of academic disciplines of varying degrees of difficulty and include current events as well as popular entertainment news. The game continues today without the TV exposure, with universities supplying resources to develop competitive teams and attract outstanding students. Year-long team activities encourage extensive preparation and provide opportunities for the experience of competition. The experiences and insights of one of the authors as a participant and as a faculty advisor to our university team were instrumental to the adaptation to the classroom implementation.

Approach

Our implementation of the introductory CIS course sequence has reflective problem solving and algorithmic design issues as the primary goals. This course sequence accomplishes these goals by the establishment of problem solving strategies, adherence to the algorithmic process, and development of code in a high level programming language [Pardue 1991, 1994], [Doran 1993]. As previously mentioned, a brief discussion of the historical perspective is called for by curricula models. The initial version of the course as developed under an NSF grant, included this historical discussion within the first couple of weeks of the first course. An extensive presentation has been removed and replaced by a brief overview and the directions necessary to search for this historical information in other sources. The approach consists of four stages:

1. Investigation
   a. Student teams are formed; each team is given a specific area in which to focus.
   b. Several acceptable general web sites are distributed.
   c. A deadline for sharing and integration is established.
2. Collaboration
   a. Each student team assembles an electronic list of questions and answers for their area of investigation.
   b. The student lists are combined to form an initial database.
   c. The initial database is reviewed by the instructor(s) and supplemented with items to achieve completeness of coverage.

d. The final list is distributed as a database of study items to each member of the class.

e. A class period is set aside for the contest

3. The College Bowl Contest

a. New teams are formed so that each area of investigation is represented on a team.

b. The participants of each round are representatives of each team.

c. A fixed number of toss-up questions is determined for each round; each toss-up question has a bonus question associated with it.

d. Enough rounds are conducted so that each team member represents their team at least twice.

e. A class victor team is declared; if multiple sections are involved, a final contest (outside of class) can be scheduled to identify a final victor team.

4. Questions for the examination are taken from the database of study items.

An active discovery is needed by the students to be successful in this project. They soon realize that they are in complete control of their learning, only guidance will be provided by the instructor. The actual details and amount of material to satisfy the requirements are the responsibility of the students. Students are cautioned to choose reliable sites such as those associated with the ACM, AITP, IEEE organizations or with a College or University.

Depending on student constraints much of the work can be done individually but eventually there must be a sharing of results. The use of groups at this point in the curriculum can provide a valuable experience in collaborative learning which can be utilized later in the curriculum. Prior work has shown the benefit of this early collaboration [Daigle 1996].

Another resource for the student learning in the use of previous questions from past contests. These questions can come from faculty or former students.

Each team takes great pride in winning the class competition. No actual grades are used but possible rewards might include bonus points. Usually just the claim of winning gives the students a sense of bragging rights. A class pride also usually results as competition between sections might occur. The learning is complete with the knowledge covered is now part of the expected learning behaviors for the courses. Most the basic general facts found by all groups will be used on quiz or test.

Results

In addition to the course objectives being met in a fun and exciting fashion, other benefits have been derived from use of this approach in our introductory course. The most direct result was a savings in lecture time. Often several lectures were needed to cover a broad historical overview of computing. Certainly, this time gave the students some historical perspective but did not encourage them to seek more information. Also students felt, although the topics were of interest, it delayed the main objectives of the course, reflective problem solving and program development. With minimal lecture time and one day of competition, a broader coverage of historical topics can be accomplished and lecture can proceed quickly and directly to the problem solving aspects of the course.

As part of the game format questions must be developed on the various historical topics. The faculty started with what was thought to be an ample supply of questions. This supply of questions was supplemented with a cadre of interesting and relevant facts found by students. This question generation is also thought to increase the students learning as they "apply" the principle of Bloom's taxonomy to pose appropriate questions at the necessary levels. This idea of student generated questions to increase Bloom mastery has likewise been applied in other courses [Denton 1996], [Doran 1996].

The most unexpected but useful result of this endeavor has been the creation of our own WEB site based on a historical time-line as supplied by the textbook [Friedman 1997]. Several student groups combined their resources and developed this site. This provided the students an opportunity to obtain the skill of WEB development not usually associated with the introductory problem solving/programming course. However, it encouraged and provided an avenue for these students to undertake a project which exposed them to the WEB which we assume our students will implicitly acquire. Additional benefits of this WEB page is a repository of previously discovered facts. This foundation could be built upon by later students. The WEB development also provided an opportunity for a collaborative effort at this early stage of the curriculum. The authors have explored and discussed how collaboration could and should be integrated throughout the curriculum [Pardue 1991], [Daigle 1996], [Landry 1997]. This project provides yet another vehicle to accomplish this collaboration goal and reenforce the overall curricular goals.

Observations

The following are general observations of the authors of the benefits and students perceptions when this College Bowl tournament and all the supporting activities are incorporated into the course setting.

1) Students generally find more information than faculty have in the past. Faculty tend to tell the same standard stories.

2) Students take a more active role in learning. This active learning is called for by the curriculum and has been integrated in various academic environments. When students are fully engaged in the process they tend to exhibit more interest and a willingness to explore beyond the expectations.

3) Faculty have updated their stories used in the limited lecture time and have a wider repository to draw upon. Also, this limited lecture time can be used to emphasize the social/ethical implications of technology (Bloom Level 2) instead of the basic facts.
4) More of the pure Bloom Level 1 facts can be learned in a shorter time frame outside of the traditional classroom lecture. Not only is lecture time saved but more historical facts are encountered.
5) The saved lecture time can now allow for the earlier introduction of problem solving/algorithm development issues which can then be implemented in code.
6) Students view what was considered an unimportant distraction in the learning of "programming" as a chance to explore and discover facts about their discipline
7) Students acquire skills not previously present in the class but useful to their computing career. This includes the WEB skills as well as the collaborative team skills.
8) The interest level of the students is increased as they want to find new unknown facts and win the contest. A sense of pride is developed when they discover something new. Although the contest does not directly affect course grades, students still want to be considered the best. It has even fostered friendly competition between sections of the course.
9) The approach is discipline independent. It can be used in any learning situation where time is always a scare resource.
10) The approach is learning level independent. Although we primarily used it to cover the vast amount of factual Level 1 knowledge, it can be adapted for topics targeted at any of the Bloom levels.

In summary, the authors have found the College Bowl tournament format with the supporting activities provided numerous benefits when integrated into the course. These benefits greatly exceeded the expectations of the authors when we experimented with the approach. We found that it complemented the previous curriculum efforts undertaken at our university in prior NSF grants. The approach provided another vehicle to utilize an active style of learning with early collaboration. These concepts, in other forms appropriate to the later courses, could likewise enhance the learning experience of students. It is these habits, once instilled in our students, which are hoped to remain a natural behavior in later courses and throughout their professional career.

References

[ACM 1991] ACM/IEEE-CS Joint Task Force, Computing Curriculum 1991.

[Bloom 1956] B. Bloom et al, The Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook I: The Cognitive Domain, McKay Press, New York, 1956.

[Daigle 1995] R. J. Daigle, M. V. Doran and J. H. Pardue, "A Group Problem-Solving Model for the CIS Curriculum", Association for Information Systems Inaugural Conference, August 25-27, 1995, Pittsburgh, PA.

[Daigle 1996] R. J. Daigle, M. V. Doran, and J. H. Pardue, "Integrating Collaborative Problem Solving Throughout the Curriculum", SIGCSE'96 Technical Symposium, February 1996, Philadelphia, PA.

[Daigle 1998] R. J. Daigle, M. V. Doran, J. H. Pardue, "Group Zig Zag: An Extension of McCaulley's Model", Journal of Psychological Types (forthcoming)..

[Denton 1996] L. Denton, K. Cannon, J. Toomey and A. Lee, "Use of Participatory Development as a transition to Higher Bloom Levels", 34th Annual ACM Southeast Conference, Tuskegee, AL, April 1996, pp198-210.

[Doran 1993] M. V. Doran, J. H. Pardue and H. E. Longenecker, "Strategies for Success in CS1 and CS2: Implications of Polya in Implementing Software Engineering Principles", The Association of Management 11th Annual Conference - Information and Technology Management Group, August 5-9, 1993, Atlanta GA, invited paper.

[Doran 1994] M. V. Doran, J. H. Pardue and H. E. Longenecker, "A Systems Approach to a Data Structures Course for Information Systems Students Consistent With DPMA IS'90, ISECON'94, October 28-30, 1994, Louisville, KY.

[Doran 1995] M. V. Doran, D. D. Langan, "A Cognitive-Based Approach to Introductory Computer Science Courses: Lessons Learned", SIGCSE'95 Technical Symposium, March 1995, Nashville, TN.

[Doran 1996] M. V. Doran, "A Framework to Consider CIS Projects By Non-Majors Entering CIS Graduate Programs", Association for Information Systems, 2nd Americas Conference on Information Systems, August 16-18, 1996, Phoenix, AZ.

[Doran 1997] M. V. Doran and D. D. Langan,"Student Perspective on Learning Based on A Cognitive-Based Approach", International Association for Computer Information Systems 1997, October 2-4, 1997, St. Louis, MO.

[Friedman 1997] F. Friedman and E. Koffman, Problem Solving, Abstraction, and Design Using C++ (2nd ed), Addison Wesley, 1997.

[IS 1997] Information Systems: The DPMA Model Curriculum for a Four Year Undergraduate Degree, IS'97, Park Ridge IL.

[Landry 1997] J. P Landry, J. H. Pardue, M. V. Doran and R. J. Daigle, "The Influence of Group Labs on Student Adoption of

Software Methodologies: An Empirical Test", 3rd Americas Conference on Information Systems, August 15-17, 1997, Indianapolis, IN.

[Langan 1996] D. D. Langan, M. V. Doran, D. L. Feinstein and H. E. Longenecker, "A Cognitive-Based Approach to the Implementation of the Introductory Computer Science Programming Sequence", American Society for Engineering Education, Summer Symposium, June 1996, Washington D.C.

[Pardue 1991] J. H. Pardue, M. V. Doran, H. E. Longenecker, "A Methodology for Group Learning in the Computer Science Environment", 29th Annual ACM Southeast Regional Conference, Auburn, AL, April 1991, pp 341-343.

[Pardue 1994] J. H. Pardue, M. V. Doran and H. E. Longenecker,"Student Perception of Benefits of a Structured CS1 and CS2 Lab Environment", The Journal of Computer and Information Systems, Volume XXXIV, number 4, summer 1994 pp 40-43.

Building a Bachelor of Science with a Major in Computer Information Systems Based on IS '97 and within the Framework of ACBSP Guidelines

Dr. John H. Reynolds, CCP; Richard W. McCullum. and E. Ray Walden, Jr.
Missouri Baptist College, St. Louis, Missouri
reynolds@mobap.edu, mccullum@mobap.edu, walden@mobap.edu

Introduction

Even before its official release, IS '97 had become the framework for building a successful industry-relevant Information Systems program. IS '97 is a model curriculum jointly developed by ACM, AIS, and AITP. Missouri Baptist College is a four-year, liberal arts college affiliated with the Missouri Baptist Convention and accredited by North Central Association. The Business Division is a member of the Association of Collegiate Business Schools and Programs (ACBSP) and plans to seek ACBSP accreditation by the year 2000. The challenge of the CIS faculty at Missouri Baptist College is to integrate the model curriculum, accreditation requirements, and institutional distinctives into a credible CIS major while keeping the total hours at or below 128.

There were two computer-related majors at MBC: Computer Science and Computer Information Systems. After analyzing the strengths and weaknesses of the current faculty, the available facilities, and the strong St. Louis job market for CIS professionals, the Computer Science major was dropped in favor of a stronger CIS program with two specialty areas: Information Technology and Systems Development.

The CIS Major at MBC

ACBSP requires a Common Professional Component (CPC) to be included in the content of courses taught in all accredited schools and programs, though separate courses for each of the fifteen subject areas are not required. In the process of revising the Business Division curriculum at MBC, the faculty reviewed the implementation of the CPC at other accredited institutions. This review resulted in course additions, changes, and deletions in the prior curriculum. One goal of the revisions was to adequately cover the subjects required in the CPC while allowing room in the degree programs for students to take additional coursework in their specific major. Several of the fifteen subject areas in the CPC were addressed by individual existing courses. MBC faculty elected to develop two business survey courses to address CPC subjects not addressed by other existing or new courses. The two survey courses were a key aspect of balancing the total number of credit hours in the required core while addressing the subject areas required in the CPC.

The Business Division of MBC developed a Business Core that will be required of all majors in the Business Division, including Computer Information Systems. The CPC includes fifteen subject areas summarized in six general areas. The relationship between the MBC Business Division Core and the CPC is shown in Table 1.

	BUSINESS FUNCTIONS/ OPERATIONS			ECONOMIC/ SOCIAL/ LEGAL ENV.			QUANT. METHODS/ INFO. SYS.			ORG. THEORY/ INTERPERSONAL BEHAVIOR			ADMIN. PROC. & POLICY		
Course ID and Name	PROD. & OPS. MGMT.	MARKETING	BUSINESS FINANCE	LEGAL ENV. OF BUS.	ECONOMICS	BUSINESS ETHICS	ACCOUNTING	MGMT. INFO. SYS.	QUANT. TECH. / STATS	MANAGEMENT	ORG. BEHAVIOR	HR MANAGEMENT	BUSINESS POLICIES	COMPREHENSIVE / INTEG.	GLOBAL DIMENSION OF BUSINESS
ACCT213 - Principles of Accounting I						X	X								X
ACCT223 - Principles of Accounting II						X	X								X
BCIS303 - Info. Systems Theory and Practice						X		X							X
BUSN303 - Survey of Business Environment: Ethical, Legal and Financial			X	X		X								X	X
BUSN313 - Survey of Marketing and Production Techniques	X	X				X								X	X
BUSN481 - Interviewing Techniques						X									X
ECON133 - Economics I - Microeconomics					X	X									X
ECON143 - Economics II - Macroeconomics					X	X									X
ENGL433 - Business Writing						X									X
MGMT303 - Management Concepts and Practices						X				X	X	X	X		X
MGMT343 - Management Science						X			X						X

Table 1 – Matrix of Business Core with ACBSP Common Professional Component

The mission of the MBC CIS curriculum is to equip students to enter the job market as an entry-level specialist in systems development or information technology and build a life-long career in this discipline. Additionally, the curriculum seeks to ensure that CIS graduates from MBC are equipped to enter graduate school and complete an advanced degree in a business or information systems discipline. After meeting General Education, BS Degree, and Business Core requirements, majors will be required to complete a CIS Core and nine additional hours of upper-division CIS courses as shown in Figure 1.

As part of the revision of the CIS curriculum, BCIS102 Fundamentals of Personal Computer Applications and BCIS112 Fundamentals of Information Technology were instituted to replace CIS103 Fundamental Concepts of Information and Computer Technology as the Computer Literacy requirement for all MBC baccalaureate degrees. By splitting one three-hour course into two two-hour courses, the courses could cover the IS'97.P0 and IS'97.1 course areas in separate courses while only adding 1 semester hour to all degree requirements. It is expected that a significant number of incoming freshman and new non-traditional students will have adequate knowledge or experience to test out of BCIS102.

The new Business Core contains the course BCIS303 Information System Theory and Practice which provides all Business majors with a foundation in the IS'97.3 course area. The mathematics requirement for the CIS degree kept MAT243 Probability and Statistics and added a new course MAT163 Business Calculus. These courses satisfy six of the nine hours required in Natural Sciences and Mathematics for the Bachelor Science degree.

The CIS Core for majors consists of one course each for the IS'97.2, IS'97.4, IS'97.6, IS'97.7, IS'97.8, IS'97.9 and IS'97.10 courses described in IS '97. The course IS'97.5 – Programming, Data, File, and Object Structures is divided into two courses: BCIS 213 which focuses on a procedural language and abstract data structures; and, BCIS 223 which focuses on an object-oriented/event-driven languages and graphics user interfaces. The nine additional hours of CIS courses may be selected from six additional courses that emphasize respective areas of the CIS Core as shown by dashed boxes in Figure 1. BCIS 233/333 is a unique course that allows the students to gain upper division credit by completing additional writing assignments and a research paper. A minor in CIS consists of the six MBC CIS core courses that correspond to the IS'97.2, IS'97.3, IS'97.4, IS'97.5, and the IS'97.6 course areas plus six additional hours of upper division CIS courses.

During the curriculum design, the faculty decided to accept the recommended courses as described in IS '97 with minor changes. MBC Catalog descriptions were adapted from the IS '97 descriptions. Special care was taken to keep the course descriptions free of any reference to specific hardware or software. Degree Plan worksheets for a CIS major, a CIS minor, and the Business Core were generated and provided to each advisor to aid in advising students.

The CIS faculty at MBC has initiated an ongoing evaluation of the CIS curriculum and plan to form an industry-based advisory-board whose members will include St. Louis area employers and recruiters. The purpose of this board will be to evaluate the relevancy of the program to the CIS job market.

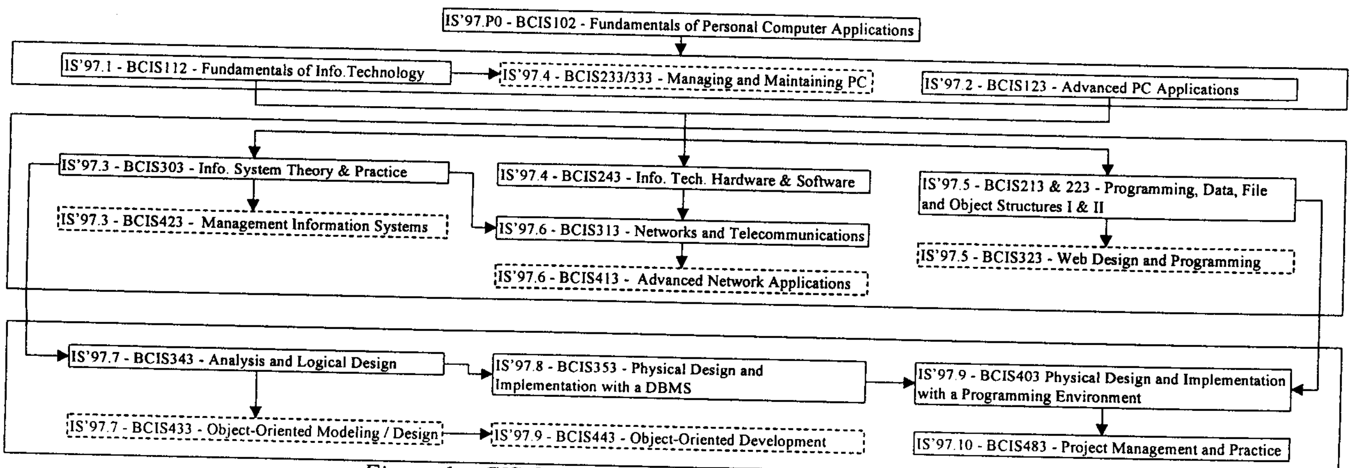


Figure 1 – CIS Course Sequence and Mapping with IS '97

References

Davis, Gordon, B., John T. Gorgone, J. Daniel Couger, David L. Feinstein, and Herbert E. Longenecker, Jr. IS '97: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. AITP (Chicago, 1997).

Integrating Real World Case Projects with Traditional Textbook Case Instruction in Systems Analysis and Design

Steven Walczak
University of South Alabama
School of Computer and Information Sciences, FCW 20
Mobile, AL 36688-0002
walczak@cis.usouthal.edu

Abstract

Students learn best when they participate in the learning activity. Furthermore, transfer of knowledge is improved when the learning situation more closely resembles the utilization situation. Use of traditional textbook Cases provide some, but not all of the experience required by students to optimize their learning potential. The use of a real-world Case study project along with textbook Cases increases a student's experiential learning activities. Implementation of this paradigm is discussed.

Introduction

Information systems (IS) concepts are abstract (Hosseini 1993) and depend on tools and experiences that are difficult to incorporate in a classroom setting. Universities have a responsibility to make sure that students are grounded in business domain knowledge (Waguespack 1997) and can satisfy the knowledge and skill requirements of future employers. Unfortunately, research studies have found that what is being taught in the classroom frequently does not transfer to on-the-job settings (Sternberg and Wagner 1989, Malhotra 1998).

How then can universities prepare IS students to enter the workforce and be a productive asset for their employer? Daniel and Daniel (1997) have demonstrated via a regression model that curricula in general should move from a lecture based method to a more active style of learning. As shown in Figure 1, Bellamy (1994) implies that active participation in the learning process enables students to retain more knowledge. Active participation in a learning setting not only helps retention, but also enables the student to incorporate knowledge into a functional process model. The incorporation of knowledge into a process model enables the transfer of academic experience to on-the-job capabilities.

The Bloom taxonomy of learning (Bloom 1956) is highly correlated with Bellamy's retention triangle displayed in Figure 1. Levels 1 and 2, knowledge and comprehension, are achieved through reading, lecture, and watching based methods. Level 3, application, is typically achieved at the participation level of Bellamy. Levels 4 and 5, analysis and synthesis, normally requiring performing a project or doing the real thing.

A means used in IS curricula and specifically in systems analysis and design (A&D) to incorporate experiential learning, and consequently to address Bloom levels 3 through 5, is the use of Case studies. Traditionally, Case studies are derived from formal collections (e.g., Harvard Business Cases) and are selected to address specific A&D issues currently being taught in the curriculum. Real-world experience is normally gained by students through internships or other part-time or full-time employment that is not specifically aimed at integrating process knowledge from the curriculum.

At our university, IS students take two full years of programming, data structures, operating systems, and similar technical skill courses during their freshman and sophomore years along with computer science students. The introductory sequence operates at Bloom's levels 1 and 2, while the sophomore courses extend level 2 and provide the students with opportunity for level 3 understanding (Doran and Langan 1995). Additionally, IS students must complete introductory and intermediate accounting, business calculus, and statistics prior to enrolling in the two course sequence for Systems Analysis and Design. Students are also encouraged to take the required database and other business management courses during the A&D sequence. Finally, the IS students at our university participate in a capstone project course during their senior year in which they must interact with a real-world client and solve a business problem (Longenecker et al. 1995). The capstone project is used to achieve a Bloom level 5 of understanding. While the senior project appears to be an ideal method for integrating a student's academic knowledge and for gaining some practical on-the-job experiential learning, students will benefit by being exposed to Bloom levels 4 and 5 multiple times throughout their academic experience. In this article, we propose thatreal-world interactions with clients should be incorporated into as many courses as possible during a student's academic lifetime, to enable level 5 learning and understanding of the subject matter. Furthermore, amixture of pre-prepared (textbook) Cases used in combination with a real-world Case provides the maximum amount of participatory learning and leads to deeper and more process oriented learning by the student, by covering the same material at multiple levels of the Bloom taxonomy.

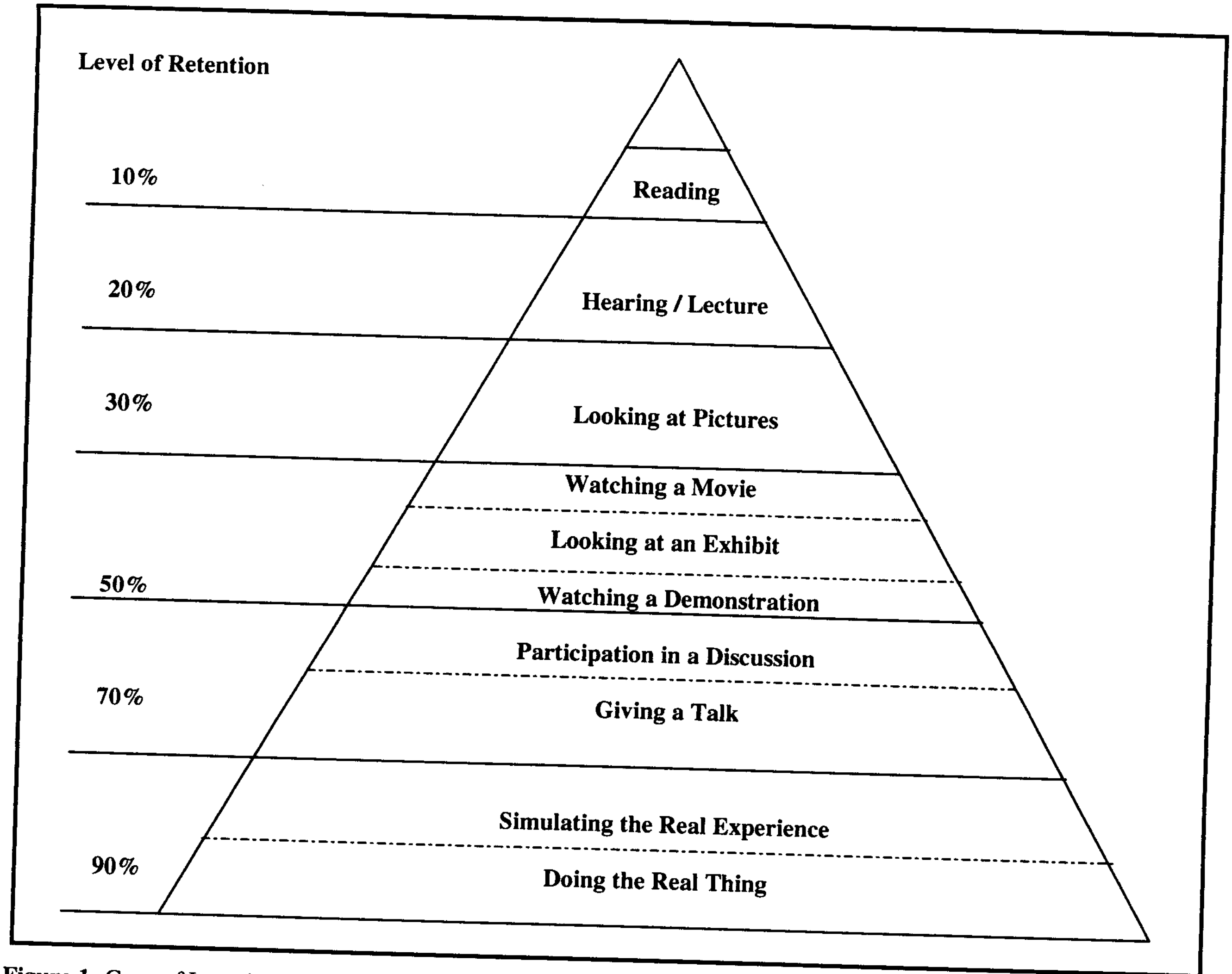


Figure 1: Cone of Learning: Effectiveness of Learning Modes

The Case for Real-World Case Experiences

As indicated in Figure 1, participatory learning provides the greatest level of retention by students and performing a real-world project provides the greatest level of learning by requiring students to integrate the "new" academic knowledge with real-world models (Hosseini 1993). Bloom's analysis level (level 4) of cognitive learning may be achieved through the use of Case-based problem solving exercises. Synthesis (level 5) can be achieved through the use of course long projects, where only minimal levels of pre-solution are offered. Finally, interaction with a real world client who has changing system requirements provides an opportunity for students to evaluate alternative solution syntheses and achieve a Bloom level 6 of understanding. In support of the Bellamy and Bloom approaches to learning, other psychology research (Regoczei & Hirst 1992) and information systems education research (Thomson 1994) has also shown that experiential learning is superior to traditional lecture style learning.

The information systems literature distinguishes between the learning and subsequent application of knowledge from pre-defined textbook Cases and from real-world Cases (Mathieu 1993). Pre-defined textbook Cases usually come with a complete functional specification and eliminate the need for in-depth interaction with a client, thus limiting the level of learning to at most level 4, analysis. Furthermore, many aspects of real-world systems A&D, such as changing system's requirements, cannot be imparted to the students through the use of textbook Case studies. Because of the missing contextual elements in textbook Cases and the fact that textbook Cases are solved in classrooms or in other non-work environments, transfer of knowledge (skill) to the workplace may be inhibited. Murnane and Phelps (1994) have shown that performance is significantly impacted by context and better performance is achieved when the learning environment is similar to the application environment. This means that when Case scenarios are used for instructing concepts, the more realistic the Case scenario is, then the better the transfer will be for students into their job environment.

In addition to providing better learning and associated transfer, real-world Cases also have other employment related benefits that cannot be obtained through the use of textbook Cases. Employers have indicated that real-world experience is a prerequisite to potential employment for today's IS graduate (Wagner 1995, Wong 1995). Studies have shown that employers regularly hire their own interns (Wagner & Duncan 1996). While the real-world Case study is different than internships with respect to the level of involvement and time commitment of the students to a particular organization, the interaction with key corporate personnel and the demonstration of high demand IS skills (Lee et al. 1995) implies that real-world Case experience for students is at least as valuable as internship experience to employers. Furthermore, the real-world case studies enable students to learn and demonstrate employer desired qualities of teamwork (Malhotra 1998, Mathieu 1993), interpersonal skills (Lee et al. 1995, Tye et al. 1996), and communication skills (Thomson 1994, Wagner & Duncan 1996). Each of these learned qualities gives students who have experienced a real-world Case study a distinct advantage with regard to employment over other students.

Integrating Multiple Cases Into the Curriculum

Recently, the Systems A&D courses have been changed at our university to focus on object-oriented A&D. This change in curriculum provided the author with the opportunity to re-introduce real-world Case studies along with the other curriculum changes. Real-world Case studies had been used previously, but where dropped by the instructor because of the significant time commitment necessary to acquire clients. The goal of introducing a real-world project is to increase the level of experiential learning, not to replace it, and also to make the experiential learning simulate as closely as possible real-world problems and information systems environments. Textbook cases can also provide teamwork experience and some limited communication skills learning. For these reasons and to maximize the experiential learning for our students, a multiple Case approach has been adopted.

The methodology described in this section requires four Case projects. First, is a real-world Case with a real-world client. Then, three traditional textbook Cases. The general method is listed below and discussed in the following paragraphs.

- Find candidate real-world clients (Cases).
- Select the real-world Case(s) to be used in the next teaching of the A&D class.
- Segment textbook Case 1 and use at the beginning of each topic to stimulate discussion, Bloom levels 2 and 3.
- Include classes on interview techniques and interpersonal skills early in the course, to facilitate student interactions with the real-world client.
- Partition the real-world Case into multiple deliverables, so that student understanding may be monitored, Bloom level 4.
- Use textbook Case 2 to simulate the deliverables from the real-world Case, but in a controlled classroom setting, Bloom levels 3 and 4.
- Have students present their real-world A&D project solutions to the class, client, and interested faculty, Bloom levels 4 and 5.

Prior to the start of a course offering, the faculty member must identify willing business collaborators from the local business community. This does take a significant amount of time and serves as the primary interference for adopting real-world Cases. Businesses must first be canvassed and then follow-up visits must be made to those businesses that pose viable problems for the time duration of the class to identify the specific problem that the students will analyze. Additionally, periodic contact with the industry client to monitor student progress and reassure the client concerning university requirements for the project are needed. Typically, a large business problem will need to be divided into multiple projects or simply scaled down to fit the timeline of the class.

Mathieu (1993) has indicated that the local AITP chapter may serve as a source for potential student projects. A reduction in the number of preparation hours required may be achieved by concentrating initial client contacts to either small area businesses (under 50 employees) or personal business contacts of faculty members and the department. Small businesses help to reduce the preparation hours, because the chain-of-command is typically less formal and decisions concerning the availability of projects and willingness to participate in academic projects can be made quickly. Examples of small businesses include: pre-schools and day care centers, doctor and dentist offices, non-chain restaurants, real estate offices, lawn care providers, and others.

A final class project (or projects for larger classes) must be selected from available candidate projects. As indicated earlier, the primary concern for real-world projects is the time duration required of the students to develop a professional analysis or design proposal and to develop understanding at Bloom's level 5. Larger projects may be divided into subsets of smaller projects, or alternatively a pre-class meeting with the client may determine that some of the initial requirements may be dropped without adversely affecting the project goals. Next, projects must be analyzed to ensure that the project requires the reasonable exercise of most of the course objectives. If both the time and coverage aspects of the desired project are still satisfied by multiple projects, then final selection of the project should attempt to select the project that will best stimulate student interest in the business domain of the project.

Students are divided into project teams the first night of class. While some authors advocate that students should be allowed to choose their own teams, this is often an unrealistic expectation in the "real-world", so students are assigned to teams as they would be in a business setting (Malhotra 1998). All interactions with the business client are required to be scheduled via telephone, so as not to unduly disrupt the client's normal business flow. This scheduling regimen also enables the faculty member to attend client-student group meetings, for observation or to assist the students with any domain problem difficulties.

After the first class meeting, students are required to develop a timeline of the projected client meetings and the topic of each meeting. Students are also required to keep a journal of all client interactions. The journal assists the faculty member in determining if the students are staying on track and addressing the necessary elements for producing the final analysis and design documentation.

Additional textbook Cases are used to supplement the real-world, course long projects, with additional experiential learning and to provide for understanding of the new course material at Bloom levels 1 through 4 while level 4 and 5 understanding progresses with the real-world project. Most current object-oriented analysis and/or design textbooks include multiple Cases (Booch 1994, Brown 1997, Yourdan & Argila 1996) and may be used directly (with little or no additional effort) to satisfy the textbook Case objectives discussed in this article. The textbook Cases are used to instruct the students directly in the object-oriented A&D methodologies and modeling paradigms. The first Case is used interactively at the beginning of each class session to introduce the current analysis or design concept. Students will have read over a portion of the textbook Case (Bloom level 1) and will interact in groups in a brainstorming session to answer thought provoking questions related to the current topic (level 3) or to relate personal business experience (also level 3) related to the current topic. These focused discussion groups enable students to discover principles of systems A&D, for depth of understanding. Subsequent lecture material (level 2), reinforces the discussion concepts and adds new information to address breadth of knowledge requirements for the A&D discipline.

The first couple of sessions, the students will interact with their project group members to help develop a functioning team, but then the remaining discussion groups are mixed to help students learn better teamwork skills. After each team has had the opportunity to answer the topical question, then they shares responses and experiences with the entire class in a class-wide brainstorming session. Several textbooks (see Brown 1997 and Yourdan & Argila 1996) already subdivide one or more of their included Cases topically.

The topics of team building and interpersonal and communication skills should be addressed early in the curriculum. If possible, these topics are tied to the first textbook Case otherwise, to improve upon the experiential learning for the students, role playing scenarios can be acted out with the students and the faculty member. The role playing enables the students to participate either first or second hand in different interviewing and joint application development (JAD) techniques, and provides for understanding at Bloom levels 2 and 3.

The final project necessitates that student understand A&D at Bloom's synthesis level, level 5. As just discussed, the in class use of a modularized textbook Case presents knowledge required for the synthesis at level 3 and the subsequent class presentation/lecture reinforces understanding at level 2. The presentation of material in these various Case-oriented formats facilitates synthesis of knowledge and future judgement of different syntheses. To further facilitate the transfer of knowledge learned at levels 2 and 3 to levels 4 and 5 of understanding, it is beneficial to partition the real-world Case project into several deliverables (e.g. for a systems analysis class, a requirements model as deliverable 1, object model as deliverable 2, state transition diagrams as deliverable 3, and final project report and presentation as deliverable 4). The real-world project partitions are formulated to coincide with presentation of the desired learning objectives from the classroom discussions and presentations (i.e., the requirements model deliverable is due shortly after requirements analysis has been discussed in the classroom setting). The utilization of subgoals in the project serves to reinforce the extant learning by providing the students with an evaluation mechanism for determining their understanding (via application, analysis, and synthesis of knowledge) of covered material.

The second textbook Case is used to give the students a chance to exercise their newly acquired knowledge at Bloom levels 3 and 4, before they have to apply their skills to the business client's project. The second Case is normally given to the students in its entirety, with the students being asked to develop in class analysis or design model components. Since this is a pre-defined textbook Case, solutions to the "Requirements Model" and "Object Analysis Model", etc. phases of the project are provided to the students after they have had an opportunity to work on the specified component, so that the students can see a professional finished product. This approach also facilitates the development of a judgement model for transition to Bloom's level 6 of understanding. The use of the second Case as a model Case provides the students with an analogous example for the requirements of their own real world Case. Finally, a third Case may be used for developing test scenarios and questions. Examination questions based on a small textbook Case require the students to perform at various levels of the Bloom taxonomy, from level 2 to 5 (although time constraints may limit this to level 4), and serves to reinforce learning by providing yet another experiential example.

Some Real-World Cases

The real-world Cases are changed with each new offering of the Object-Oriented Systems A&D course sequence to minimize the time requirements necessary from the business client however, concurrent sections may utilize the same Case. In this section, the real-world Cases for the first year (two offerings) of the Object-Oriented Systems A&D course are described.

A local area preschool indicated interest in serving as a client for the A&D course. This preschool has three different locations, each with a different number of classrooms and different capabilities, such as a lunch program that is centered at one of the locations. The client was interested in a combined centralized accounting system and a student tracking system. As recommended by Mathieu (1993), because of the large class size of the first offering, the client's project was divided into two different sub-projects with multiple teams each working on one sub-project. The first sub-project was a centralized accounting system to produce standard GAAP reports and permit the owner to perform ad hoc queries and analysis of relevant accounting information. For the accounting systems, students were required to incorporate cross-disciplinary knowledge. Integrated curriculum is viewed as a positive academic quality by most researchers (Cognition and Technology Group at Vanderbilt 1993, Waguespack 1997). The second sub-project was a student recruitment and tracking system. The student recruitment system required interaction with the Internet and focused on a different set of users than the accounting system.

The second A&D offering real-world Case project utilized a dentist's office as the client. The participating dentist desired for the class to analyze and design an interoffice communication system that would allow message passing between various members of the staff as well as provide for automating the billing and insurance process. This particular Case provided some unusual business culture requirements for the design phase of the project, such as the requirement for sterility. Due to a smaller class size on the second offering, only a single project was required.

The one detriment of using real-world Case projects is the time commitment necessary from the participating faculty and clients. While these Cases did require the author to spend additional time to identify and configure the projects, the benefit to the students is immeasurable. As discussed earlier, small businesses and personal business contacts of the faculty member instructing the class can significantly reduce the necessary time commitment. As the quantity of real-world Cases completed grows and business partners perceive a benefit from the academia-industry course project collaboration, then we anticipate additional business partners will become eager to volunteer their systems development projects.

Conclusions

Real-world Cases will require students to perform at Bloom's level 5, synthesis, whereas traditional textbook Cases may only achieve a level 3 or 4 of understanding due to presentation format. The multiple Case methodology serves as a bridge between lower division courses where Bloom levels 1 and 2 are the typical level of understanding required and upper division courses that require Bloom levels 4 or 5 of understanding.

The use of real-world Cases as class projects provides distinct benefits to students, enabling them to acquire experience that is difficult or impossible to get in a traditional academic setting. Interacting with a real-world client exercises interpersonal and communication skills that are being demanded by employers (Lee et al. 1995, Tye et al. 1996, Wagner & Duncan 1996), as well as providing some real-world experience. The business clients that provided the Case projects for the Object-Oriented Systems A&D classes indicated that they thought very highly of the student's work and would be willing to hire these students to perform future information systems consulting.

The students in the course were asked to respond to an informal student feedback form. Over 94% of the students felt that the use of a real-world Case and the interaction with a real-world client provided a desired learning experiences and indicated their desire to keep real-world Cases as a functional part of the A&D courses. Additional student comments highlighted the benefits mentioned earlier, including the improvement of interpersonal and communication skills as well as the opportunity to work on an unstructured problem.

In addition to the benefits of a real-world Case project, additional textbook Cases are used in combination with the real-world Case to increase the quantity of experiential learning. Additional textbook Cases aid the student by providing an experiential medium for discussing current course topics and also as a model of the desired outcomes from the systems analysis process and the systems design process. Since each Case incrementally increases the knowledge requirements of the student, students practice the skills and knowledge of the course at multiple Bloom levels:

- Reading the textbook Cases ⇒ Bellamy retention level 10%, Bloom level 1,

- In class group discussion ⇒ Bellamy 70% level, Bloom level 3,
- In class lecture/presentation on topic ⇒ Bellamy 20% level, Bloom level 2,
- Textbook Case exercises ⇒ Bellamy 90% level, Bloom levels 3 and 4,
- Real-world Case project ⇒ Bellamy 90+% level, Bloom levels 4 and 5.

The multiple Case methodology enables students to have real-world or simulated real-world experiences on three different projects simultaneously and provides a framework for evaluating different A&D syntheses (promoting a Bloom level 6 understanding).

The use of a combined real-world and textbook Case approach imparts significant benefit to the students. A multi-Case approach enables the delivery of the complex and abstract concepts of systems A&D at multiple levels of the Bloom taxonomy, including level 5 (synthesis) afforded through the use of a real-world project, and under different levels of classroom control. Experiential learning in general, and real-world experiential learning specifically, increases the learning potential for students.

Acknowledgements

Special thanks to Roy Daigle and Michael Doran for their insightful comments on initial drafts of this article.

References

Bellamy, L. (1994) Active Learning in the Engineering Classroom. Foundation Coalition Workshops.

Bloom, B.S. (1956) *Taxonomy of Educational Objectives*, New York: David McKay.

Booch, G. (1994) *Object-Oriented Analysis and Design with Applications, Second Edition*, Reading, MA: Addison-Wesley.

Brown, D. (1997) *An Introduction to Object-Oriented Analysis*, New York: Wiley.

Cognition and Technology Group at Vanderbilt. (1993) Toward Integrated Curricula: Possibilities From Anchored Instruction. In Rabinowitz, M. (Ed.), *Cognitive Science Foundations of Instruction*, Hillsdale, NJ: Lawrence Erlbaum Associates, 33-55.

Daniel, J.H. and Daniel, B.F. (1997) Using Learning Styles to Promote Active Learning in a Computer Literacy Course. *Proceedings ISECON '97 Information Systems Education Conference*, Park Ridge, IL: AITP, 8-12.

Doran, M.V. and Langan, D.D. (1995) A Cognitive-Based Approach to Introductory Computer Science Courses: Lessons Learned. *SIGCSE Bulletin*, 27(1), 218-222.

Hosseini, J. (1993) Application of Bloom's Taxonomy and Piaget Model of Cognitive Processes to Teaching of Management Information Systems Concepts. *Journal of Information Systems Education*, 5(3).

Lee, D., Trauth, E.M., and Farwell, D. (1995) Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation. *MIS Quarterly*, 19(3):313-340.

Longenecker, H.E., Daigle, R.J., and Feinstein, D.L. (1995) Successful Application of Priniciple Centered Leadership in the Information Systems Project Course. *ISECON '95 Proceedings*, Park Ridge, IL: DPMA, 194-200.

Malhotra, M.K. (1998) Industry-Academia Partnerships in Germany. *Decision Line*, 29(1):4-7.

Mathieu, R.G. (1993) Bridging the Gap Between the University and the Local DPMA Chapter: The Case for Cooperative University/Industry Student Projects. *Journal of Information Systems Education*, 5(1).

Murnane, K. and Phelps, M. (1994) When does a different environment context make a difference in recognition? A global activation model. *Memory and Cognition*, 22:584-590.

Regoczei, S. and Hirst, G. (1992) Knowledge and Knowledge Acquisition in the Computational Context. In R. Hoffman (ed.) *The Psychology of Expertise, Cognitive Research and Empirical AI*, New York: Springer Verlag, 12-25.

Sternberg, R.J. and Wagner, R.K. (1989) Individual Differences in Practical Knowledge and Its Acquisition. In Ackerman, P, Sternberg, R.J., & Glaser, R. (Eds.), *Learning and Individual Differences*, New York: Freeman, 255-278.

Thomson, N.S. (1994) Using TQM Principles to Teach Current Topics in Information Systems. *Journal of Information Systems Education*, 6(2):65-69.

Tye, E., Burn, J.M., Ma, L., and Poon, R. (1996) Re-Engineering the IS Curriculum for the IS Professional of the Future. *Journal of Information Systems Education*, 7(4):154-160.

Wagner, G.E. (1995) Internships: A Bridge Between Theory and Practice. *ISECON '95 Proceedings*, Park Ridge, IL: DPMA, 41-48.

Wagner, G.E. and Duncan, D.G. (1996) Cooperative Education: A Different Perspective. *Proceedings ISECON '96 Information Systems Education Conference*, Park Ridge, IL: DPMA, 88-92.

Waguespack, L. (1997) Threaded Live Case Study, Weaving Practice Through IS '97. *Proceedings ISECON '97 Information Systems Education Conference*, Park Ridge, IL: AITP, 151-156.

Wong, J.W. (1995) 'Real Life' Case Study Projects to Facilitate Student Learning in Business Information Systems: A Course Management Approach. *ISECON '95 Proceedings*, Park Ridge, IL: DPMA, 41-48.

Yourdan, E. and Argila, C. (1996) *Case Studies in Object-Oriented Analysis and Design*, Upper Saddle River, NJ: Yourdan Press.

Developing an Electronic Commerce Focus within the IS Curriculum

William T. Schiano
Irv Englander
Bentley College
Department of Computer Information Systems
Waltham, MA 02154-4705

Abstract

Electronic commerce is one of the hottest topics in information systems and many business school IS departments are scrambling to react. This paper outlines the experiences to date at Bentley College in planning and developing a cluster program that focuses on electronic commerce as a rapidly developing aspect of business. E-commerce courses must serve the needs of both majors and students of other business specialties. Presently, we are teaching electronic commerce as a graduate course and aspects of web design and development as a pair of undergraduate half-credit courses. Additional courses are in development or under consideration.

Introduction

Electronic Commerce is arguably the fastest growing aspect of Information Systems. As such, it has attracted widespread attention in the business community, resulting in a rapid demand for students with capability and understanding of the area. Academic IS departments are pressed to meet this demand, but there are a number of difficulties:

(1) The field is so new, and is developing so rapidly, that there is a dearth of information, and what little information there is changes almost overnight.

(2) Electronic Commerce addresses IS issues that are different from other IS problems in important ways: the focus is different from traditional IS, and there are many new issues to deal with—marketing considerations, interface and presentation to external users, security, both real and perceived, even transaction processing methodology takes on new twists.

(3) There is interest in electronic commerce outside the traditional IS community. Marketing specialists are concerned with E-commerce as a new and different channel with global implications (Quelch and Klein 1996). Operations managers are concerned with the impact on production and fulfillment (Benjamin and Wigand 1995). General managers need to understand E-commerce in order to make intelligent decisions and to build reasonable strategies in the new marketspace (Rayport and Sviokla 1994; Rayport and Sviokla 1995).

From an academic IS department's perspective, Electronic Commerce becomes an important topic to a number of different constituencies. E-Commerce system development and design remains the bailiwick of the IS community, but other topic areas will be of interest to other business disciplines as well. Therefore, IS courses in E-commerce must be designed to meet the needs of majors from other business disciplines, as well as those of the IS majors.

At Bentley College, the IS department is attempting to meet this challenge by creating a cluster of courses at the graduate and undergraduate levels that will explore various aspects of electronic commerce. Clusters of courses were selected as the most appropriate way to offer relevant and timely material to non-majors in an easily identified and convenient package of courses. A cluster can be chosen as a group of courses within a major or minor, or simply taken as electives within another program. They are not "programs" in that there is no official recognition by the institution such as major, minor or concentration. We have, however, found it a useful device in advising and in developing and marketing our courses.

The goal of this cluster will be to provide a substantial understanding of Electronic Commerce to those non-major students who take the cluster, and to complement the technology-focused education of IS majors. Some of the new courses will be open to both IS majors and non-majors, while others will be designed to fill in background in technology for non-majors or as advanced electives for majors.

The initial courses in the cluster are attracting both majors and non-majors, and are filled to overflowing, with waiting lists for each. Initial student evaluations of the courses have been among the highest in the department.

Initial Cluster Offerings and Development

At present, three courses within the cluster have been developed and are being offered successfully. One course is a graduate elective in electronic commerce open to MSCIS and MBA students as an elective. The other two courses are undergraduate half-semester courses: one in web development and one in computer graphics, focusing on graphics for the web. A fourth course, under development, will provide a strong background in IT infrastructure, particularly to non-majors who have not been exposed to the intense courses in architecture and data communications that are normally taken by IS majors. Other courses are under consideration, some of which may be offered by other business departments, under the guidance of CIS faculty.

The e-commerce cluster will offer non-IS students an opportunity to take a coherent set of related courses on a topic of enormous interest without needing to take far less relevant IS courses intended for majors. It also offers IS majors an opportunity to focus their electives and prepare for a career in the IS side of electronic commerce. It is not our intention to create an e-commerce "program" but rather a set of courses that can be used within other programs. Some of the material in the cluster will be moved each year into "core" courses taken by all students in the school, but the courses in the cluster will adapt by adding more current and advanced material as that happens.

At Bentley, there will be myriad different programs focusing on various aspects of the role of electronic commerce. We have already introduced an Accounting Information Systems program, and expect a number of others including marketing and finance in the near future. Other majors and programs such as finance, management and marketing are drawing on the cluster courses to design electives for their majors that will complement the electronic commerce focus with those disciplines. For the CIS department, this entails considering differentiating the role and constitution of major and non-major courses. For more on these issues, see (Englander and Schiano, 1998).

A Course in Electronic Commerce

The graduate-level electronic commerce course was one of the first courses developed and offered in the graduate school to address issues of electronic commerce for either IS masters students or MBAs. The decision was made to develop it as a graduate elective with only an introductory IS course as a prerequisite. We felt that graduate students would be more tolerant beta testers of the material and that the business experience in the group would make it easier to test material about the business issues involved.

The students for the first iteration of the course were half MBA and half IS Masters students. This mix created opportunities and challenges but, on balance, greatly strengthened the course and is now an explicit design goal. The interaction between technically and managerially focused students serves as a microcosm of the real business situations faced by firms developing electronic commerce. Simply forcing students to be understood by other students, some from different programs, is a powerful lesson. Frustration on each side about lack of depth of coverage of interest to them is addressed with optional detailed readings. The course is taught in discussion method, placing a heavy burden on students for class preparation.

The vision for the course is that managers must have some understanding of the technology in order to appreciate and plan for its potential impact. However, it is also emphasized that the technology is not the barrier to the progress of electronic commerce. Appendix A contains the topics covered in the course by week. Given the lack of coverage of e-commerce issues in the current graduate curriculum, this is a broad course. Many of the issues revolve around corporate strategy and industry structure. The first three sessions are technologically intensive. This results in some redundancy for students who have taken the graduate data communications and/or computer architecture courses. We expect the planned infrastructure course discussed below to relieve the need to cover the technological material in this course and to open space for more coverage of e-commerce specific issues and case studies. By week 4, "cases" are introduced. In some weeks, these are formal "Harvard" style cases; in other weeks they are discussions of specific businesses based on articles and student exploration of the firms' web sites.

Web Development and Computer Graphics Courses

In its initial iteration in Spring 1997, the course on web development introduced students to the Web and its use, taught HTML and introduced JavaScript. For more detail on this course, see (Robertson and Schiano 1997). The web browsing and searching components have been absorbed earlier in the curriculum, particularly in the required "IS101" course, and JavaScript now accounts for half of the course. We expect much of the HTML portion to be covered in the "IS101" course next year and we will add dynamic HTML and other "advanced" features to the web development course.

The half-semester course in graphics is intended to expose students to a wide range of tools, techniques and issues related to creating, modifying and using graphics on the web. The course explores the development of decorative and data representational graphics designed for use on the World Wide Web. A variety of tools for creating, compositing and manipulating graphical designs and images are surveyed. Specific attention is given to production problems (such as transmission time, color matching, resolution and animation) associated with the presentation, transmission and browser technology of the World Wide Web. The course has just finished its first iteration with overflow enrollment and seemingly high student performance and satisfaction.

Course in IT Infrastructure, with Focus on E-

Commerce

A course in IT infrastructure is in the late stages of development. This course is designed primarily for managers, who must understand and use the technology as part of their strategic planning and decision making. The course assumes that IS designers will build the technology, but that managers must understand the implications and possibilities. The course is significantly broader in coverage than a traditional IS Computer Architecture course, but considerably deeper than an "IS101" course. It will not be open to IS majors, since it is assumed that they will have acquired the material in other courses.

The concept of IT Infrastructure is addressed in the broadest possible sense. The topics include the IT components that make up an electronic commerce system: computer hardware, system software, data formats, basic file and database concepts, networks, and inter- and intra-networking anatomy, techniques, protocols, and standards, as well as topics that address infrastructural issues that are more managerial in nature.

These latter topics include system management, system support, security, and web design issues, such as the relationship between data formats and system performance, the implications of system and application software and programming language selection, the tradeoffs between outsourcing internet and web services and internal , corporate design, and other such uses. Throughout the course, consideration is given to specifications, tradeoffs, and the effects of different choices and options on system performance, system reliability, safety, and other business concerns. An initial design for the course syllabus is shown in Appendix B.

IS students interested in becoming involved in the construction of electronic commerce systems will clearly need a stronger technological grounding beyond the infrastructure course and would involve moving beyond the cluster into an IS program. Additional coursework would include a data communications course (or sequence of courses) with a strong focus on Internet technologies. A security course would be essential, covering firewalls, encryption and other techniques for assuring the safety of electronic commerce. Specific web development skills would also be necessary, including some combination of HTML, Javascript, VBScript, Unix, C++, Perl, etc. Web design, possibly taught out of the business communications department would also be important. These courses would fit comfortably within the existing Bentley undergraduate and graduate programs, and we do not see a need to create new degree programs to deal with e-commerce.

Beyond IS students, electronic commerce concentrators will need to have a sense of the business impact in various areas. This may include coursework in marketing, operations, law, logistics, marketing, strategy and human resource management. The design of the "electronic commerce" course described above will necessarily evolve as the material covering various aspects of the value chain is covered in other courses.

Challenges and Advice

Currently at Bentley College, web development (HTML, etc) is taught in several classes. These courses use different tools but repeat the same topics. Given the demand for these abilities, we expect to incorporate them into the "core" coursework. Adding them to the core does not instantly solve the problem, however, since upper classes of students will have completed the core without seeing that material. For a few years, this creates even more overlap.

Supporting materials for teaching electronic commerce have lagged the explosion of the technology. Few books and articles are appropriate for an IS focus, moving too far to either the technological or managerial focus. The field is changing so rapidly that most printed materials are out of date technologically by the time they hit the shelves. This makes keeping up with the material a substantial burden for faculty. While this trend can be seen in other areas (for instance, programming languages such as Visual Basic and Java, and telecommunications) nearly the entire field of electronic commerce in constant flux. For faculty who are not researching in the area, it is unrealistic to think they can keep up.

To increase student choice and reduce scheduling and administrative complexity, Bentley has placed high pressure on curriculum designers to reduce the number of prerequisites for courses, especially at the graduate level. As one year Masters programs proliferate, this trend will be exacerbated. There is also increasing pressure to give students more choices in course selection. We have managed these trends in our curriculum by allowing "co-requisites" and re-developing our core courses to offer the crucial material as concisely as possible. This trend makes increasing the amount of e-commerce material in the core difficult, and hard choices will have to be made about what to drop from the core.

Setting the depth of technological coverage is a perpetual challenge in electronic commerce. At every level of the OSI model there are technological details relevant to the topic, but the needs are not the same for non-majors who will not enter technological positions. This calibration is essential to the success of the courses, and should be made in context of the cluster and its constituencies, not with respect to the IS major only.

One issue we have not yet resolved yet is the extent to which electronic commerce course work is mutually exclusive with "traditional" coursework. For instance, should Java replace Visual Basic as the primary programming language in the program? Can the telecommunications portions of electronic commerce be covered in the data communications course? Once the material is absorbed into the mainstream courses, managing overlap with the electronic commerce courses becomes a challenge if the courses are to remain open to majors.

The electronic commerce program must be viewed across the entire curriculum and planned for accordingly. All business departments and some non-business departments are incorporating elements of electronic commerce in their courses. If these are not viewed as a whole, students will suffer from duplication, wheels will be reinvented and opportunities for building on other courses will be lost. The platforms described above can help increase communication among faculty across departments and move toward the development of a coherent curriculum.

One clear concern has been the currency of CIS offerings in terms of technological skills recent graduates possess (Morgan and Mehta 1996). The unbundling of technology and theory courses eases the management of the changes. For more on the advantages of "unbundling" technology and theory courses, see (Waguespack, Chand et al. 1996).

Conclusion

Over the next several years, IS departments will need to meet the demand for courses that support the study of electronic commerce in the business curriculum. By planning a coherent and cohesive set of courses, IS departments have an opportunity to lead the business disciplines in establishing new programs. The new courses must be attractive to non-majors, but the department must ensure that needs of majors are met. The department must also plan for regular changes in the courses as the field evolves.

References

Benjamin, Robert and Rolf Wigand (1995). "Electronic Markets and Virtual Value Chains on the Information Superhighway." *Sloan Management Review*(Winter): 62-72.

Englander, Irv ,Schiano, William T. (1998). "Attracting Non-Majors to the IS Department: Challenges and Strategies Proceedings Of ISECON 98.

Morgan, George W. and Mayur Mehta (1996). *IS Professionals Suggest Courses for Undergraduate Majors in Computer Information Systems.* Information Systems Education Conference, St. Louis, Missouri, Data Processing Management Association.

Quelch, John and Lisa R. Klein (1996). "The Internet and International Marketing." *Sloan Management Review*(Spring): 60-75.

Rayport, Jeffrey F. and John J. Sviokla (1994). "Managing in the Marketspace." *Harvard Business Review*(November-December): 141-150.

Rayport, Jeffrey F. and John J. Sviokla (1995). "Exploiting the Virtual Value Chain." *Harvard Business Review*(November-December): 75-85.

Robertson, J. Douglas and William T. Schiano (1997). "I Am Scheduled to Teach "World Wide Web:" Now What?" .

Waguespack, Les, Donald Chand, et al. (1996). *Crafting a Business Bachelor of Science Program in Information Systems Following on IS '95.* Information Systems Education Conference, St. Louis, Missouri, Data Processing Management Association.

Appendix A: Syllabus for Graduate Electronic Commerce

Week	Topic
1	Introduction Kalakota and Winston's <u>Frontiers of Electronic Commerce</u> (AddisonWesley, 1996) (K&W) Chapter 1: Welcome to Electronic Commerce K&W Chapter 2: Network Infrastructure for Electronic Commerce
2	Technological Infrastructure K&W Chapter 3: The Internet as a Network Infrastructure Skim K&W Chapter 19: Broadband Telecommunications
3	WWW K&W Chapter 6: Electronic Commerce and the WWW Skim Chapter 17: The Internet Protocol Suite.
4	Intranets K&W Chapter 11: Intraorganizational Electronic Commerce Case: Federal Express
5	Electronic Data Interchange K&W Chapter 10: EDI Implementation, MIME and Value-Added Networks Case: Dutch Flower Auctions
6	Electronic Payment K&W Chapter 8: Electronic Payment Systems K&W Chapter 9: Interorganizational Commerce and EDI Case: Mondex
7	Electronic Marketing K&W Chapter 13: Advertising and Marketing on the Internet Case: Amazon.Com v. Barnes & Noble **Mid-Semester Evaluation**
8	Electronic Ordering K&W Chapter 7: Consumer-Oriented Electronic Commerce K&W Chapter 14: Consumer Search and Resource Discovery Case: Valuation of Search Engine Companies (Yahoo!, Lycos, Excite) *Choice of site for Evaluating a Web Business due*
9	Facilitating Electronic Commerce K&W Chapter 4: The Business of Internet Commercialization Case: Microsoft v. DOJ; Consolidation of the ISP Industry.
10	Security K&W Chapter 5: Network Security and Firewalls Case: TBA
11	Web Page Development Technology Readings and case TBA
12	Managing Web Projects and People Readings and case TBA **Take-home exam distributed in class (due in class, April 21)**
13	Role of Government K&W Chapter 15: Digital Copyrights (read only pp. 585-594); Clinton Administration Framework for Electronic Commerce Case: Analyze a country by looking at their e-commerce issues/strategies. **Take-home exam due in class**
14	Emerging Technologies/Issues K&W Chapter 16: Software Agents Case: Ernie **Web business evaluation due**
15	Summary/Presentation of Final Projects **Final Projects/Papers Due**

Appendix B: Infrastructure course syllabus

Week	Topic
1-2	System overview Major components, system organization, hardware, software, operating systems, networks, application software, data forms: text, numbers, graphics, video, sound
2-3	Hardware infrastructure CPU, memory, I/O, peripheral components, buses, evaluation and selection issues.
4-5	System software infrastructure Operating systems, virtual storage, scheduling, data storage, comparing Unix and Windows
6-7	Networks Media, topology, data movement (packets, switching, etc.), protocols, TCP/IP, ATM, Ethernet, etc.
7-8	Network/application concepts Databases, transaction processing systems, client/server, remote login, DCOM, virtual private networks.
9	Anatomy of the web Http, e-mail, ftp, html, web servers, browsers.
10	Programming languages Procedural languages, object orientation, nonprocedural languages (SQL), operating systems languages, Perl, CGI, Java
11	System management Administration, support, network management, system organization, construction and setup, maintenance, reliability, configuration, repair, upgrade.
12	System security and protection Secure transactions, encryption, fireswalls, user security, data protection.
13	Current technical issues and developments.

Four Computer Disciplines

Garry White
Computer Information Systems
Southwest Texas State University
San Marcos, Tx 78666

Two Overlapping Disciplines

Texas A & M University - Corpus Christi teaches word processing and Visual Basic programming in the Computer Science (CS) department. Howard Payne University teaches these same courses in the Computer Information Systems (CIS) department.. A survey of 17 other universities in 1994, found 3 teaching Computer applications in CS and 14 teaching it in the business school. The content of this Computer Applications course included word processing, spreadsheets, and DOS. Another course, Data Structures, is taught in CIS at Tarleton State University. At Texas A & M University - Corpus Christi, it is taught in CS. The books used for these two data structure courses are the same.

A question addressed in an article was Systems Analysis: Is it CS or CIS? Another article suggests CS needed a Systems Analysis course while at many universities it is in CIS. Other courses that fall in this situation are computer architecture, computer literacy for general users, and C++ programming.

The Dilemma!

Differences exist between these two disciplines. Yet both have the same courses and contents. How can word processing skills be a math/theoretical science? How does CPU architecture and machine code format relate to user needs? Is Systems Analysis CS or CIS? These questions confuse students as to what each discipline is and what careers they prepare.

Different Professional Careers

Instead of looking to academia to define the differences better, I looked at the different professional careers in the working world. In doing so, four specializations developed.

1) Tool Maker -- those who code compilers, create new languages, create new operating systems, deal with data communications programming, and design distributed systems. They use algorithms that interface with the hardware, i.e., memory management. They are systems analysts/programmers who work for Microsoft, IBM, Novell, or Oracle. Examples of tools created are Norton's Anti-virus software, Windows NT, Netware 4.1, HTML, and Sun's Java language.

2) Product Maker -- those who write application programs using the tools from the Tool Maker. They are business/application oriented and focus on software that provide for user needs. These are application analysts/programmers who work for Sears, K Mart, or any application software vendor. Examples of products are Peachtree Accounting package, Quicken, in-house payroll program, and Web pages.

3) Product/Tool Managers -- those who manage products and tools created from Tool Makers and Product Makers. In corporations these managers provide user support and maintain vendor tools/products and in-house written application programs. Job titles include Network Administrator, Web Master, Database Administrator, User Support Specialist, and User Trainer. Examples of tasks performed by these managers are installing E-mail or a word processor on a network, monitoring a network, and troubleshooting a user's PC. Like Product Makers, they are business/application oriented and focus on software that interface with the user. Also they must have some Tool Maker background when it comes to operating systems and hardware.

4) Product Users -- those who use the products managed by the Product/Tool Managers and created by the Product Makers. They are secretaries, managers, accountants, etc. They use the products, such as word processors and spreadsheets, to make decisions and be productive in the work place.

Four Disciplines Defined

Considering the four career types just described, I came up with four disciplines. The first two are CS and CIS with minor changes. The next two are new disciples and reflect the rapid changes in the computer field. The four are as follows:

Discipline/ School	Career
Computer Science School of Science	Tool Maker
Computer Information Systems School of Business	Product Maker
Computer Systems Management School of Science or Business .	Product/Tool Manager
Business Information Technology School of Business or Bus. Tech.	Product User

The New Disciplines

Computer Systems Management (CSM) provides the distribution and access of data/information for users. It deals with the installation and maintenance of vendor tools and products. Content in this discipline could lead to vendor certification like Novell's CNE.

Business Information Technology (BIT) is product use oriented. The foundation course for this discipline is Computer Literacy, the understanding of computers and information systems. It is needed for a broader supply of educated people in the work place. Other courses for professional users include spreadsheets, decision support systems, accounting and tax packages, word processing, and any software where the professional user tells the computer what is wanted. Zhao's paper on End-User Skills is a good example of a BIT curriculum.

CS and CIS stress programming languages, which tell the computer what to do. CSM and BIT stress user friendly 4th generation languages, which tell the computer what is wanted. The two new disciplines, CSM and BIT, will better serve students who find difficulty in programming and math.

Cross-Discipline Courses

In defining these four disciplines, it was apparent that some courses cross disciplines. One course that has found its way to both CS and CIS is Systems Analysis. This course involves the design, development and implementation of tool or product software. All computer professionals, Tool Maker, Product Maker, and Product/Tool Manager, need a Systems Analysis course. C programming courses are also for both CS and CIS. The C language was used to write the UNIX operating system (CS). It is also used in application programming (CIS). The discipline CSM involves courses found in the other three computer disciplines. Examples are operating systems (CS), HTML (CIS), and computer applications (BIT).

Conclusion

It is becoming harder for computer and user professionals to stay current. Using this model, we get a broader range of disciplines that allow for better specializations. CS professionals can focus on the newest CPU architectures. Intel will soon come out with the Pentium Pro II. CIS professionals can focus on the newest application programming languages. Java programming developed three years ago. CSM professionals can focus on the newest versions of a network tool. Novell has just introduced IntranetWare. BIT professionals can focus on the newest word processor or desk top publishing software. MS Office 95 and MS Office 97 are examples. This model makes it easier to stay current.

As computer/information technology advances, new job positions develop. In the last three years a new job specialist, a Web Master, has developed. This job position deals with the creation and maintenance of a Web server and Web pages. It also deals with networks. This is different from an application programming job. As more distinct computer positions develop, academia must change to meet the new and changing professional careers. New computer disciplines and curriculum must develop to satisfy new careers and the rapid changes of the working world. Also, students with different abilities will be better served.

Information Systems Curricula in a Global Environment: The Need for Change

Sanjeev Phukan
Professor of Business Administration
Bemidji State University
Bemidji, MN 56601
(218) 755-2907
sphukan@vax1.bemidji.msus.edu

Abstract

The last two decades have seen enormous changes in Information Technology, including computers, communications, and office automation. These changes have had far reaching effects, not the least of which has been the creation of a global marketplace on an unprecedented scale. This marketplace, along with its tremendous opportunities and not inconsiderable pitfalls has affected even relatively tiny companies. As a result, for an increasingly large number of organizations, profitability and survival have come to depend on their ability to successfully negotiate the intricacies of this global arena. Information Systems (IS) and Information Technology (IT) have played pivotal roles in the creation of this global market, and will have an enormous impact on its future. The management of organizations that must and will operate in this environment now and in the future will demand a comprehensive array of attributes and skills from their personnel. IS professionals particularly will be subject to an increasing list of demands. Unfortunately, at least in the United States, IS curricula have so far done little to address these issues. The purpose of this paper is to examine the environment and suggest some changes in the way we educate the IS professionals of today and tomorrow.

1. Introduction

The last twenty years have dramatically changed the worlds markets. More and more organizations today view the entire world as their market, and a significant proportion have come to the realization that their greatest opportunities for profits and growth may in fact lie outside the boundaries of their "home" country. These organizations are affected by events and activities that occur all over the world, not just in the region where their "home" office happens to be located. Thus, while we may previously have viewed a corporation's international operations as an extension of its domestic activity, this viewpoint may no longer be appropriate in many instances. In fact, although political boundaries between countries technically still do exist, a map that shows the real flows of financial and industrial activity will demonstrate that these boundaries have largely disappeared (Ohmae, 1989). For example, although the European Union is yet to become a full-fledged reality, the concepts behind it distinctly demonstrate the direction in which nations and regions appear to be moving. It is apparent that far stronger relationships between nations and regions are created on the platform of trade than on the basis of any alignment of political ideology.

Today the number of companies that have some form of international, if not global presence is dramatically higher that what it was just a few years ago. Even small companies routinely have contacts with geographically distant lands, either as markets for their products or as sources for these same products. Terms of definition for these organizations have also increased; today we speak of multinational, transnational and virtual corporations. These corporations increasingly use IS and IT as strategic and operational tools to manage geographically dispersed enterprises. Goods and services are transported from locations scattered all over an increasingly shrinking globe to customers that may be equally scattered.

Much of current worldwide economic activity depends on the operations of organizations such as these (Egelhoff, 1991). Tremendous leaps forward in IT and IS have brought global markets and global competition to the doorstep of even the smallest companies (Cash et al, 1992, Neumann, 1992). The first aspect offers opportunities, the second, threats. It is safe to say that almost no major industry has escaped the effects of this globalization. A visit to an automobile dealership to examine the breakdown of source locations for the parts in a single automobile model demonstrates an almost incredible diversity of purchase points. A Boeing 747-400 may be assembled in Washington, but its components are made around the world. A department store emphasizes this even more dramatically. An examination of the products on a typical shelf reveals a veritable United Nations. Often we are surprised at the origin of a product that we had always assumed as being manufactured domestically. Thus, our homes have Christmas trees that are made in China, clothes from Sri Lanka, shoes from Indonesia and Italy, wood products (surprisingly) from Taiwan, computer keyboards from Singapore, grapes from Chile, and so on. In fact, a close examination of the products we use and live with every day might reveal that more of the products that we use are manufactured overseas rather than at home. Very little is really local anymore, and to many businesses, any place in the world is pretty much the same as any other place. In the words of Jim Hoagland, a columnist for the Washington Post, "anywhere is rapidly becoming everywhere."

Perhaps some of the most dramatic perspectives on this globalization are provided by firms that are in the IT business. By their very nature, IT firms have a firmly entrenched global presence, and the work that they do seems to ignore the boundaries of states, geography, and time. For instance, programmers in one US company working on year 2000 routines work till 5:00 p.m. and then hand over to several thousand programmers in India. Callers for technical support in the wee hours of the morning in the United States might very well find themselves talking to someone in Ireland. The tremendous shortage of IT professionals has resulted in a worldwide "head-hunt", or as one recruiter uncharitably put it, "nerd-hunt" for qualified professionals. Obviously, teams of professionals assembled from all over the world are going to present rather unique management challenges. And even though companies today are scrambling to hire almost anyone who even vaguely resembles an IS professional, maturity in the market will place increasingly complex demands on these personnel.

Companies and countries have reacted in many different ways to the challenges of. Strategic and operational trade and monetary alliances are one example. The EU and NAFTA are cases in point, and their success or failure, I believe, as yet remains unproven. Corporations have had to re-engineer the way they do business in order to operate in the global arena. It is obvious that the skills that an individual must possess to perform effectively in this arena are different from what they might have been twenty years ago. Although educational institutions are scrambling to change their curricula to meet the expectations of the marketplace, I fear that this change is too slow and often in the wrong direction.

In the United States we have been fortunate to enjoy a period of unprecedented economic stability and growth. To be complacent, however, would be foolish. As most of us know, economic circumstances can rapidly change. Today, more than ever, our fortunes are inextricably tied to the economic well being of regions around the globe. The recent economic crisis in South East Asia has provided ample evidence of this fact. We also need to be aware that many industries that were once mainstays of the US economy have either been entirely lost to foreign competition or have been overshadowed because of their inability to compete effectively in the global marketplace. Since globalization will be a continuing and even increasing trend (Neumann, 1992), corporations will need to be vigilant to the threats of global competition. They also need to be aware that the information technology that has driven this globalization has created an entirely different kind of economy - an information economy that is as different from a manufacturing economy as the manufacturing economy was different from the agricultural economy that prevailed at the turn of the century.

What does this really mean for business? The future will include both opportunities as well as potholes. Those companies that seize the opportunities by being adequately prepared, by optimizing efficiency, by responding quickly to changes in the global marketplace, by continually learning, will likely succeed (Bartlett and Ghosal, 1987, Porter and McKibbin, 1988, Porter and Millar, 1979). Many companies will try to succeed by pursuing a truly global business strategy. These firms would treat the world as a single, linked resource (Nelson, 1996). Companies that do not change will probably discover that they are ill equipped to meet the challenges of rapidly changing markets and foreign competition. Survival, or at least profitability, will be difficult to achieve.

The global marketplace is an increasingly complex and volatile marketplace. To effectively operate in this environment, businesses have little choice but to become information based. (Drucker, 1988). As previously mentioned, IS and IT have played key roles in the development of this global marketplace and will continue to be of strategic importance to firms that wish to operate successfully in this arena. The use of IS and IT for competitive advantage, to change and streamline organization structures, to bring efficiency to operations and to cope with increased levels of complexity and uncertainty is well established (Cash et al, 1992, Davis, 1986, McFarlan, 1992, Porter, 1990, Porter and McKibbin, 1988, Roche, 1992). Thus, IT and IS become the tools by which companies expect to prosper in the years ahead. The effectiveness of a company's IS will have much to do with its continuing success. The global marketplace demands the additional dimension of a global orientation for this IS (Benjamin et al, 1984, Ives and Jarvenpaa, 1991, Karimi and Konsynski, 1991). Global companies must deal with a diversity of products, markets, nations and cultures. Thus, they regularly must deal with issues that are far more diverse and complex than those encountered by even by even the largest domestic firms (Egelhoff, 1991). If one examines the issues and concerns that are involved in the management of a domestic IS operation, those in the corresponding global counterpart are usually far more extensive. The potential rewards offered by the creation of an effective global IS organization are usually more than enough to offset these difficulties, however. IT can provide tremendous advantages in overcoming barriers such as time zone differences, geographic separation and training difficulties. In the small world created by today's technology almost all businesses will participate in the global marketplace in some way or another. Even smaller companies will find potential benefits in an effective global IS (Neumann, 1992), because IT allows even the smallest firms to become global. The lure of potential benefits offered by larger markets, growth, and profitability often play a prominent role in the long term strategic plans of most companies. Effective use of IT in the global marketplace can allow smaller entities, whether they be companies or countries, to successfully compete with their larger counterparts. Singapore's use of EDI with its TRADENET trade document processing system is an excellent example (King and Konsynski, 1992), allowing the port authority to move more cargo than any other port in the world. An island nation of about 600 square kilometers (230 square miles), Singapore's natural resources are conspicuous by their absence. Yet, in the last 30 years, she has taken her place in the world as a developed, newly industrialized, and technologically advanced nation. The government of Singapore has been firmly committed to technology, even going so far as to bring fiber optic cable into every apartment house in the nation. This national commitment to IT is certainly one of the primary reasons for the country's advancement (Gable and Raman, 1992). As a result, Singapore's technology infrastructure is one of the most advanced in the region and compares favorably with much of the rest of the world. Small wonder then that Singapore enjoys an excellent standard of living and an impressive per capita GDP. The extensive technology investment, which has led to an excellent communication and computing infrastructure and the availability of skilled IS professionals has also been a catalyst for massive increases in foreign direct investment in Singapore.

2. Defining the Global IS Professional

In many ways today's global economy is reminiscent of the age of empires. During that period, professionals had to have a working knowledge of other areas of the world, notably the various colonies of the mother country. Toward this end there was the grand tour, an education strongly based in the liberal education traditions of history, geography, languages, and the arts, and the somewhat dubious distinction of always having the upper hand as a citizen of the ruling country. Circumstances today are vastly different; nevertheless certain lessons are still valid. The imperial powers, from Rome to Britain, ensured that their professionals had a thorough understanding of the cultures and values of the areas to which they were sent. Those who did not possess this understanding proved to be incapable of operating effectively. Today's global professionals also have to deal with a wide range of problems. IS personnel may face a host of issues that may range from technical telecommunications issues to global corporate management (Deans et al, 1991). In addition, they must be familiar with other, non-technical issues as well, such as culture and tradition. The management of a global IS thus poses special challenges for IS managers (Deans and Ricks, 1993) and the global IS professional will need a far greater depth and breadth of knowledge in comparison to his or her domestic counterpart (Cheney and Kasper, 1993). Global Information Systems professionals will also need to have international experience in interactions with global competitors and global customers (Nelson, 1996). It goes without saying that the successful global IS professional will need be familiar with IS standards and practices in other areas of the world.

Many authors have attempted to define the characteristics that a successful global IS professional must possess. For example, in his examination of the role of a global Chief Information Officer (CIO), Roche (1992) suggests that the CIO's task must include the construction of short-term infrastructure requirements with the flexibility to meet the longer-term needs of the global organization. This is a tall order.

Kanter and Kesner (1992) also attempt to define the role of what they define as a Global Information Officer (GIO). They conclude that the GIO must possess capabilities above and beyond the attributes considered necessary for a successful CIO. Aside from a thorough understanding of all aspects of IT and an appropriate IT skill base, the authors believe that a successful GIO must possess a flexible management style, superior organizational skills, a thorough understanding of the national and international environments, and an ability to successfully manage and implement technology transfer.

Surely one of the most daunting aspects of the task faced by any global IS professional is what can only be described as the simultaneous management of several learning curves. He or she must be well versed in the IS organization, the different national organizations, the corporation as a whole, and the country management. This is above and beyond any technical skills, which must be taken for granted.

McFarlan (1992) points out that much of the research that has been carried out concerning the nature of the CIO's job has assumed an almost totally domestic orientation, whereas the reality is quite different. He points out that the CIO that is responsible for international operations must contend with all the domestic issues as well as many additional problems. Even when authors do address the necessity of a global perspective among IS professionals, their focus often falls short of the reality. For example, Flynn (1994) makes a strong case for education to address the requirements of a global market. However, he focuses almost exclusively on interactions between the United States and the European markets. When one considers that in all likelihood, it is the developing nations that offer the greatest potential for market growth, (Cheney and Kasper, 1993) such a perspective is ill advised and short sighted.

Factors such as the geographic transfer of work, global networking, global service levels, time based competition and cost cutting have all contributed to the increasing importance of global IS, and consequently to the increased reliance on global IS personnel. These global IS professionals must deal with a variety of additional transnational problems, including those of inadequate infrastructure, sketchy technical support, language problems, geographic separation, differing time zones, and greatly different labor technology cost tradeoffs.

Perhaps it is not possible to arrive at a comprehensive list of the skills and attributes that a global IS professional must possess. And maybe this is not entirely a disadvantage. A contingency approach could then be used, where a global IS professional is gradually eased into the global arena during his or her career. This would still necessitate, however, a certain broad based background that would have to be provided by the educational process.

3. Restructuring the IS Curriculum

As the worldwide demand for IS professionals has grown, educational institutions have been scrambling to try and produce enough graduates to satisfy the burgeoning market. At the same time, rapid changes in the IT environment and explosive growth and change rates in technology have made the development of a viable IS curriculum extremely difficult. Adding a global element to an already difficult task seems to be akin to adding the last straw to the aching camel's back, and many curriculum initiatives seem to be only too relieved to shove it onto a remote back burner. From the intermediate and long term perspectives, I believe that this would be shortsighted.

It appears that the employers of IS graduates would like these graduates to have an ever larger technical background, preferably delivered in a period considerably shorter than the traditional 4 years.. Once they receive these graduates, however, many employers discover that a significant number of these graduates lack skills in other areas, including communication, organizational, managerial and human relations skills. The complaint is very often that these IS graduates just don't seem to know very much about the world around them. They have little or no knowledge of countries and cultures, politics, the environment, social structures, or languages. IS educators, then, seem to be on the horns of a dilemma. While on the surface employers demand a greater degree of technical expertise, they also require the conditioning that only a strong liberal education can provide. In the case of business administration graduates, this issue had become so acute that the AACSB, reversing course for the first time in its history, has actually recommended increasing the liberal education content of many business degrees.

There is little doubt that because of globalization, IS graduates the world over will require specific skills to succeed in a fast moving marketplace that will be characterized by a culturally and ethnically diverse work-force and a significant dependence on Information Technology to cut across many barriers (Ng Tye et al, 1995). In addition, for IS graduates to address the needs of developed, developing, and under-developed markets, they will require an expanded IS curriculum and a focus that supports the global IS manager's technical needs (Cheney and Kasper, 1993). In the United States, as elsewhere in the world, universities and institutions of higher learning are faced with the problem of creating curricula that will meet these requirements of a dynamic and rapidly changing world market The real problem, I believe, lies in determining exactly what the content of these curricula should be.

Obviously, these curricula will need to focus on a host of issues. In their article, Scott and Hayen (1991) list issues such as quality of communication, power requirements and reliability, multiple language reporting requirements, date formats, difficulties in providing end-user support and restrictions in trans-border data flow among many others as a partial list of topics for a global information systems course.

It is apparent that the preparation of IS managers and professionals for a global career will be a challenge, the resolution of which will require cooperation between IS practitioners, corporate executives, and academics (Neumann, 1992). An appropriate starting point is an examination of IS education. Most IS curriculums, at least in the United States, are housed in departments or schools of business, where the need for internationalization has at least been acknowledged. Nehrt (1987) concluded that a majority of AACSB member schools intend to bring about some degree of internationalization in both their undergraduate and graduate business curricula in response to changes in AACSB accreditation guidelines. Other studies, notably the one by Thanapolous and Vernon (1987) lend credence to this conclusion. The fact remains, however, that there is many a slip between the cup and the lip. The number of business schools that have actually implemented this decision is much smaller than one might wish. Deans and Goslar (1993) confirmed this conclusion when they found that there are very few resources currently available that address the international dimensions of IS. They further conclude that most IT curricula are at present devoid of a well-defined international component. Dunning (1989) made a strong case almost ten years ago for an interdisciplinary approach to the study of International Business (IB). He pointed out that many academic organizations have been active in seeking the internationalization of a variety of academic curricula. Deans and Ricks (1993) support the interdisciplinary argument by suggesting a research framework that provides an interface region for IS, IB and other functional areas. Palvia (1993) concludes that initially most schools will offer a single course in International IS. His study has determined that the number of books in the field is limited and that educators will need to undergo formalized training in the area of international IS.

Even the most recent curriculum guidelines from the Association of Computing Machinery, Association for Information Systems, and the Association of Information Technology Professionals (Davis et al, 1997) contain no real efforts to include an international component. I think this is a shortsighted perspective, and one that may ill serve IS students in the future.

Several approaches might be taken towards the internationalization of the IS curriculum. An international flavor might be made to permeate throughout all IT courses. Or, a separate international IT course may be taught. The former approach allows for the diffusion of the international element to the greatest number of students, while the latter provides a more in-depth understanding to fewer students.

The final determination may very well be made by the amount of time available for a typical college degree. IS educators are under pressure to pack more and more technical classes into a fixed-length curriculum. As they scramble to create additional classes to meet apparent market demands, liberal education seems to be the obvious place to make cuts. I question, however, if this will really better serve IS students as well as their employers. A well-rounded education may be a cliché, but it is probably what the global market will find most palatable.

4. Conclusion

Given the environment, I believe we can safely reach certain conclusions: 1. An increasing number of companies will rely on an inter-connected global market for their continued good health. 2. Success in this global market will to a large extent be determined by how effectively they use Information Technology. 3. Managing IT on a global scale is likely to be a complex process that will need IS personnel with special skills and attributes. 4. Educators and businesses are going to have to cooperate on the creation of these individuals; neither can achieve the desired results on their own. 5. Assuming that education is the preliminary step in this process, curriculum changes will be necessary and resources must be made available to bring about these changes. IS curricula today are for the most part devoid of an international element. When attempts are made to internationalize these curricula, perhaps the focus may need to be on classes that fall outside the bounds of what is normally considered to constitute an IS education.

5. References

Bartlett, C.A. and S. Ghosal (1987). "Managing Across Borders: New Organizational Responses," Sloan Management Review, 29(1), 43-53.

Benjamin, R.I., J.F. Rockart, M.S. Scott Morton and J. Wyaman (1984). "Information Technology: A Strategic Opportunity," Sloan Management Review, Spring 1984, 1-10.

Cash, J.I., F.W. McFarlan, J.L. McKenney and L. M. Applegate (1992). Corporate Information Systems Management, Third Edition, Irwin: Homewood, IL, USA.

Cheney, P.H. and G.M. Kasper (1993). "Responding to World Competition: Developing the Global IS Professional," Journal of Global Information Management, 1(1), 21-31.

Davis, G.R. (1986). "MBA Students Need More MIS," Datamation, September 1, 1986, p.19.

Davis, G.B., J.T. Gorgone, J.D. Couger, D.L. Feinstein, and H.E. Longenecker, Jr. (1997). "IS '97: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems," AITP: Chicago, USA.

Deans, P.C. and M.D. Goslar (1993). "Alternative Curriculum Approaches for Global IT Education Settings," in M. Khosrowpour and K.D. Loch (eds.) Global Information Technology Education, Idea Group Publishing: Harrisburg, PA, USA.

Deans, P.C., K.R. Karwan, M.D. Goslar, D.A. Ricks and B. Toyne (1991). "Identification of Key International Information Systems Issues in U.S.-Based Multinational Corporations," Journal of Management Information Systems, 7(4), 27-50.

Deans, P.C. and D.A. Ricks (1993). "An Agenda for Research Linking Information Systems and International Business: Theory, Methodology and Application," Journal of Global Information Management, 1(1), 6-19.

Drucker, P.F. (1988). "The Coming of the New Organization," Harvard Business Review, 66(1), 45-53.

Dunning, J.H. (1989). "The Study of International Business: A Plea For a More Interdisciplinary Approach," Journal of International Business Studies, Fall 1989, 411-436.

Egelhoff, W.G. (1991). "Information Processing Theory and the Multinational Enterprise," Journal of International Business Studies, 22(3), 341-368

Flynn, J.A. (1994). "Global Information Systems: Problems, Solutions, and How to Manage Them," Journal of Information Systems Education, 6(3), 142-147.

Gable, G.G and K.S. Raman (1992). "Government Initiatives for IT Adoption in Small Business: Experiences of the Singapore Small Enterprise Computerization Program," International Information Systems, 1(1), 68-93.

Ives, B. and S.L. Jarvenpaa. (1991). "Applications of Global Information Technology: Key Issues for Management," MIS Quarterly, 15(1), 33-49.

Kanter, J. and R. Kesner (1992). "The CIO/GIO as Catalyst and Facilitator: Building the Information Utility to Meet Global Challenges," in S. Palvia, P. Palvia and R.M. Zigli (eds.). The Global Issues of Information Technology Management. Idea Group Publishing: Harrisburg, PA, USA.

Karimi, J. and B.R. Konsynski (1991). "Globalization and Information Management," Journal of Management Information Systems, 7(4), 7-26.

King, J. and B. Konsynski (1992). "Singapore Tradenet: A Tale of One City," in J.I. Cash, F.W. McFarlan, J.L. McKenney and L .M. Applegate. Corporate Information Systems Management. Irwin: Homewood, IL, USA.

McFarlan, F.W. (1992). "Multinational CIO Challenge for the 1990s," in S. Palvia, P. Palvia and R.M. Zigli (eds.). The Global Issues of Information Technology Management. Idea Group Publishing: Harrisburg, PA, USA.

Nehrt, L.C. (1987). "The Internationalization of the Curriculum," Journal of International Business Studies, 18(1), 83-90.

Nelson, K. (1996). "Global Information Systems Quality: Key Issues and Challenges," Journal of Global Information Management, 4(4), 4-14.

Neumann, S. (1992). "Issues and Opportunities in International Information Systems," International Information Systems, 1(4), 1-13.

Ng Tye, E.M.W., J.M. Burn, L.C.K. Ma and R.S.K. Poon (1995). "Re-Engineering the IS Curriculum for the IS Professional of the Future," Journal of Information Systems Education, 7(4), 154-160.

Ohmae, K. (1989). "Managing in a Borderless World," Harvard Business Review, May-June 1989.

Palvia, P. (1993). "Assessment of Global IT Education in the United States," in M. Khosrowpour and K.D. Loch (eds.). Global Information Technology Education. Idea Group Publishing: Harrisburg, PA, USA.

Porter, L.W. and L.E. McKibbin. (1988). Management Education and Development: Drift or Thrust into the 21st Century? McGraw Hill: New York, USA.

Porter, M.E. and V.E. Millar. (1979). " How Information Gives You Competitive Advantage," Harvard Business Review, March-April 1979, 137-145.

Porter, M.E. (1990). "The Competitive Advantage of Nations," Harvard Business Review, 90(2), 73-93.

Roche, E.M. (1992). Managing Information Technology in Multinational Corporations. Macmillan: New York, USA.

Scott, J.P. and R.L. Hayen. (1991). "Global Information Systems: A Curriculum Challenge," Journal of Information Systems Education, 3(1), 14-16.

Singapore Facts and Pictures 1993. Singapore Ministry of Information and the Arts, Singapore.

Thanapoulos, J. and I.R. Vernon. (1987). "International Business Education in the AACSB Schools," Journal of International Business Studies, Spring 1987, 91-98.

They Wrote the Book: Students Seize Control of an International Information Systems Seminar

Elia Chepaitis
Fairfield University

Abstract

Students evaluated the leading questions in International Information Systems (IIS) courses, and wrote and justified a proposal for an IIS textbook. The class utilized the debate about the value and focus of International Information Systems as a springboard for a lively course. The students analyzed existing textbooks and readings, and worked together for ten weeks of continuous brainstorming.

The paper describes the dynamic structure of the course, learning methods, challenges, and outcomes. By analyzing an academic frontier through a writers' eyes, students improved their conceptual, organizational, and interpersonal skills, and gained significant confidence in their intellectual capabilities.

Introduction

In the past decade International Information Systems (IIS) has been accepted as a component of the Computer Information Systems (CIS) curriculum. It is offered either as a stand-alone course or as a set of integrated topics in non-IIS courses. Yet IIS has not matured to the extent that other additions such as ethics, object-oriented programming, multimedia, or the Internet have. The ongoing debate on the inclusion of IIS is not heated, but there is a lack of agreement in several key areas: the content of teaching materials, the selection and sequence of topics, the degree to which concept should corporate theory from other disciplines, the value of an international classification for global applications, and the degree to which socio-economic issues should be covered. Although IIS has not been the topic of heated debate, acceptance has been piecemeal and lukewarm (1997, Deans and Loch). For a broad range of reasons, educators have not yet identified the most important questions in IIS and, moreover, they have not yet developed adequate teaching materials. The list of reasons includes, but cannot be confined to, ten factors listed in Table 1 below.

The author decided to challenge students to evaluate the state of IIS, to identify the most important questions in IIS, and to produce and justify a textbook proposal. In short, we used the debate about IIS as a springboard for a lively course. The students conducted a systematic analysis of textbooks and readings, and we put our heads together for ten weeks of continuous brainstorming, quality research, and a rigorous analysis of the field.

Course Focus

This seminar is cross-listed as an elective for majors and minors in both information systems and international studies, but the majority of students who take this course are information systems majors. The students were asked throughout the course to keep in mind the irreverent questions we ask about every course in CIS: "So what?" "What is the purpose of this course?"

The challenge was to present IIS as a frontier, an area of discovery, a field in need of definition. In a seminar on IIS in the spring of 1997, the author sought to capitalize on the ambiguous position of IIS, and, in particular, the lack of teaching materials by asking students to decide what should be taught and how. The students were presented with a task: to write a textbook proposal for IIS.

Table 1

1. the lack of consensus among both academics on the content of the course;

2. the lack of consensus among academics about the need for a stand-alone course and about the amount of time which should be devoted to IIS in the rest of the IS curriculum;

3.the identification of varied priorities and needs by CIS managers in foreign environments and global enterprises;

4. the difficulty of developing IIS because of a lack of language skills, research abroad, or foreign work experiences, in contrast with extensive and ongoing practical experience in other new modules, such as ethics, object oriented programming, or the Internet (Chepaitis, 1997);

5.a difference of opinion about whether technical aspects of the course have been overemphasized which endures and possibly has broadened since the inclusion of the Internet in the curriculum;

6. a difference of opinion about which technical aspects of IIS should be included in view of the emergence of the computer as an effective and economical global communication tool, rather than a computation device;

7. the difficulty of including new courses and new components in the expanding CIS curriculum ;

8. the lack of a robust body of IIS theory;

9. the reluctance of administrators to support an expansion of IIS in the midst of ongoing debates on upgraded CIS facilities, resource sharing, curriculum integration and duplication of courses, and cost justification; and perhaps, most importantly,

10. the changing nature of IIS because of ongoing change in global markets, especially in services.

Course Requirements

In the first class, students were assigned a book of readings and given with the questions for open book midterm and final exams (Fig.1). Students decided upon and the point distribution for grading and how the weekly sessions should be organized and evaluated during their leadership. We agreed to two rules: "Be prepared, and make it interesting."

Grading:

30% Midterm (take home, open book)

"What are the most important changes in enterprises, in information technology, in business environments, and in geopolitics which affect international information systems in 1997? In your introduction, conclusion, or another appropriate location, feel free to note what is not changing, or where change is uneven.

30% Oral/Written Project: on a technology, geographic area, or other topics or issues in International Information Systems

40% Final (take home, open book): an Introductory chapter, a Detailed outlines of any 2 chapters, and the concluding chapter, plus Recommendations (cases, themes, multimedia, glossary, study aids)

Fig. 1

Learning Methods: A Syllabus, a Task, and Student-Generated Rules

The syllabus proclaimed, "We're Going to Write the Book!" on the top line. The exhortation was not just a description of the major thrust of the course, but also a reference to the triumphant exclamation by George C. Scott in the movie Patton: "I wrote the book...!" Hopefully, the expression connotated mastery of a subject, confidence, personal delight in learning, and adventure. We agreed to two rules: "Be prepared, and make it interesting."

In the first five weeks, we surveyed germane information technologies and paradigm shifts in the global marketplace, and also scanned textbooks in International Marketing, International Finance, and International Management but decided that an IIS textbook could not use a similar format. By the third week, our first Table of Contents hung together loosely, ready to be amended continuously during the semester (Figure 2). The first three chapters of the proposal clearly mirrored the material covered in class the first three weeks. However, Chapters IV through XI were developed independently and were changed repeatedly by May (Figure 3). Students could ask for research assistance, contacts with authors, and editorial advice, and a liaison with a textbook editor was arranged. Everyone involved learned to listen, including the instructor.

The students initially read the syllabus with a mixture of bewilderment, skepticism, and trepidation. Unfortunately, two of the four international studies majors withdrew, leaving us with a class of eight. Within three weeks, students became familiar with the material and were wildly enthusiastic. Cases, videos, and data on competition and the changing global marketplace blended neatly with theory borrowed from Tapscott's and Caston's Paradigm Shift.

Table of Contents

Chapter 1	Introduction: The Global Marketplace and International Information Systems
Chapter 2	The Changing International Business Environment: Paradigm Shifts
Chapter 3	Changing Information Systems: Open, Integrated, Extended (with an emphasis on international communications)
Chapter 4	Issues and Trends in Information Resource Management Goals: Efficiency, Effectiveness, Competitive and Strategic Advantage
Chapter 5	International Information Resources and Needs: Patterns of Economic Development, Salient Regional Differences, National Priorities
Chapter 6	International Management and International Information Systems: with cases
Chapter 7	International Marketing and International Information Systems: with cases
Chapter 8	International Finance and International Information Systems: with cases
Chapter 9	International Accounting and International Information Systems: with cases
Chapter 10	Information Technologies and International Systems Management
Chapter 11	International Information Management Trends and Challenges

Figure 2

The first outline provided the class with a center--the "Book" (henceforth capitalized). The discussions of readings, individual projects, and the Book were first rate throughout the semester. Interestingly, the students were relatively indifferent about whether the proposal would be acceptable to a publisher.

Outcomes

The decision by students to diverge from the syllabus and to collaborate on one Table of Contents and one title, and then develop individual projects was pivotal to the success of this course. Students identified the major questions in IIS, which was the purpose of the course, and they learned CIS from a different perspective, which is the purpose of electives. Six areas were relatively novel: multidisciplinary research and teaching; international socioeconomic issues; changing global business needs and ranges of appropriate solutions; the impact of varied value systems upon IS ethics; resource management challenges in foreign environments; and varied IT infrastructures.

The focus of the proposal was competitive advantage through information systems, reflected in the title: Going Global: Information Systems and Competitive Advantage in the Global Marketplace. However, The title was written in haste with little discussion about whether it squared with all major topics and themes in the Table of Contents.

The material presented in the first weeks of the course was valuable, but students had little time left to scout around for other materials and use resources such as the Internet. The student evaluations which the instructor received the following fall rated this course as excellent, but offered one salient criticism: some materials were dated and readings could have been better coordinated.

Table of Contents

Chapter 1	Introduction: The Global Marketplace and International Information Systems
Chapter 2	The International Business Environment: Government Regulations, Socio-Economic Factors, and Cultural Constraints
Chapter 3	Changing Information Systems: Open, Integrated, and Extended: The Issue of Data Security
Chapter 4	Issues and Trend in Information Resource Management: Efficiency, Effectiveness, Competitive and Strategic Advantage, and Privatization
Chapter 5	International Information Resources and Needs: Patterns of Economic Development, Salient Regional Differences, National Priorities
Chapter 6	Changes in Telecommunications: Software Development, Deregulation, and Cases in International Management, Marketing, Finance, and Accounting
Chapter 7	International Information Systems Management: Trends and Challenges
Chapter 8	Conclusion

Figure 3

All the participants, including the instructor, worked hard and honestly together in this frankly experimental effort. Information systems majors and minors dominated the course until the last weeks of the semester, however. This was not because the course very technical, but possibly because the international studies students had less experience working with teams and were relatively unfamiliar with the terminology. The immersion method of learning worked well, and trust and confidence developed swiftly in a class which may have seemed bizarre initially. Learning that it was all right and necessary to make mistakes was liberating and constructive. Students often mentioned that they were having fun.

The proposals and the outlines for the text, Going Global: Information Systems and Competitive Advantage in the Global Marketplace, surpassed the instructors expectations. However, the course would be improved if these five measures were taken: eliminate the individual project which took too much time and did not add significant depth to the course; participate extensively or not at all in the first student-driven session which was chaotic; prepare a more current varied group of readings, videos, and cases, and Internet searches; push the deadlines forward; and, most importantly, require that the students produce a joint proposal of fifty or sixty pages encompassing several chapters, and eliminate individually-authored chapters on identical topics. In this seminar, students viewed CIS , and perhaps themselves, from a different perspective: they critiqued multidisciplinary research and teaching, novel socioeconomic issues, and changing global business needs and appropriate solutions. In addition, they investigated varied value systems, material infrastructures, and regulatory environments.

Bibliography

Callon, J. D.(1996) Competitive Advantage through Information Technology. New York: McGraw-Hill.

Deans, R. C. and Kane, (1993) International Dimensions of Information Systems and Technology. Boston: PSW-Kent.

Deans, C. and Lock, K. (1997) "Is There a Difference of Who's Doing What? A Comparison of AACSB-accredited and Non-accredited schools." Proceedings: International Academy for Information Management. Atlanta, GA.

Deans, C. and Loch, K., and Roche, E. (1993) "Internationalizing the information systems curriculum". Interface: The Computer Education Quarterly, 15(3), 2-8.

Palvia, P., Palvia S., and Roche, E. editors. (1996) Global Information Technology and Systems Management. Ivy League Press.

Tapscott, D.and Caston, A. (1993). Paradigm Shift: The New Promise of Information Technology, New York: McGraw-Hill---H-1-11_.

Wiersba, R.K. (1992). "Business information systems in transition--The challenge for academia". The Journal of Computer Information Systems (Winter, 1991-1992), 50-57.-

Distance Learning - Courseware Development

Netiva Caftori
Computer Science and Women Studies
Northeastern Illinois University
Chicago, IL., 60625
n-caftori@neiu.edu

As population increases and the need for education is made more evident in this changing world the demand for distance and web-based courses will only grow [Bork, 1997]. Major learning modes in schools and universities are still the lecture and the textbook. Since people are different and require different teaching styles we know too well now that these major learning modes are outdated. Computers provide us with new opportunities for learning with their capability of interactivity and connectivity. The web in particular opens wide doors for obtaining information and seeing the world with new lenses. However we need to be cautioned as information is not knowledge and knowledge acquisition alone is not learning [Rudenstine, 1996]. What we want learning to be is the utilization of knowledge acquired in the solving of problems.

A good example for us to follow of teaching via problem solving is found in the Netherlands. Courses at the University of Maastricht are conducted in the style of Problem-Based-Learning (PBL) which is derived from the Harvard University model [Caftori and VanReeken, 1995]. Classes are restricted to 12 students. The instructor acts as a program and project manager, but does not lecture. The students conduct the classes, taking turns as the class secretary and summarize the activities of each class in written form, which is then presented at the next class. Students identify the cases and problems they need to explore, then report back as to how they have achieved their results.

This PBL technique is important to the study of on-line education, as the lecture mode is not desirable on-line either. Rather, students can be directed to a group of problems and cases, depending on the subject, which is summarized in the syllabus and course guide, written by the instructor. Students then work in groups to achieve results, and report back to the class in written form.

Another model for us to follow as a guideline to good teaching are the seven principles of Good Practice [Chickering and Ehrmann, 1997]. Good Practice encourages

1. 1.contact between students and faculty,
2. reciprocity and cooperation among students,
3. active learning techniques,
4. prompt feedback,
5. time on task,
6. high expectations, and
7. respect for diverse talents and ways of learning.

We contend that all these principles can be observed using the new distance learning technologies combined with committed faculty and students who are made aware of them.

Too many web pages available for teaching today are designed in the lecture mode of presentation. We would like to caution our audience about this danger. We would also like to encourage individualized teaching. Any kind of distance education should include a face-to-face component as much as possible. Interactive work is essential whenever available. Presenting problem situations and group work can remedy the lack of interactive software. As mentioned earlier, active participation in problem solving will guaranty learning. Passive involvement as in listening to lectures or reading text is certainly less effective. Chat rooms and web conferencing may be easily added to a web course and may help in the communication between members of a team, or in giving feedback between the instructor and the students. Feedback may be made compulsory as to ensure participation.

Some of the positive aspects of web-based courses are that they provide 24-hour access, increased interaction between students and faculty, and more flexibility in learning styles. Face-to-face meetings are still essential. When students meet in the classroom, notes need not be taken since students know that all materials are on-line already. There is therefore less passivity on their part and more interaction and active learning. Web courses can also provide good assessment of students' progress and instruction effectiveness as well by installing counters which count the number of visits to certain sites and quizzes which give immediate feedback and keep track of the number of students failing a particular question. Keeping student records and progress is important for individual learning and for assessment of progress and its monitoring. Privacy can be maintained on-line as well although the technology is not user-friendly yet.

Some other benefits of web courses include

- the sense of community that students gain by having many occasions to interact with others,
- the increased attention that they exhibit in class because of the opportunity they are offered to prepare ahead of time for class,
- the flexibility of space and time to learn as they can work from home, work, or school lab , and
- the possibility of cross-platforms as the web may be accessed from any computer attached to a modem.
- Since interactions on-line may now be based on common interests and not just on physical space one surprising new benefit is that students spend more time studying on topics of concern to them and therefore more learning is taking place.

Another important factor in reaching students is the natural language we use in traditional classrooms. Natural language is our most powerful tool for communication. It lends itself to complex learning. Whenever possible we should include this mode of communication in our distance learning as well. Asynchronous communication such as conferencing on-line , listservs, e-mail, news-groups, or synchronous communication such as chat environments, telephoning, "moos" and "muds", video or TV-based conferencing, or face-to-face meetings are examples of such human interactions. It is important to use some of them in some form. Use voice recognition devices whenever available.

Smart classrooms, as found at Northeastern Illinois University, combine traditional classroom setting with networked computers. The sky is the limit as to what can be achieved in such an environment: Students can work on individual computers or turn around and face each other for a class discussion or an occasional presentation. From hands-on learning, to team work, to individualized attention to group discussions problem-solving situations find fertile ground in this environment.

This is still a brainstorming era. Collaboration is essential among instructors since many hurdles are on our way. Copying source code of HTML, Java or CGI from each other is one way of collaboration. Preparing a web course is time consuming. Copy right and giving appropriate credit to authors is important. Most courses available present therefore only a syllabus. We depend on the technology, and on each other. The support we receive is many times insufficient but is growing with increasing expertise. Helping each other can have far-reaching effects.

As a summary, distance learning can be conducted in many different ways: by correspondence, video conferences, or web-based courses. It allows people with handicaps, people who live far away, people with similar interests, or people with different life-styles to obtain an education at a distance. It is up to a good teacher with much preparatory work to conduct teaching and learning in a very effective way. By using modern technology but keeping basic pedagogical methodology, while implementing the "Seven Principles for Good Practice in Undergraduate Education" [Chickering and Ehrmann, 1997] one can achieve what we consider quality education.

References

[Bork, 1997]. Bork, A: (1997). The Future of Computers and Learning, *T.H.E. Journal*, 25th anniversary issue

[Caftori and VanReeken, 1995]. Caftori, N. and VanReeken, A. (1995). Problem-Based Learning, *Information Systems Education Conference, 1995*, Data processing management Association, Charlotte, NC.

[Chickering and Ehrmann, 1997] Chickering, W. and Ehrmann, S. (1997). Implementing the Seven Principles. Technology as Lever, http://www.aahe.org/ehrmann.htm

[Rudenstine, 1996]. Rudenstine, N.L. (May 29, 1996): Special Address, Harvard University.

A Profile of First Computing Course Students: New Insights and Their Implications for the Curriculum

Jeanine Meyer (jmeyer@pace.edu)
and
Stuart A. Varden (svardenf@pace.edu)

Pace University
School of Computer Science and Information Systems
New York City and Pleasantville, NY USA

Abstract

In the Fall 1997 semester, 404 students of Computer Information Systems 101, the undergraduate core computing requirement at Pace University, were asked to complete a survey on the first day of class. The survey focused on the students' prior experience with computers, their attitudes toward technology, their knowledge of current events relating to information technology (IT), expectations for the course, and general demographic data. The main premise of the study was that if we wish to improve instruction, we first need to know who our students are and what they are thinking. The study showed few gender differences, a rather low level of awareness of societal issues dealing with IT, but a largely positive and confident attitude toward computers and IT. Students also exhibited a surprisingly mature attitude regarding their learning goals for the course in that general understanding of concepts and issues tended to take priority over mastery of specific applications. An exit survey on the final day of class also was administered. Resulted will be presented in a subsequent paper.

Background

The question of what should constitute the undergraduate first course in computing for both computing majors and non-majors has been (and continues to be) the subject of much discussion. The debate surrounding courses designed for majors often has centered on the selection of the most appropriate programming language vehicle, while for the non-major course the issue often has been whether programming is indeed an important notion for the general student population to understand. An even more fundamental question is whether non-majors should be required to take a computing course at all. This may seem to be an absurd question in light of the pervasiveness of computing today, but the fact remains that many students graduate with undergraduate degrees with no formal course work in computing whatsoever.

Many well designed curricula for the first course has been proposed and implemented, but the computer field changes so quickly that nothing approaching a "steady state" has been achieved. In addition to the computer field itself, what students bring with them to the college campus in the way of computing competencies and attitudes also continues to change. This paper, then, offers new insights on today's students as they begin a first course in computing designed for non-majors. The authors hope that the findings presented here will help inform the course development process at similar institutions.

Pace University

Pace University is a medium-sized (13,500 students) private institution with schools of Arts and Science, Business, Education, Nursing, and Computer Science and Information Systems, and Law. It operates on six campuses in both suburban and urban settings. The students are quite diverse, representing a wide spectrum of peoples in the New York City Metropolitan area. There is a significant international student population as well. Many are so called "first generation students" meaning that they are the first member of their family to attend college. Many students are on partial scholarship. The University requires a substantial (60 credit) liberal arts core, including a basic course in computing. Pace encourages an early declaration of major, and offers a very strong cooperative education program that provides an important career related work experience for students.

Computer Information Systems 101

CIS 101 has attributes of an overview, science for poets course; an introductory course for students continuing study in computing; a computer literacy course; and a recruiting tool for students to change majors or at least take one or more additional computing courses.

The course goals are for students to acquire:

1. Conceptual understanding and operational skill in the basics of computer hardware and software. This will include actual use of common application packages and introductory procedural programming. Fundamental concepts will be covered through classroom exercises, homework and lecture and discussion.

2. General problem-solving and communication skills, and experience in working in teams to solve problems. This will include the appropriate use of computers to accomplish tasks and the use of systematic, analytic thinking to address problems that may not be appropriate for automation.

3. Awareness and insight into the pervasive presence of computer-based technology in working and everyday life. This will include discussion and analysis of current applications and potential trends.

CIS 101 is taught on three campuses each semester, with up to fifteen sections. The course structure consists of four contact hours, two hours of lecture/discussion and two hours of computer lab delivered in a "closed lab" computer classroom setting. Full-time faculty and experienced adjuncts teach the lecture/discussion sections. These classes are divided into smaller groups for the lab work, taught by adjuncts. The lab currently covers programming using **Visual Basic 5,** spreadsheet using **Excel 97**, Web research using **Netscape Navigator**, and production of Web documents using **Notepad**, **HTML Assistant Pro** and **Paint Shop Pro**. Some students also make audio files using **Wave Studio** [1,2]. The basic components of a computer system, computing career opportunities, and the societal impact of information technology are also covered.

The most controversial part of CIS 101 as a liberal arts course is the requirement for programming. Some of the resistance is actually from a small number of faculty from other departments, who believe students just need training in a small number of tools. Our view is that programming and algorithms are fundamental concepts in our field and in the tradition of liberal arts, and so require coverage. Moreover, it is only by trying to construct a program that a student can gain an appreciation of the concept that computers are programmable. For all the tools, we strive to get students to reflect on what they have learned because the tools will change and they will need to learn what is current.

In terms of a first course for majors, we consider IS, OIS and CS separately. IS'97 suggests that literacy, that is, basic computer skills, precede the other courses [3]. CIS 101 provides an introduction to hardware (storage, I/O devices), software (operating systems, basic programming concepts of variables, subroutine, looping), and telecommunications (protocols, concepts such as channel, bandwidth). With respect to CS, we do not believe that someone with no programming experience can go into our CS1 course in C++, so such students take CIS 101 to get some experience. CIS 101 also provides attention to current events and ethics, part of the CSEB curriculum. The OIS department is working to follow the OSRA model curriculum [4]. CIS 101 serves a similar role here as with IS, providing basic literacy and grounding for the Concept and Solutions categories of courses. OIS is also making Visual Basic the choice for the programming component of their program and so CIS 101 provides a productive bridge.

The Survey

We designed a survey to include questions on prior experience with computers, attitudes, and knowledge of specific current events as well as record certain demographics. Most of the questions had fixed categories for answers but a few were open-ended: language spoken at home, what the student wanted to get out of the course, and brief descriptions of the Deep Blue and the Year 2000 problem were some of the open-ended questions. After categorizing these responses, we recorded and analyzed the data using SPSS.

The survey was given to students on the first day of classes to most of the day sessions on the New York City and in Pleasantville campuses. In addition, one evening session in Pleasantville took the survey. The students were told that this was to be anonymous and we were doing it to improve our teaching of the course. Altogether, 404 surveys were completed and analyzed.

Students appeared to take questions seriously. For example, most students did admit that they did not like speaking in public. Some students openly said that what they wanted out of the course was a "good grade." Still others said that they were nervous when learning new software. The anonymity of the survey was undoubtedly important in assuring candid responses.

What the Survey Revealed

Who Students Are

The students who completed the survey are fairly typical of the undergraduate college populations of U.S. universities in urban and suburban areas. The main demographic facts are:

- The gender breakdown was females (57.3%) and males (42.7%).
- Three fourths (75.9%) were under 21.
- Nearly three fourths (72.1%) speak English as a first language, but twenty-four other
- languages (from Albanian to Vietnamese) were cited as first languages.
- Only a little more than one half (54.3%) come from families in which both parents were born in the U.S.

Some differences in student profile were found between students on the New York City versus the Pleasantville campuses and between day versus evening students as well. The differences, however, were not pronounced enough to warrant separate analyses.

What They Know

Students were asked to indicate their experience level in using a number of computer-related skills and tools. We felt that this would be important to know in order to plan better a curriculum appropriate to their needs. The results are summarized in Table I.

As can be seen, computing background is mostly weak, but not totally absent, including some background in programming and considerable experience with Windows, spreadsheet, the Internet and e-mail. Nearly ninety percent (89.4%) reported at least some experience with word processing.

On the other hand, students seem to be largely unaware of the broader societal issues surrounding information technology. Only about one in nine students (11.9%) could identify "Deep Blue" as the IBM computer system that had defeated World Chess Champion Gary Kasparov, and one in five (20.0%) had some idea of what the "Year 2000 Problem" was about. When asked to describe another "recent news story that concerned computers", less that a fifth (17.8%) were able to do so.

Table I: Student Self-Assessment of Knowledge/Skill in Selected Computer Topics

Software	Never Used	Some Experience	Working Knowledge
Windows	24 (5.9%)	165 (41.2%)	212 (52.9%)
Mac OS	320 (83.5%)	42 (11.0%)	21 (5.5%)
Word processing	42 (10.6%)	148 (37.3%)	207 (52.1%)
Spreadsheets	186 (47.7%)	140 (35.9%)	64 (16.4%)
Logo	351 (90.7%)	27 (7.0%)	9 (2.3%)
Basica or Qbasic	335 (86.6%)	36 (9.3%)	16 (4.1%)
Visual Basic	347 (89.5%)	36 (9.3%)	5 (1.2%)
C, C++ or Pascal	343 (89.1%)	34 (8.8%)	8 (2.1%)
E-mail	96 (24.1%)	146 (36.7%)	156 (39.2%)
Internet	65 (16.3%)	167 (42.1%)	165 (41.6%)
Presentation Graphics	167 (42.6%)	147 (37.5%)	78 (19.9%)

How They Feel

Students were asked to respond to eleven questions mainly regarding their attitudes on information technology. A five point Likert scale running from "strongly disagree" to "strongly agree" was used. The results are reported on Table II below.

Table II: Students Attitudes Regarding Computing as They Begin the First Course

Question	SD	D	N	A	SA	Mean
I get nervous when using a computer	130 (33%)	117 (29%)	98 (24%)	37 (9%)	19 (5%)	2.25
I avoid using ATM machines – I prefer going to a teller	217 (55%)	83 (21%)	58 (14%)	28 (7%)	10 (3%)	1.82
I enjoy computer games	17 (4%)	25 (6%)	94 (24%)	159 (40%)	105 (26%)	3.78
Computers don't like me	151 (38%)	109 (27%)	87 (22%)	38 (10%)	14 (3%)	2.14
I can program a VCR	19 (5%)	26 (6%)	43 (11%)	142 (35%)	171 (43%)	4.05
I enjoy doing puzzles of various kinds	16 (4%)	39 (10%)	136 (34%)	142 (35%)	69 (17%)	3.52
I get nervous when learning new software	63 (16%)	88 (22%)	136 (34%)	91 (22%)	24 (6%)	2.81
I like speaking in front of groups of people	120 (30%)	88 (22%)	108 (27%)	60 (15%)	27 (6%)	2.47
I do well in math courses	51 (13%)	59 (14%)	110 (27%)	135 (34%)	48 (12%)	3.17
I do well in writing courses	10 (3%)	43 (11%)	116 (28%)	168 (43%)	62 (15%)	3.57
All things considered, I enjoy using computers	11 (3%)	22 (5%)	104 (26%)	179 (45%)	85 (21%)	3.76

In general, the responses show a more positive and confident attitude toward information technology than we expected. Only 13% agreed with the statement "computers don't like me", only 28% reported getting "nervous learning new software", and only 14% "get nervous when using computers." This may reflect a high comfort level with consumer oriented technology products such as ATM machines and VCRs. We do acknowledge, however, that there are substantial portions of the class that still report some discomfort with technology. One cautionary note, however, is that nearly one fourth of all responses were "normal" or "unsure." Perhaps students at this young age simply have not formed a judgment on these questions.

What They Want Out of the Course

The responses to this open ended question reveal that students value "general knowledge" over a knowledge of specific applications. Gaining a sense of increased comfort in mastering computer technology also was important to many students. Finally, students foresee themselves as using computers in their careers.

Gender Differences

Much has been written over the years regarding gender differences with respect to computing and computer instruction. The survey, however, shows very few differences in both self-assessment of knowledge and attitudes toward technology. This confirms the findings of Heslin who studied gender differences in a four-year historically black college [5]. The only noticeable differences in knowledge as shown in Table III are in the area of computer programming. When the responses to the four programming language questions (Logo, Basica, Visual Basic, C) are averaged, 17.5% ((14.2 + 7.4 + 11.9 – 4.4 + 14.8+1.9 + 12.3+3.1)/4) of males report having at least some experience with programming compared with only 6.3% ((6.0 + 1.9 + 3.7 +0.9+4.6+0.9 +5.6+1.4) / 4) for females.

Table III: Student Self-Assessment of Knowledge/Skills by Sex

Software	Never Used		Some Experience		Working Knowledge	
	Female	Male	Female	Male	Female	Male
Windows	16 (7.1%)	7 (4.2%)	91 (40.6%)	69 (41.3%)	117 (52.2%)	91 (54.5%)
Mac OS	187 (87.0%)	123 (77.8%)	21(9.8%)	21 (13.3%)	7 (3.3%)	14 (8.9%)
Word processing	22 (9.9%)	17 (10.4%)	90 (40.4%)	55 (33.5%)	111 (49.8%)	92 (56.1%)
Spreadsheets	113 (52.3%)	66 (40.2%)	73 (33.8%)	65 (39.6%)	30 (13.9%)	33 (20.1%)
Logo	198 (92.1%)	127 (78.4%)	13 (6.0%)	23 (14.2%)	4 (1.9%)	12 (7.4%)
Basica or Qbasic	207 (95.4%)	134 (83.8%)	8 (3.7%)	19 (11.9%)	2 (0.9%)	7 (4.4%)
Visual Basic	204 (94.4%)	135 (83.3%)	10 (4.6%)	24 (14.8%)	2 (0.9%)	3 (1.9%)
C, C++ or Pascal	198 (93.0%)	137 (84.6%)	12 (5.6%)	20 (12.3%)	3 (1.4%)	5 (3.1%)
E-mail	56 (25.3%)	21.0 (21.0%)	80 (36.2%)	65 (38.9%)	85 (38.5%)	67 (40.1%)
Internet	41 (18.6%)	20 (12.0%)	96 (43.4%)	69 (41.6%)	84 (38.0%)	77 (46.4%)
Presentation Graphics	90 (41.5%)	70 (42.4%)	85 (39.2%)	59 (35.8%)	42 (19.4%)	36 (21.8%)

The findings on the attitude questions, however, reveal more substantial differences between female and male students as shown in Table IV. On the whole, males report being somewhat more confident in their ability to use technology. They report being less nervous (Questions 1 & 7), see themselves as technically more competent (Question 5), and are generally more positive about computers (Questions 4 & 11).

Table IV: Students Attitudes Regarding Computing by Sex (One-way ANONA)

Question	Female	Male	Diff.
1. I get nervous when using a computer	2.39	2.05	0.34*
2. I avoid using ATM machines – I prefer going to a teller	1.79	1.85	-0.06
3. I enjoy computer games	3.65	3.93	0.28**
4. Computers don't like me	2.23	2.04	0.19
5. I can program a VCR	3.82	4.37	-0.55**
6. I enjoy doing puzzles of various kinds	3.58	3.43	0.15
7. I get nervous when learning new software	2.98	2.59	0.39**
8. I like speaking in front of groups of people	2.48	2.48	0.00
9. I do well in math courses	3.17	3.22	-0.05
10. I do well in writing courses	3.67	3.43	0.22*
11. All things considered, I enjoy using computers	3.67	3.87	-0.20*

Note: * = statistically significant at .05 level ** = statistically significant at .01 level

The differences, however, are not great and certainly less pronounced than male-females stereotypes would suggest. This may be an instances of a finding that is "statistically significant" due to the large sample size, but not very important. Curiously, males report enjoying computer games more than females, while females prefer doing puzzles.

Implications for CIS 101

Spectrum of Backgrounds Is a Challenge

The findings point to the challenge of effectively teaching student cohorts with widely varying skills and knowledge about computers. Two changes have taken place in recent years that have led to fewer computer majors being waived out of the CIS101: (1) students have had less programming experience in high school, and (2) with the inclusion of Visual Basic and production of HTML pages, the course has grown more attractive to students. Thus, the diversity of skills among students is even wider that it once was.

Lack of Computer Phobia Offers Opportunity

The generally positive attitude toward technology -- perhaps a cultural norm these days -- should provide an excellent opportunity to engage students in skill development. We have used this, along with the expectation that they will be using computing in their careers, to motivate students. The finding that 65% of students claim to enjoy using computers means that even with this being a required course, students believe that they will make some or considerable use of computers in their careers. Indeed, many students become eligible for attractive computer-related cooperative education positions with just the background that CIS101 provides.

Awareness of Current Events Weak
It was a surprise to the authors that so few students had heard of the Year 2000 Problem. Our work in class indicates that using current events can be a powerful strategy. We feel that the examination of ethical and societal issues that surround information technology is fundamental to the course. However, we may have to imagine the viewpoint and habits of people who do not read newspapers or listen carefully to the news.

Conclusions

In general, we can conclude that our students are quite a diverse group, which nevertheless is mainly rather positive and confident in its ability to deal effectively with computers. We believe that computer educators should capitalize on the positive student attitudes regarding the importance and benefits of information technology to the individual and society. The findings reveal that students value the conceptual knowledge of the computer field as much as the development of skills in specific applications. This means that instructors must be creative in their approach to delivering material, but the prospects for positive results are good.

References

[1] Meyer, Jeanine. "Thoughts and Experiences on Multimedia Education." Technical Report, Number 92. School of Computer Science and Information Systems, Pace University, New York, February, 1996.

[2] Meyer. Jeanine and Stuart A. Varden. "Teaching Hypertext Markup Language in the First Computing Course: One University's Experience." Proceedings of the Thirteenth Information Systems Education Conference (ISECON'96), DPMA Education Foundation, St. Louis, MO, October 18-20, 1996, pp. 33-37.

[3] AITP. "IS'97: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. Park Ridge, IL, 1997.

[4] Caouette, Judy and Charles Lutz. The Status of Model Curricula Development: A Look at the Efforts of ACM, DPMA, and OSRA." Technical Report, Number 105. School of Computer Science and Information Systems, Pace University. New York, October, 1996.

[5] Heslin, Alexander, Jr. "Exploring the Myth that the Gender Factor is a Significant Determinant of Performance on Computing Courses at a Four-Year College." Proceedings of the Thirteenth Information Systems Education Conference (ISECON'96), DPMA Education Foundation, St. Louis, MO, October 18-20, 1996, pp. 156-160.

Improving Communications Skills In IS Majors: An Innovative Method of Teaching Traditional Content

Brian D. Janz
Steven M. Zeltmann

Fogelman College of Business & Economics
The University of Memphis
Memphis, Tennessee 38152
(901) 678-4156

Abstract

IS professors at the University of Minnesota have developed a systems analysis and design course which emphasizes the mastery of communications skills in conjunction with the learning of systems development topics [2]. In this paper we review that work, and report on our experience in presenting our version of the course to masters students at the University of Memphis.

Introduction - The Need for Communications Skills in IS Graduates

Employers frequently identify good communications skills as a most desirable capability for new-hires. Unfortunately, one of the most often heard complaints of IS majors relates to the inadequacy of their communication skills. It is not uncommon for IS departments, consulting companies, and computer vendors to recruit non-IS majors for this reason. Bright IS students can be overlooked in favor of students of other disciplines who have demonstrated good interpersonal and communications skills. When asked why this is the case, recruiters indicate that the ability to communicate effectively is a critical skill in their organizations, and that the interpersonal skills possessed by their candidates are fundamentally more important than the technical skills possessed by IS graduates. Many recruiters believe that technical deficiencies possessed by their newly-hired employees can be overcome in training programs, whereas deficiencies in the ability to communicate effectively present a much larger training challenge. This is consistent with recent literature which reports that of all skills, the following are the most sought after by employers [1]:

- listening and oral communication
- group effectiveness: interpersonal skills, negotiation, and teamwork
- adaptability: creative thinking and problem solving
- personal management of career development.

We believe that IS educators can and should address these needs. We also believe that an IS course designed with these needs in mind can provide a more salient learning experience for some of our traditional IS topics while fostering improved communications skills in our students.

Technical Training Versus Communications Skills?

IS educators are under increasing pressure to provide more and more technical training to insure graduates possess current skills. At the same time we need to address communications deficiencies in our students. What are we to do? We suggest that one or more redesigned courses in IS can address both concerns and result in a superior learning experience for our students. We have been involved in a project to achieve advances in interpersonal communication skills and teaching effectiveness in parallel with material covered in the traditional IS curriculum. We have initially focused our efforts on one masters-level IS course. Rather than relying only on traditional lectures, quizzes, exams, and term papers (all of which typically focus only on technical course content), we have added elements in our course which address process along with content. It is the process portion of the course that we feel adds a unique (and critical) component to our students' education. The process portion stresses to students the importance of being able to identify when the application of the content is appropriate, and how to communicate the content effectively to both IS and non-IS people.

In addition to reading assignments from textbooks and journal articles, students study from a text which provides a discussion of fundamental communication models [3]. The rationale for why and when to use the models, as well as a discussion of how to use them is included for the following communication challenges:

- effective explanation
- resolving doubt

- responding to questions or confusion
- dealing with indifference
- handling conflict and overcoming objections
- asking questions to uncover more information
- responding to supportive comments and gaining agreement
- bringing communication to an effective close
- the importance of non-verbal communication (i.e., body language)

Practice in the use of these models is through the active learning method of role-playing.

Active Learning Through Role-Playing

Learning is not a spectator sport. Active learning helps students apply process skills to their daily lives and prepares them for future jobs. Role-playing is an effective active learning method for the following reasons [3]:

- students practice what they've learned
- principles from the course can be illustrated
- students develop insights into human relations issues
- the role plays provide a concrete basis for follow-on discussion
- role plays arouse and maintain interest

We have found that many students are not familiar with the concept of role-playing, and are initially uncomfortable with role-playing. Therefore, it is most important to thoroughly explain the concept of role-playing, and to practice role-playing early in the class. By doing so, students gain an understanding of the purpose for the teaching method, understand that role-plays are not just an academic exercise, and better understand the value that we as instructors place on the teaching method.

Role-Play Scenarios

Our role-play topics consist of common IS business scenarios. A student team might be meeting with a financial VP, CEO, CIO, an end-user, fellow programmer or whoever is appropriate for the topic situation. Student teams are assigned the roles of systems analysts, applications developers, outside technical consultants, outside managerial consultants, etc. The teams are given an objective to explain, persuade, or overcome objections to a particular problem. Some examples of problems or issues include: how to convert existing legacy applications to a client-server environment; what information architectures are, and why they are important; or how end-users might participate in prototyping or rapid application design. The students are expected to communicate (using the communication models from the text) the technical course content they have studied from their assigned readings as appropriate for the particular role-playing scenario. This type of exercise requires the instructor to assume different roles, and feign ignorance of the material to force students into explanations. Students are required to communicate their position based upon good rationale and logic as opposed to saying, "According to the text book, it says that...," or, "According to article X that we've just read..." Students must be able to develop an argument for someone who will debate the issue with them.

The scenarios created as well as the act of role-playing can cause a great deal of intensity, excitement, stress, and amusement for all members of the class. This is generally good. The intensity generated by role-playing helps to increase the effectiveness of learning. Major "faux pas" made by the students are especially effective for generating "teachable moments." It is stressed heavily in class that mistakes are common in role-playing, and that it is better to make mistakes during the role-play, rather than on the job later. Following this discussion, the role-play is backed up and replayed. In addition to these discussions in real time, a short discussion follows each role play in which both the content and process of the team is analyzed.

If possible, role-plays should be videotaped. Videotaping allows students to review the role-plays between class meetings and assess their performance. This is an especially effective form of feedback since students become their own critics on issues like body language, unusual mannerisms, the manner in which they present their ideas, etc. An additional benefit of videotaping is that it provides a chronicle of each student's progress in communicating effectively. The improvement in the students' communication abilities between their first and last role-play is often dramatic.

Motivation and Evaluation

A purpose of traditional testing is to motivate students to study class material. In the case of role-playing, students are potentially more motivated to study the material because they know that they will have to demonstrate knowledge in front of their peers. Grading consists, in part, of students conducting a peer evaluation of each session's role-playing teams, as well as a self-appraisal by each team. The class evaluates each role-player in terms of content and process. At the end of each class, each team that conducted a role-play is then ranked by the class. Self-appraisals require each of the members on the team to rank each of their teammates in terms of their preparation and contribution to the team performance. All evaluations are anonymous, and scores (in aggregate only) are shared individually with each student at the next meeting of class.

Student Responses to the New Course Design

Our first implementation of the course concept described above is in our masters-level *advanced* systems analysis and design course at the University of Memphis. This course was chosen for our first implementation, in part, because every student has successfully completed the required masters-level SA&D course. Each student in the class is in a good position to directly compare the two classes – the initial class which was taught along traditional lines with a content focus versus the second class taught as described in previous sections of this paper. Preliminary student responses have been positive; however, it is important that the students both experience the complete course, and respond anonymously to our survey instrument. Accordingly, we gathered our data in April for report in this paper.

Survey Instrument

Our survey instrument is attached at the end of this paper. The instrument measured substantially beyond the typical questions asked of students at the end of classes. One substantive difference is that a direct comparison was made with the previous class. We also elicited significant input with regard to the process component of the class including its effectiveness in both teaching communications skills *and* content knowledge.

Survey Results

We had seven responses from our survey. Here we report the means and standard deviations for each question. The text of each question can be found in the survey instrument attached.

Question Number	Mean Response	Stand. Dev.
Part 1		
1	3.57	0.75
2	3.57	1.21
3	4.29	.082
4	3.86	.075
5	3.86	1.55
6	3.57	0.75
7	4.29	.075
8	3.43	1.22
9	3.83	.098
10	3.83	.075
11	3.67	.052
12	3.00	1.26
13	4.00	.063
14	4.17	.075
15	3.50	1.38
Part 2		
1	1.33	.082
2	2.00	1.10
3	1.00	0.00
4	1.33	0.52
5	1.17	0.41
6	1.17	0.41
7	2.67	0.82
8	2.00	0.63
9	1.33	0.82
10	2.67	0.52
11	1.50	0.84
12	1.33	0.82

Brief Analysis of Responses

Overall students found role play to be an important contributor to their learning in the class. Note that the response to question 3 was very strongly in support of role play contributing to perceived relevancy to student careers. This result is supported by the responses to questions 4, 5, and 6 in part 2.

Question 10 in part 2 was one of our 'bottom line' questions – "I would have preferred a traditional lecture class". Clearly the class preferred the role play component to the class.

Notes

[1] ASTD. (1988). The Skills Employers Want. American Society for Training and Development.
[2] See Wetherbe, J. C. and Janz, B. D. (1994). Reengineering to Reality: A Parallel Processing approach to Achieve Communication Skills for IS Majors Without adding a Single Course, Journal of Education for MIS, 2(1), 5-24.
[3] Wetherbe, J.C., & Wetherbe, M.B. (1993). So What's Your Point? Minneapolis, MN: Mead Publishing.
[4] Refer to Wilbert McKeachie's, Teaching Tips: Strategies, Research, and Theory for College and University Teachers, ninth edition. Lexington, MA: D.C. Heath and Company, 1994.

Role Play Survey

Please respond to the following questions about your experience with the *role play component* of this course. Your responses are and will remain anonymous. Accordingly, your responses cannot and will not affect your grade in any way.

This survey is being administered to evaluate role play as a teaching method, NOT to evaluate your instructor. This survey is not related to the SIRS evaluations, and will not be considered in any evaluation of your instructor.

PART 1

The following questions ask you to choose between traditional lecture and role play in your response as follows:

1 strongly favor traditional lecture in answering this question
2 somewhat favor traditional lecture in answering this question
3 indifferent between traditional lecture and role play in answering this question
4 somewhat favor role play in answering this question
5 strongly favor role play in answering this question

Sample

	traditional lecture		same or indifferent		role play
Noise in the classroom is most noticeable during	1	2	3	4	5

Circling a "1" (or "5") would indicate that you believe noise is clearly more noticeable to you in a traditional lecture (or role-play based class); a "2" (or "4") would indicate that you believe noise is somewhat more noticeable to you in a traditional lecture (or role play based-class); a "3" would indicate that you notice noise to the same extent in either environment.

Survey Questions

NOTE: The survey questions are reproduced in the right column without a response scale. In the actual instrument each question was provided with the response scale above.

1. Learning of course content is best reinforced by	1	2	3	4	5
2. I will most likely remember material presented by	1	2	3	4	5
3. Learning most relevant to my career occurs during	1	2	3	4	5
4. I am most motivated to learn during	1	2	3	4	5
5. I am most attentive during	1	2	3	4	5
6. A class is most meaningful to me during	1	2	3	4	5
7. A class is most interesting to me during	1	2	3	4	5
8. My class time is best spent during	1	2	3	4	5
9. My educational objectives are best met during	1	2	3	4	5
10. I improve competence in job skills best during	1	2	3	4	5

11.	Learning of course content is best clarified by	1	2	3	4	5
12.	I am most comfortable during	1	2	3	4	5
13.	I enjoy a class more during	1	2	3	4	5
14.	A class is more of a challenge during	1	2	3	4	5
15.	I find learning is easier during	1	2	3	4	5

PART 2

The following questions ask you to state your agreement or disagreement with the statement. A 1 indicates agreement, a 2 indicates no opinion, and a 3 indicates disagreement.

agree	no opinion	disagree
1	2	3

1.	Role play has helped me master the textbook material	1	2	3
2.	I felt comfortable with role play early in the semester	1	2	3
3.	I felt comfortable with role play later in the semester	1	2	3
4.	I learned skills important to me during role play	1	2	3
5.	Role play helped me better interact with colleagues at work	1	2	3
6.	Role play helped me better interact with my fellow classmates	1	2	3
7.	Anticipating role play made me fear coming to class	1	2	3
8.	Role play motivated me to attend class	1	2	3
9.	Role play improved my satisfaction with this class	1	2	3
10.	I would have preferred a traditional lecture class	1	2	3
11.	I believe that my time was well spent during role play	1	2	3
12.	I would recommend a role play-based course to others	1	2	3

Implementation of the Communication Skills Program in an Upper-Level Computer and Information Systems Course at Robert Morris College

Charles R. Woratschek, Ph.D.
Robert Morris College
Coraopolis, PA 15108-1189
woratsch@robert-morris.edu

Abstract

This paper describes a new program at Robert Morris College called the Communication Skills Program; a 27-credit hour program designed to enhance the employability and advancement of graduates in a competitive job market by improving their communication skills. Specifically detailed are the problems encountered in designing, implementing, and evaluating this program in the upper-level Computer and Information System course Management Information Systems.

Background

Robert Morris College (RMC) is an independent four-year co-educational institution located in the greater Pittsburgh area. The college awards associate, bachelor and master degrees in business and other selected areas. The focus of the college always has been on the business disciplines. Currently, the programs leading to the bachelor of science in business administration (B.S.B.A.) degree are in the fields of accounting, aviation management, business teacher education, communications management, economics, finance, finance-economics, health services management, hospitality management, human resource management, long-term health care management, logistics management, management, management information systems, marketing, nursing and managed care administration, operation management/decision sciences, and sports management.

Beginning with the Fall 1995 semester, Robert Morris College implemented a Communication Skills Program to enhance the employability and advancement of its graduates in a competitive job market by improving their communication skills. The Communication Skills Program (CSP) is a 27-credit hour program, comprised of five courses within the first 63 credit hours of study and four designated courses in the disciplines during the remaining years of study. The courses emphasize these areas: 1) reading and interpreting a variety of texts, 2) writing, 3) speaking and making presentations using appropriate software support, 4) listening, 5) developing skills in cross-cultural and multicultural group dynamics and 6) applying rhetorical skills to the discourse of each discipline.

The Courses

In Communication Skills Courses I - V students explore reading, writing, speaking, presenting and listening in terms of a unifying theme -- audience. Each course treats audience in an increasingly complex way. All Communication Skill Courses I - V are taught by Communication Department Faculty. These courses are taught in specially designed communication skills classrooms which are equipped with a full-color projection system, a document camera, a microcomputer, a VCR, dry-erase boards, wired and wireless microphones, a wireless mouse, a camera, a CD/Cassette recorder/player, and conference tables with computer access and telephone ports. Word Processing and Presentation software competencies are required to complete these courses.

In addition to completing Communication Skills Courses I - V, the student is required to complete four designated communication intensive courses in the disciplines. These courses are existing junior- and senior-level courses that must achieve normal course goals and incorporate communications goals building on the objectives of Courses I - V. The goals for Communication Skills Courses VI - IX are:

1) Skills for Critical Reading, Research and Thinking

   Students demonstrate their knowledge of and ability to analyze self-concept and explore its impact on communication; the effectiveness of their own and others' communication strategies; the source of communication problems, including cross-cultural misunderstandings, apply and analyze the principles of audience analysis to a variety of audiences and situations in order to determine the appropriate communication strategies; and perform sustained library research using both print and electronic sources for in-depth projects such as case studies, critical essays, and reports; select appropriate media for communicating with others, including intercultural audiences;

2) Skills for Communicating

Students demonstrate their knowledge of and ability to apply analyze, and evaluate communications appropriate to their disciplines or professions and develop strategies for resolving communication problems, including cross-cultural misunderstandings; create communications that are clear, coherent, and logically sound; demonstrate a command of standard written and spoken American English, including accuracy in spelling, grammar, and pronunciation; prepare all writing necessary for job searches including resumes and letters of application, and conduct themselves effectively during the interviewing process; use appropriate computer software and other electronic media to create professional reports and presentations, including illustrations and visual aids and use computer software to create appropriate support material for presentations; and

3) Skills for Communicating in Groups

Students demonstrate their knowledge of and ability to apply communication principles that underlie group problem solving and decision making; apply principles of leadership to motivate groups to achieve organizational objectives; apply strategies for managing apprehension, aggression, and conflict in group interactions; apply strategies for negotiations in group interactions; and participate appropriately in all kinds of professional groups.

The Challenge to Design Communication Skills Courses VI - IX

Because Communication Skills Courses VI - IX already exist as courses in the college curriculum, each department of RMC was asked to pick two junior - senior level courses in their discipline appropriate for incorporation of the communication skills. One or more full-time faculty members who taught the designated courses were then sent to a 15-week workshop, conducted by the Communication Department. The objectives of this workshop included generating strategies to incorporate the goals of courses VI - IX into the chosen courses, rewriting the department syllabus for those courses to incorporate the CSP goals into the courses, rewriting the student syllabus for the course, and generating a workable strategy to evaluate the students with respect to the CSP goals. The academic administration decided that class size in the communication-intense section of a course would be limited to 18 students and that 50% of the grade for the course would be based on course content while the other 50% would be based on communication skills. Needless to say, the debate that ensued over this decision was long and heated.

The workshop for faculty entailed: 1) selecting a practitioner in the field and surveying him/her as to the typical communications required in the field, 2) various presentations and activities on active learning, speaking, grading communications content, listening, critical reading, identifying audience, cultural differences, individual versus group activities and using support technology. The end-result of the workshop was to generate a document which included: 1) the name, rational, description, course content objectives, master teaching syllabus, student syllabus and assignments for the chosen course; and 2) the rewrite of the chosen course incorporating the CSP objectives and goals and the evaluation methodology of those CPS objectives and goals. This document was then reviewed by a college-wide Steering Committee. Approval of this committee was necessary to offer the chosen course as a Communication Skills Course VI – IX.

Courses VI – IX in the Computer and Information Systems Discipline

The Computer and Information Systems department at RMC offers a B.S.B.A. in Management Information Systems (MIS). The department chose three courses for the CSP: 1) CI-310 Management Information Systems, 2) CI-360 Systems Analysis and Design, and 3) CI-490 Strategic Information Systems. All of these courses are required courses for the B.S.B.A degree in Management Information Systems.

The incorporation of the CSP into computer courses posed a unique challenge for the department. The courses are already content- and software-rich. Attempting to add any objectives seemed impossible – there already was not enough time in a normal semester to accomplish all of the course objectives and now communication objectives needed to be added. First thoughts were that course content would suffer for the sake of the communication skills objectives. Those thoughts turned out not be true. This paper will discuss and illustrate some strategies developed for the Management Information Systems as one course that successfully interleaves the course content objectives with the communication skills objectives.

CI-310 Management Information Systems

CI-310 Management Information Systems is a junior-level course offered by the Computer and Information Systems department. It is required of all students in all majors who are studying for the B.S.B.A. degree. The catalog description for the course is:

> ***CI-310 Management Information Systems*** provides the student with an integrated perspective to the technology and techniques that can be utilized to provide information needed to support the operation and management of a business organization. The course involves both theory and practice, with the following concepts addressed: the role of information and information systems in operating and managing the business; systems theory; technology used to store and process information; and the techniques to design, develop, and implement information systems. Practical problems and case study techniques will be used to support strategic, tactical and operational decision-making; implementing systems, such as decision support systems; and planning, utilizing, integrating, and managing the information resources within business and other organizations.

The course is offered as a lecture/discussion course with a weekly laboratory. Students present to their peers a case study that demonstrates a real world illustration of course content. Additionally, students complete spreadsheet and database case studies regarding Management Information Systems, Decision Support Systems, and Executive Support Systems. To rewrite this course to incorporate the CSP objectives, no course content or objective was altered; rather the lectures, tests and assignments were creatively redone in such a way as to incorporate the CSP objectives. Some examples of the changes are described below.

First, all students must keep five portfolios for the class: 1) spreadsheet assignments, 2) database assignments, 3) case studies, 4) group written class work, and 5) individual written work. These five portfolios are reviewed at the end of the term. Using spreadsheets and database assignments for the portfolios was based on the idea that these artifacts are a form of communication themselves; additionally, written memos, notes or detailed analysis regarding the spreadsheet/database content could be requested as another form of communication.

To meet the CSP objectives, the oral case-study required of all students was altered to become a professional presentation and team based. It now requires the use of presentation software along with a peer evaluation. The assignment in its original form and rewritten form are presented in Figure 1 and Figure 2 respectively. The cases assigned remain consistent between the new and rewritten form, only the directions were altered. Figure 3 is the peer evaluation sheet used in the rewritten case assignment.

Another change for the communication skills-intensive course was in the testing method. Rather than administer just multiple choice, true/false, and/or short answer examinations, the test contains group writing and the computer laboratory class time is used to complete this group writing. See Figure 4.

ORIGINAL CASE STUDY ASSIGNMENT

Case Study Analysis & Presentation (50 points)

Chapter	Description	Page No.
3	Can Sears Reinvent Itself?	88
4	Who is Responsible?	120
5	Bar Codes Become a Strategic Business Weapon	159
6	A Geographic Information System Adds Zest to Sonny's Bar-B-Q	192
7	Can Migration to a Relational Database Management System Help a German Home Loan Lender?	225
8	Goodyear Automates Its Sales Force	261
9	Unilever Tries to Unify World Operations	295
10	Curing Chaos At Methodist Hospital	332
12	Designing the Paperless Airplane	397
13	Zeneca Searches for Decisions	427

You have been assigned the CASE STUDY circled above. Please note that this is NOT a group project. For this assignment, read the case study, answer the accompanying questions in a written report (25 points) and present the salient points about the case in class on the day assigned (15 points). Turn in the written report to me for grading. Your class presentation can be NO MORE than 15 minutes. Exceeding this time limit, you will be penalized 1 point a minute or fraction thereof. Your presentation should be concise and clear and will be scored accordingly.

Figure 1 Original Case-Study Assignment

RE-WRITTEN CASE STUDY ASSIGNMENT

Assignment #1: Case Study Analysis & Presentation (50 points)

Your group (maximum of two (2) people) will be assigned one (1) of the case studies above. The presentation date for your case study will be assigned later, but as a rule of thumb it will be approximately the first class period after the specific chapter associated with the case is finished. For these assignments, read the case study, summarize the case and answer the accompanying questions in a group-written report (25 points). Your group is to make a presentation about the case in class on the day assigned (25 points). **Each person in the group must present** some part of the case in the **FRONT** of the classroom. This is a **PROFESSIONAL** presentation -- minimally appropriate dress and the use of PowerPoint are required. Your class presentation can be NO MORE than 15 minutes. Exceeding this time limit you will be penalized 1 point a minute or fraction thereof. Your presentation should be concise and clear and will be scored accordingly. In addition to my grading your group's class presentation, each of your colleagues in the classroom will also score your presentation. Turn in ONE group written report to me (individually written if working alone) for grading.

Figure 2 Re-written Case-Study Assignment

Reflecting Changes to the Course in the Master Syllabus

During the faculty workshop, a major problem surfaced concerning how to mix the course content objectives with the communication skills objectives and show this in written form in the master syllabus for the course being developed. To accomplish this, a matrix mix was used for each major topic in the course. Using subtopics as guides, activities were designed or taken from the text that would teach or reinforce the content of the subject matter but also involve one or more communication skills. The matrix was then built using the subtopics of the major topic being discussed as the column headings for the matrix and the communication skills objectives for courses

CI-310 Management Information Systems Speech Evaluation Sheet

Case Number ____________ Date ____________________ Evaluator ______________________________
Speaker's Names ______________ ______________

Please rate the speaker on a scale of 1 (poor) to 5 (excellent) for each of the following:

1. Appearance ________ ________
2. Clarity of speech ________ ________
3. Preparedness ________ ________
4. Use of aids such as: Overhead, video, etc. ________ ________
5. Overall professionalism ________ ________
6. Appropriateness to Designated Audience ________ ________

For items 7 through 10 please rate the speaker using the following scale:

Yes -- the speaker exhibited this trait, problem, characteristic
Some -- the speaker exhibited some evidence of this trait, problem, or characteristic, but not to an annoying degree
No -- the speaker exhibited no evidence of this trait, problem, or characteristic

7. "Reading" of the Speech ________ ________
8. Use of inappropriate words such as "and," "um," "but," etc. ________ ________
9. Use of hand gestures ________ ________
10. Looking at the audience ________ ________
11. How well did this group present the salient features of this case study? ______________________________
12. What grade (A -- F) would you give each of the members of this group? ______________________________

Figure 3 Peer Evaluation Sheet used in Re-Written Case-Study Assignment

CI-310 Management Information Systems
Examination 1 Chapters 1-3 Part II
Twenty-five (25) points

Assume that you and your team have been hired as consultants to Leitzerman Bus and Tour Company. This company is currently an entrepreneurship that wishes to become one of the major competitors in the bus travel business. Your team was previously assigned the task of studying the Greyhound Case on pages 56 – 58 of your textbook. Now, the owner of Leitzerman Bus and Tour Company has asked your team to prepare a formal written response to questions #3 and #4 on page 58.

Figure 4 Group-Writing Examination

VI – IX grouped became the row headings. The activities that involved a specific subtopic were then categorized according to the communication skills groups that they reinforced. An example of the matrix for the Management Information Systems course is shown in Figure 5.

Implementation of Courses, Feedback, and Problems

The communication-intensive sections of CSP courses VI - IX were first offered in the Fall 1997 term. A myriad of problems were identified: 1) faculty complained that the communications components required too much time, time that was better spent on course content; 2) the grading of the communication components of assignments was extremely time intensive; 3) hardware broke down in the communication skills classrooms and could not be repaired in a timely manner; 4) the computer center was flooded with more users than could be handled; and 5) students complained that the communication-intense sections were too much work, the classroom equipment didn't work, there were insufficient computers available to complete the outside class requirements, and that there was a tremendous difference in the material covered and amount of work among instructors teaching the same course.

Many of these problems were anticipated and originally discussed in the 15-week faculty workshop. Presently under discussion is a reduction of course load for faculty teaching a communication-intensive section of a course. This course reduction has both pros and cons in addressing the faculty complaints about teaching communication-intensive sections. Obviously, faculty resources are limited, but a reduction of course load usually means an addition of part-time faculty. The risk of having many of the courses in a major field being taught by part-time faculty must be carefully monitored and controlled.

CI-310 MANAGEMENT INFORMATION SYSTEMS

Topic 2: Information Systems Technology

COURSE SUBTOPIC \ / *COMMUNICATION SKILL GROUP* \	EVOLUTION OF I.S. TECHNOLOGY	STATE-OF-THE-ART COMPUTER HARDWARE	COMPUTER SOFTWARE	NETWORKS AND DATA COMMUNICATIONS
CRITICAL READING	1, 2, 3, 5, 8	1, 3, 5, 8, 9	1, 2, 3, 4, 7, 8, 9	3, 4, 8, 9
COMMUNICATING	1, 2, 3, 5, 8	1, 3, 5, 8, 9	1, 2, 3, 4, 7, 8, 9	3, 4, 8, 9
GROUPS	1, 2, 3, 6	3, 6	1, 3, 6	3

SUGGESTED ACTIVITIES

1. Will Pen-Based Computers Take Over? - Case Study (Written and group presentation to the class)
2. OS/2 or Windows? Toronto Dominion Securities Inc. and Delta Airlines Select Operating Systems - Case Study (Written and group presentation to the class)
3. Unilever Tries to Unify World Operations- Case Study (Written and group presentation to the class)
4. Write a one page abstract on a professional journal article.
5. National Nifty Nuggets would like to introduce computers into its order entry process, but feels that it should wait for a new generation of machines to be developed. "After all," Randy Racketeer the spokesperson for the company declares, "any machine bought now will quickly be out of date and less expensive a few years from now." As head of MIS, (lucky) you have been assigned the task to appear at Board Meeting of the Company this afternoon to present your views on this matter. Unfortunately, you've only been given two (2) minutes. Prepare your remarks.
6. Form a group with three or four of your classmates. Design an ideal "student desktop workstation." Clearly address input, output, storage, memory, processing capacity and software. Prepare to present your remarks orally in five (5) minutes.
7. All department heads of Wonderful Wondrous Widgets, Inc. are meeting this afternoon to discuss the ideal of replacing the current company programming language COBOL with a fourth-generation language. You have been elected to represent the programming department at the meeting because you are a real COBOL "fan." Prepare a list of ten (10) questions/issues/concerns to bring to the meeting.
8. Your firm, Various Variegated Veggies, Inc. has just decided to build a new headquarters building in a suburban setting. You have been assigned to work with an architect on plans for making the building intelligent -- that is, capable of supporting computing and telecommunications needs of the business. Prepare a bullet list of factors you feel need to be considered.
9. National Nifty Networks (your current employer) designs, installs and maintains networks for a multitude of different businesses across the United States. NNN has built its reputation as one of the leaders in the industry by providing excellent customer need analysis, cost effective designs and installations and top caliber service. Now a new challenge has been presented to NNN - develop a network for a very large junior high school. This project, which you are a part of, had been going very smoothly. Both the School Board and the PTA were very cooperative and decisive in regard to hardware and software they felt the students should be exposed to. They also believed that INTERNET capabilities should be provided. So far, the project is right on schedule and you felt confident that it would be completed on time and successful UNTIL TODAY..................................
It seems that the School Board President has called. The members of the PTA have heard all about the news story where two New York City junior high school students accessed the INTERNET from the school's network and learned how to make a fertilizer bomb. While the New York City junior high school students were apprehended before they could plant and explode the bomb, the PTA is having second thoughts as to the validity of providing students access to the INTERNET. The School Board President says that the School Board members are also having second thoughts. (Lucky) You have been asked to meet with the members of the School Board and PTA to present your views regarding the issue. Write a two -- five page position paper regarding this issue. Be sure that you include the issues of physical setup, monitoring, firewalls, and censoring software. You

Figure 5 An Example Matrix for the Management Information Systems Course

may provide any additional ideas that you have regarding security or any other pertinent issues.

COMMUNICATION SKILL GROUPS

CRITICAL READING & THINKING

Students will demonstrate their knowledge and ability to:

a. analyze self-concept and explore its impact on communication.
b. analyze the effectiveness of their own and others' communication strategies.
c. analyze the source of communication problems, including cross-cultural misunderstandings.
d. apply and analyze the principles of audience analysis to a variety of audiences and situations in order to determine appropriate communication strategies.
e. perform sustained library research suing both print and electronic sources for in-depth program such as case studies, critical essays and reports.

COMMUNICATING

Students will demonstrate their knowledge and ability to:

a. apply, analyze and evaluate communication strategies appropriate to their disciplines or professions for resolving communication problems, including cross-cultural misunderstandings.
b. create communications that are clear, coherent and logically sound.
c. demonstrate a command of standard written and spoken American English, including accuracy in spelling, grammar and pronunciation.
d. prepare all writing necessary for job searches including resumes and letters of application and conduct themselves effectively during the interview process.
e. use appropriate software and other electronic media to create professional reports and presentations, including illustrations and visual aids.
f. use computer software to create appropriate support material for presentations.
g. demonstrate self-confidence in these skills areas as related to their majors and their career goals.

Groups

Students will demonstrate their knowledge and ability to:

a. apply communication principles that underlie group problem-solving and decision-making.
b. apply principles of leadership to motivate groups to achieve organizational objectives.
c. apply strategies for managing apprehension, aggression and conflict in group interactions.
d. apply strategies for negotiations in group interactions.
e. participate appropriately in all kinds of professional groups.
f. demonstrate self-confidence in their applications of communication skills in professional groups.

Figure 5 An Example Matrix for the Management Information Systems Course (cont.)

The idea of having part-time faculty teach a communication-intense section of a course has been discussed. However, this strategy would only shift the source of the faculty complaint from a full-time to a part-time employee, and orchestrating consistency between the part-time and the full-time faculty with respect to communication skills objectives would be an administrative nightmare.

As with any program that relies heavily on computer and equipment resources, workable solutions to most of these problems have yet to be found. Requiring all students to have their own laptop computer has been discussed and strongly favored by the academic administration. While the idea has merit and has been successfully demonstrated at other academic institutions, RMC lacks the infrastructure to support such an undertaking. The fragility of the classroom equipment must be dealt with. Presently, the faculty must act as a watchful eye over this equipment, especially when students who possess less than a "gentle touch" are utilizing it.

The lack of consistency among instructors teaching the same communication-intense course is a huge problem. The author and his colleagues anticipated this problem. To avoid inconsistencies, a team approach was used to create the master and student syllabi, create a pool of appropriate assignments for each course topic and design the rubrics for the grading of student assignments. Regularly scheduled meetings, as well as impromptu ones, where ideas and problems are discussed and resolved are now an integral part of teaching a communication-intense course. Other departments at the college are now attempting to rethink and rebuild their communication-intense courses using this approach.

The C&IS department has plans to develop a quantifiable measure to compare the communication skills of a student who has taken CI-310 Management Information Systems as a communication intense-course with one who has not. Current discussion centers on a pre- and post-test instrument that would evaluate individual and group writing and video taping the case-study presentation given and comparing it with a presentation the student gave and recorded during Communication Skills courses I - V.

Despite the emerging trouble spots, it is believed that the communication skills program is a sound approach to preparing students for employment opportunities in the 1990s and beyond. It has educated faculty, administration and students to the needs of the business community for articulate communicators.

Delivery of a K – 12 Network Planning and Management Course on a State Wide Basis

Tom Farrell
Assistant Professor of Business and Information Systems
Dakota State University
Madison, SD 57042
Farrellt@columbia.dsu.edu

Abstract:

Because of the need for training of K-12 teachers in the area of computer network planning and management a course was developed that utilized a statewide interactive television network, video tape, and a concentrated hands on session. This mode of delivery presentation was additionally supported by extensive utilization of web pages and electronic mail. The need for this course was magnified by an initiative from the Governor of the South Dakota that utilized inmates from the South Dakota's prison system to wire all of the K – 12 schools within the South Dakota. The schools were left with the problem of implementing network systems using Windows NT version 4.0

The Need

K – 12 schools are recognizing the advantages and importance of networking computer resources within their schools. This is being prompted by several factors within South Dakota. One of the most significant advantages that networked computers are allowing K – 12 schools in South Dakota access to the Internet and electronic mail. Additional advantages of networking K – 12 computers include the ability to share resources, ease of managing software and users, security, printing and upgrading client systems.

In addition to the reasons stated above South Dakota's Governor William Janklow is a pro technology Governor and as a part of his continued commitment to technology he implemented a program whereby minimum security prisoners were used for wiring of the schools. With the schools wired there was an urgent need for planning and management of computer networks within the schools.

Course Design

The course was designed to assist the K – 12 teacher in South Dakota to plan and manage computer networks. The course was built around the fact that there would be wide variation in knowledge levels and the population of teachers taking the course would come from wide spread geographic areas within South Dakota.

The actual curriculum was modeled after an undergraduate class that was taught on the campus the preceding fall. This prototype for the course was taught in a traditional classroom setting and was supplemented with numerous hands on outside of class activities. The textbook also allows for the student to prepare for the Microsoft Certified Professional testing. The textbook that was adopted for the course was Hands-On Microsoft Windows NT 4.0 with Projects written by Michael Palmer and published by Course Technology.

It was the outside of class activities that initially provided the largest number of challenges in the planning process. There was no way those could be handled effectively at the remote sites. A resolution to the this problem was developed by having the students come to the campus an intensive hands on weekend experience that would begin on Friday evening and conclude Saturday afternoon

The RDTN System

In South Dakota there is in place and two way video and two way audio interactive television network that serves most of the larger communities. A decision was made that the course would be transmitted to five of those sites and made available also from the studio site on our campus. Because of the importance that the Governor of South Dakota attached to this project he intervened to waive the fees of $35.00 per hour per site that are normally charged for the use of these facilities.

Each week one of the sites was featured and was asked to introduce themselves to the remainder of the group. This facilitated better interaction once all of the students came together on campus and also increased an awareness of who was in the class.

The classroom for the RDTN studio is housed in the campus library and has front and back broadcast and remote monitors. It had a computer that was equipped as a NT server connected to the entire campus NT and Netware networks. An Elmo unit allowed for the projection of the computer image and for overhead projection of pictures, figures and the instructor written information. The RDTN system did require the instructor to modify instructional style as he is traditionally a roamer while teaching and utilizes all of the white board space available in the classroom.

PowerPoint slides were provided as a part of the instructor's support materials and were modified slightly They were placed on the campus network and were accessed from NT computer and projected using the Elmo unit.

The Video Tape Model

As would be anticipated once the night of the week and the RDTN sites were decided upon the conflicts began to develop. These conflicts were caused by community education teaching requirements, family schedules and distance from an RDTN site. A decision was made that all of the classes session would be taped and that no person would be excluded because of distance from an RDTN site or schedule conflict. This also simplified make up work for students with one time conflicts.

The RDTN studio is equipped with a video recorder that allows for the audio and the video portion of the class to be recorded. Once a class was over with the assistance of the library staff and the office of distance education the process of creating as many as 15 copies of the tape to be mailed out began. The process was usually complete within two days of the completion of the class. Priority U. S. mail was used for the mailing of the tapes and they normally took one to two days for delivery. A database was used for storing the student's mailing addresses and when a student required a tape to be mailed a notation was made for that week and a mailing label was generated.

Students returned their copies of the tapes and the tapes were used over. Some of the students using the video tape option opted to simply keep the tapes and replace them. There were even requests from students attending RDTN sessions to make the tapes available to them to assist with the material.

Promotion of the Class

Advertising and promotion of the class was handled by the College of Education utilizing participants from a U. S. West grant for technology and participants of the Governor's technology academy hosted on the campus the previous summer. Mailings were also sent to all of the South Dakota's school administrators. Word of mouth also proved to be an excellent medium of promotion.

The Website

As a means to assist with providing information to the students a website was developed. This website is found in appendix A and the address on the web is courses.dsu.edu/ced570. As can be seen it provides multiple links with information form the web as well evaluation activities.

On Line Internet Based Testing

Exams, quizzes and labs were created and placed on the website using FrontPage98. Each of the assignments was created as a form which allowed for electronic submission. Appendix B shows a sample of a quiz and appendix C shows a sample of a lab.

Hand's On Weekend

As stated earlier an important part of the course was that a hands portion of the course. It was the completion of the hand's on weekend that really brought all of the components of the course together. Complete details of the weekend are found in appendix D.

Evaluation and Future Implementation

This course was evaluated using the standard University evaluation procedure. Students were very complimentary of the course and the efforts of Dakota State University. Students reported that they would like to see additional work in the following areas:

- Web server
- Trouble shooting
- Trusts and Trusting relationship
- Proxy servers
- Exchange or other mail server
- E-mail
- Hardware / repair class

Suggestions for the future would be to offer an advanced class that would consist of one credit hour content specific modules that could be taught as a cumulative three credit hour course. This course would definitely require the use of extensive hands on components.

Plans are to also offer a repeat of this planning and management course preceding the advanced course.

General comments from students

Course definitely designed to meet an urgent need in South Dakota.

I appreciate the concern for the people's distance!

Need more hands on!

Thanks – looking forward to a follow up WAN course.

Thank you for being so flexible and allowing the use of the video tape! I truly enjoyed the class.

Access to software during this course would have been extremely helpful.

Access to a server at the RDTN site would have been helpful.

Hands on weekend very informative and helpful.

I really liked taking the course via RDTN.

This course was excellent. The timing was wonderful. Doing this in conjunction with my network going up was very helpful.

Twenty six of the participants strongly agreed and 12 agreed that the waiving the RDTN fees was a large factor in their taking this course. Sixteen of the forty-three participants had their districts pay for the class. Twenty six strongly agreed and fifteen agreed that the course increased their ability to complete technology planning for their school district.

"Teaching Telecommunications in the College of Business"

Dr. Ward Testerman
Computer Information Systems Department
College of Business
California State Polytechnic University, Pomona

Abstract

This paper examines a curriculum in Telecommunications that is taught in the College of Business in the Computer Information Systems Department. This is a unique placement for a strong program in telecommunications. The paper explores why this program belongs in the College of Business, the challenges of the operating in the College of Business, the advantages to the students and presents the program, emphasizing the telecommunications courses only. The content of each course is explored in some detail and the use of labs is identified and their use explained.

Background

The traditional approach to telecommunications in the university system is to teach telecommunications in either the Engineering or Communications Colleges, often at the graduate level. The more technical the program, the more it tends to be in the Engineering College. This placement deprives the student of the business and computer skills we feel they need to be most effective in a business environment. Our program was designed to provide the telecommunications field with entry level people who can be productive upon entry into the company. These graduates are not interested in the design of new equipment, as the engineering student would be, but are interested in the design and building of networks that are better built and more efficient to operate.

Placement of Our Program

We have chosen to teach a highly technical telecommunications program housed in the College of Business in the Computer Information Systems Department (CIS). This unique placement gives the student additional skills in the areas of Accounting, Finance, Law, Marketing and Management. In addition, the CIS Department requires the student to learn Object Oriented Systems Analysis, Design and Programming, as well as take courses in Interactive Web Development and classes dealing with CIS management. In the CIS Department, there are several options available to the students including the telecommunications option. The capstone course of our program is a project course that requires teams of students, from various CIS specialties, to complete a project in "real life" often with companies outside of the university environment.

The placement includes some challenges too. The biggest internal challenge is that the students are not required to have as much math as an engineering student would be required to have. This is handled by requiring more math-oriented courses in the student's elective courses in the curriculum and reducing the theory to application in the courses. In many cases, the student decides to voluntarily seek more math, either before or after graduation.

A second challenge in a College of Business placement is the lack of knowledge of our unique needs in the higher administrators and even in our own department. CIS receives equipment upgrades at the same rate as all other faculty and are limited to a single computer both in our offices and in the classroom. Support is needed to have at least two and possibly three computer in both the office (for practice) and the classroom (for demonstration). Labs, and offices, need to be upgraded more often than the usual College of Business lab. Telecom labs also need "hands-on", dynamic utilization where most other labs are static during the quarter/semester. There is also a problem receiving purchasing support for multiple network operating systems. Unless we purchase these additional resources ourselves, we fall behind quickly.

Another major challenge was in industry's bias in telecommunications toward engineering students. This has been somewhat mitigated by individual companies experimenting with our graduates and the performance of our students in the field. Once a company tries one of our students, they tend to seek us out when they have another opening.

Telecommunications Track Courses

The primary telecommunications courses in this option are Introduction to Business Telecommunications, Local and Metropolitan Area Networks, Wide Area/Voice Networks, Network Analysis and Design, and Network Management. The student can then select from two optional courses. The two optional courses are Wireless Networking and Multi-Vendor Networking. A student must take one of these courses but may select their second course from a selected list of CIS courses, appropriate to the Telecom Track, outside of the track. Each Telecom course will be discussed in more detail below. To fully cover this program would require far more time space than that provided. For that purpose, I have placed syllabi of all courses discussed below on the Internet located at www.cisdept.csupomona.edu/testerman/testerman.html.

Introduction to Business Telecommunications is a course that exposes the student to all aspects of telecommunications. It is designed to introduce the student to the Open Systems Interconnect (OSI) model as a basis for understanding the telecommunications process from message formulation through delivery and message acknowledgement. All media and hardware used in telecommunication is introduced and discussed in terms of strengths and weaknesses, when to choose one over the other and the cost components are contrasted. Protocols are introduced and discussed so the student can understand which protocols are in wide use and why. Connection vs. Connection-less networking and Dynamic vs. Static routing systems are presented. Network operating systems are discussed and the Windows 95 system is highlighted as a Peer-to-peer network operating system. We discuss the delivery and application systems using both TCP/IP and OSI terminology. Error recovery and security are discussed at their appropriate layers and we relate applications, such as e-mail and updating of distributed data bases, to the steps necessary to complete each task. This course is a required course in the College of Business and, because of the number of students, no extensive lab sessions are involved. The networking products are demonstrated in the classroom.

Local and Metropolitan Area Networks is mostly a LAN course with MAN technology discussed but not practiced. This course is "hands-on" in the LAN portion and the students do installation of at least a Windows NT or Novel NetWare server and workstation. Depth is greater than the first course and cabling, interface cards and network operating systems are addressed so the students get an extensive understanding of the choices and trade-offs between each component. Pricing of components and building of networks from these components is addressed and each student actively demonstrates their capabilities in the technology. We utilize a "hands-on" lab where our students demonstrate cabling, installation of operating systems and diagnosis of the network installation. Metropolitan Area Networks are discussed in terms of equipment and options available but the course does not have a "hands-on" MAN component at this time.

Wide Area/Voice Networks is a course designed to demonstrate the principles of wide area networking and the components used in wide area networks. While we do not have "hands-on" equipment at the current time, we are attempting to get a number of routers, etc., so we will be able to have some "hands-on" components in the future. All technologies are discussed including data, voice and multi-media; the demands each makes on the system; and the various transmission media and routing strategies available to meet these demands. This includes various forms of copper, fiber and wireless transmission technologies. Routing techniques and enroute timing are a major component of this course and includes discussions on connection vs connection-less trade-offs and data gram, packet switching and circuit switching techniques. Public vs. Private vs. Internet based networks are compared. This course covers the various applications that utilize WAN systems and the problems of integrating multiple application demands over a single network.

Network Analysis and Design is a course developed to teach the student how to analyze corporate and departmental needs in telecommunications and build networks to meet those needs. The student is involved in the analysis of requirements, designing to those requirements, building of a simulated system and analyzing the simulated system for modification. Simulation packages, such as ComNet, are used to allow the students to implement and analyze their designs. Lab exercises in this course include the use of simulation packages and costing packages. The RFP process is discussed and students complete an RFP project.

Network Management is a course designed to teach the student management principles tied to the management of the telecommunications resources. The student is introduced to management analysis concepts such as performance management, fault management, configuration management and security management concepts. Analyzing existing networks and developing methods to evaluate and improve their performance is covered in this course. The students use network tools such as Manage Wise, network meters and sniffers to evaluate the performance of local networks and make modification to their installation. SNMP and OSI Network management is compared. Students work in both teams and individually to complete their analysis. Security and firewalls are discussed and demonstrated. The class does utilize a telecommunications lab but only to analyze and tweak the networks already installed.

Additional Course Requirements include courses in Multi-Vendor Networking and Wireless Networking. The student may take both courses but both are not required. There are additional, non-telecommunications courses that the student may choose from but most students will take one of these courses.

Multi-Vendor Networking is a course in local area networking utilizing multiple vendors. Currently, the course covers integrating a Windows network with a NetWare network. The Windows network is NT4 based and has NT4 Workstations and Servers and Windows 95 Clients. The NetWare system uses Windows 95 and Windows for Workgroup clients. The students work in teams and install both types of networks and then connect the networks together. When routers are available, the networks will be connected through routers. Problems, such as security and robustness, of the multi-vendor network are both discussed and evaluated. Twisted pair and coax are both used so the student can see the advantages and disadvantages of each.

Wireless Networking looks at this newer technology in both the local and wide area implementations. This class looks at the equipment involved in wireless technology and various cable based solutions. Cellular technology is examined, as are microwave and laser technologies. We currently have no lab facilities to support a 'hands-on' component but we are looking at adding a wireless LAN "hands-on" component when we can acquire the resources, both technological and space availability.

Output of Our Program

The program described above has been in place for almost ten years. It has evolved from a four-course sequence into our current seven-course sequence. The content has continued to evolve in the same manner as the industry has continued to evolve. Our "hands-on" components have been added and increased over the years to help insure some experience for our graduates. One of the ultimate proofs of the viability of a program is how and where your students are employed. In the early years, our students had some difficulty getting their first job in telecommunications because of the bias toward Engineering. As more of our students were hired into organizations, the organizations were so impressed they have kept coming back to recruit our recent graduates. Our graduates now have little trouble finding jobs in the industry and are finding better jobs each year. Additionally, many have moved up into management positions in telecommunications. The report from the students has been that the industry is in serious need for their services. After working for as little as one year, many graduates are commanding mid 50k salaries. Those who participate in our Internship program make considerably more.

Conclusion

The program presented above is a tried and proven program in telecommunications. The challenges of teaching the program in the College of Business have been reduced and the need for our students is shown with the return of recruiters seeking more of our graduates. The program provides a wide base of business courses and computer information systems courses. It includes a base of general education courses to help round the graduate. The telecommunications courses are sufficient in depth and number to give the graduate a very healthy experience. The 'hands-on' components insure the graduate has been given the opportunity to install and evaluate networks before graduation. There is sufficient theory in our courses that the student understands the 'why' of telecommunications systems but the experiential component insures they understand the 'how' also.

Experimenting With Teaching Resources in Upper-level MIS Courses: Are They Helping?

Liang Chee Wee
Assistant Professor of Management Information Systems
Department of Economics and Business
Luther College, Decorah, IA 52101
Ph: (319)387-1338
Fax: (319)387-1088
E-mail: weeliang@luther.edu

Abstract: The purpose of this paper is to share how MIS faculty members at a small liberal arts college have experimented with using various resources in teaching upper-level MIS courses and to invite colleagues of other institutions who had similar success to share their ideas with us. In order to inculcate active learning in our students, it takes much effort to demonstrate that many lessons and teaching ideas can be found in various materials we encountered in our working environment. Through our experimenting with using these materials, we found our students to be more engaging in class. As faculty members, we have widened our scope as far as the pool of resources is concerned, and we are actually having fun teaching and learning with our students.

1. Introduction

In the spring of 1996, our interim president urged the faculty to consider several "Academic issues for the 21st Century," including (1) will our focus shift from how faculty teach to how students learn?, and (2) what will our 2005-2010-2020 curriculum need to look like? He strongly urged members of the Luther faculty and staff to begin active planning for the continued intellectual vibrancy of the College and its curriculum.

According to recent Carnegie Foundation surveys, the best American institutions in the eyes of both faculty and students are the selective liberal arts colleges. "In these institutions *all* members of the collegium believe they are important contributors to a community where they are respected ..." (Spitzberg, 1994, pp.302). How do we get our students to be active participants in their learning process? How do we make learning meaningful? How do we make teaching fun and rewarding for the faculty as well?

Current literature on teaching and learning abounds with articles and research demonstrating the need for both greater variety in teaching strategies and greater student involvement with the content. Research on the concept of "active learning" has clearly demonstrated that the more college students become involved with the education process, the more they learn (Wadsworth, Heoppel & Hassell, 1994).

We shall discuss our experimenting with some of the resources in two of our MIS courses below, and what observations we have derived.

2. Upper-level MIS Courses

Two upper-level courses, MIS 55 and MIS 62, are offered every year for our junior and senior students. MIS 55 has mainly junior students and MIS 62 is a senior-year course offered each fall semester.

The objectives of MIS 55 are: (1) to identify the forces of change in a global business environment, (2) to discuss the impact of changing paradigms, (3) to define the role of IT in business transformation processes, (4) to examine the impact of IT on organizational infrastructure and culture, and (5) to understand the characteristics and responsibilities of future MIS professionals. The course covers topics such as anytime, anywhere workplaces, business process redesign, delivering IT value in organizations, impact of new business and IT paradigms, organizational transformation, and information empowerment.

MIS 62 is part one of a year-long systems analysis and design course. The objectives are to understand the roles and responsibilities of a system analyst, to explore the systems analysis and design process, and to experience interactions with end-users. The course topics include the systems analysis and design process, how to manage meetings, and people skills. The second part of the course, offered in the spring semester, is more project-oriented.

The key question we ask ourselves frequently is: What can we do creatively to fulfill the course objectives with the students? Below we describe some ideas and resources we have used in both MIS courses.

2.1. Resources for MIS 55

One of the key ideas stressed in the course is that MIS professionals should provide quality service to our clients. We came across a book in a Barnes & Noble store, "Delivering Knock Your Socks Off Service" (Anderson and Zemke, 1991), which we felt is both fun to read and relevant to our need. It is definitely not a traditional type textbook. We encourage students to provide examples of good and poor services they have encountered in their lives as we go through the book. We discussed different facets of quality service once a week for about four weeks. Then we contacted several local business owners to solicit their views on such areas as their definition of quality service and their success and horror stories. The findings were then compiled and we compared we have read with what we found practiced in the local businesses. It was exciting for the students because they were able to connect what we read and what we experience in our lives.

The MIS faculty attended a project management workshop over a year ago and we came across the "The Management Advantage" tape series (Nightingale Conant Corp.). The speakers featured were Tom Peters, Brian Tracy, business executives, and faculty from top business schools. Topics presented include fostering innovation in employees, using conflict as a positive force, career management, preparing your firm for the 21st century, goal setting, creating quality for customers, corporate ethics, presentation skills, flexible workplace, strategic planning, and negotiation skills. There were 12 tapes and students were required to listen to one tape each week. The tapes are placed in the reference area of the library for easy access. Instead of reading multiple books, which was not feasible given what we wanted to do in a semester, or listening to MIS faculty lecturing on all topics, these tapes introduce topics in a concise manner through a different delivery medium to our students.

We have also relied on several print media for up-to-date examples of managing MIS issues in organizations. The ComputerWorld's Leadership Series is an example. Articles we have shared with our students include "The Hidden Traps of IT Transformation" (10/21/96), "A Better Way to Buy IT Through IS/Line Cooperation" (8/18,1997), and "Ten Steps For Success for Line As An IT Leader" (7/21/97). ComputerWorld's supplements such as E-Commerce and Intranets have come in handy for class discussions as well. These articles enabled both our students and us to keep up with MIS trends.

Various weekly columns in the Wall Street Journal, written by Sue Shellenbarger, Hal Lancaster, Thomas Petzinger, Jr., Walter S. Mossberg, can provide interesting topics of discussion as well. A recent article, "Nurses Discover The Healing Power of Customer Service" (2/27/98), discusses how "when scarce resources create conflicting demands, the interests of the customer provide the largest space on which to seek common ground." Another article last year dealt with hotdesking issues, "Cisco's Staff Conquers Separation Anxieties After Losing Desks" (2/21/97). These articles gave valuable insights into practices across industries.

We have also involved our College's IS staff in our course. We invited our CIO to visit with the class to discuss the different stakeholders and political, social, and cultural issues he has to deal with in his position, and how decisions are made regarding IT resources on campus. Our library and IS department were merged recently and so the CIO shared the rationale behind the organization and management of the Library Information Services (LIS) department also. The students became better informed about the various factors to consider when limited resources meet unlimited demands from faculty, staff, and students.

In order to help our students appreciate the diversity of people in their future work environment, the class participated in the Myers-Briggs Type Indicator test. We requested help from trained staff from the Career Development Center and Student Support Services to administer, score, and explain the test results. It was an eye-opening experience for the students to see the various "types" found in their class alone. We always emphasized that tests like the MBTI are not and should not be used to "box" or label a person. They are meant to illustrate the need to understand the tendencies in all of us when we are put in different situations. It also demonstrated that individuals should to be less quick to judge others who might not think or act the way they do.

2.2. Resources for MIS 62

Today, organizations and industries are moving toward work teams rather than discrete job assignments.

Are our students learning the non-technical skills of a job which will maximize their performance in such a work setting? Are we effectively providing learning of key cognitive skills such as the ability to communicate effectively and to solve problems and seek solutions? A few of the critical, non-technical skills reported by ComputerWorld recently were: managing IS customer expectations, IS customer service, earning a partnership role with IS clients, active listening, adapting to and managing change, and cooperation and collaboration (Vitiello, 1997).

When we discuss the importance of active listening skills, Diane Bone's practical guide came in very handy. The guide book was a concise and direct way for the students to assess their listening skills. The exercises were useful, fun, and do-able within the class period. Again, the Wall Street Journal came in handy too. An article by Cynthia Crossen, "Blah, Blah, Blah: The Crucial Question For These Noisy Times May Just Be: 'Huh?'" (7/10/97) noted that "many more mouths are operating today than ears."

One of the topics discussed and practiced in this course is conducting effective meetings. We found that "How to Make Meetings Work" (Doyle and Straus,1976) is a very helpful resource for our students. It was very interesting to see how they "meet" at the beginning of the semester when divided into groups for accomplishing tasks before reading the Doyle and Straus book. We spent about 5 weeks, once a week, discussing the various facets of effective meetings. It was amazing to see how the students put the ideas from the discussion to practice. We also sensed that the meeting took on a more serious tone when the meetings were better managed and participants' roles were better defined.

Project management is obviously important in this course. What are some of the issues facing project managers in the business world? A series of ComputerWorld articles provided current data and information: "Why We Build Systems That Users Won't Use" (9/15/97), "Captain of Crunch" (10/6/97), "Project Management Top Gun" (10/20/97), and "Beyond ROI" (10/27/97). Furthermore, IS recruiters from John Deere & Company also provided useful information on request for proposal (RFP) pertaining to their projects (NewsBytes, 1997). And one of our students who had an internship with Metronics, Minnesota, invited her manager to discuss the vendor selection process with the class.

When we were discussing the values and mission of IS professionals, the IS recruiters from John Deere & Company, Moline, IL, also shared their recently adopted "Vision, Mission, Values, and Principles" document with the class. (CIS Division, 1997).

Besides involving our CIO, our network manager was also requested to make a presentation on networking issues pertaining to our College. One of the current issues on campus is networking of the dormitories. The network manager's presentation provided the students with a better understanding of the current network infrastructure and what the challenges and opportunities were for further expansion. A few of the students were interested in seeking a career in network management and so the role, training and qualification requirements, and responsibilities of a network manager were also discussed.

To enable our students to experience working with IS users, we solicited volunteers from our colleagues in other departments. Eight volunteered and each was assigned a two- to three-student group. The exercise lasted for eight weeks and the students were required to identify the computing needs of the users and support them the best they can. One group supported the Classics department in setting up a multimedia software for interactive use in the classroom. Two of the problems they ran into were the memory size of the hardware and the accessibility to the hardware. They were also responsible for training the Classics faculty on how to use the software. Managing and prioritizing users' needs was a challenge for all the groups. Every group was required to share their experiences with the class so that all could see that there was no one right way to support a user.

3. Conclusion

It is fascinating how many resources are available for MIS faculty to take advantage of in our working environment. From our positive experiences with the resources discussed above, we no longer rely solely on "traditional" textbooks and materials. Nowadays, it is exciting to scan the other resources and find relevant materials to share in the classrooms. In our busy schedule as faculty, seeking resources enables us to both prepare for our classes and also to keep ourselves informed of current development in the business and IS world. These resources also serve as a benchmark to help us determine if we are emphasizing the appropriate topics in class. Also, are we preparing our students appropriately to accept the challenges in their professional careers; the IT Career section in

ComputerWorld is very informative about current and future IS needs and opportunities.

Finally, one of the unplanned consequences of using various resources is that we actually helped our students see for themselves that their environment is full of relevant materials. Hence, we help them to foster a desire for continual contact with various sources to keep themselves informed throughout their career. One of our graduates told us recently that the Wall Street Journal, which we use frequently in her class, is one of the publications she reads nowadays to keep abreast of developments in the business and IS world. And some students actually call our attention to articles they think are relevant for their peers; a student brought in an article about data and information management tools used by home health care clinical directors (Tidd, 1998) to share with her peers.

If colleagues from other institutions have similar success or ideas to share, we look forward to hearing from you or visit with you at the conference.

References

Anderson, K. and Zemke, R., (1991), *Delivering Knock Your Socks Off Service*, AMACOM, New York.

Bone, D., (1994), *The Business of Listening: A Practical Guide to Effective Listening*, revised edition, Crisp Publications, Inc., Menlo Park, CA.

CIS Division, 1997, *Mission, Vision, Values, Principles*, Deere & Company, Moline, IL.

Doyle, M. and Straus, D., (1976), *How to Make Meetings Work*, Jove Books, New York.

NewsBytes, 1997, *The Deere & Company Computer Operations Newsletter*, Deere & Company, Moline, IL.

Nightingale Conant Corporation, *The Management Advantage: Lessons from America's Top Business Schools and Executives*, with Tom Peters and Brian Tracy.

Spitzberg, I.J., Jr., (1994), *It's Academic: The Politics of the Curriculum,* In P.G. Altbach, R.O. Berdahl and P.J. Gumport (eds.), Higher Education in American Society, third edition, Prometheus Books, Amherst, NY, PP. 289-305.

Tidd, C., (1998), *From Data to Information: Management Tools for Home Health Care Clinical Directors*, Home Health Care Manage Prac, vol. 10, no. 2, pp. 1-10/

Vitiello, J., (1997), *Hard Facts on Soft Skills*, ComputerWorld, pp. 91-92.

Wadsworth, E.C., Hoeppel, J.R. and Hassell, R.K., (1994), *Prevention Across the Curriculum,* New Directions for Student Services, fall, no. 67, pp.53-64.

Computer Networks -- A Hands on Approach

Dr. Wayne C. Summers
Computer Science Department
New Mexico Highlands University
Las Vegas, NM 87701
(505) 454-3230
wsummers@nmhu.edu

Abstract

This paper describes two courses developed and taught at New Mexico Highlands University. The two courses are designed to introduce Computer Science and Management Information Systems students to computer networking. They include a large hands-on component to provide students with experience using and designing computer networks.

Introduction

"I hear and I forget, I see and I remember, I do and I understand."
This ancient Chinese proverb should be an axiom for most classrooms. Students respond better to technical courses if the course includes a large degree of hands-on experiences. The courses *Computer Networks* [11] and *Networking in a Business Environment* [12] are two such courses. To fully understand networking concepts, students need lots of experience with both networking hardware and software, otherwise they may remember some of the concepts, but not really understand them. *Computer Networks* and *Networking in a Business Environment* provide students with the necessary experiences to fully understand many of the computer networking concepts.

Course Background

IS'97.6 – Networks and Telecommunications is one of the recommended courses in the Information Technology Area of the IS'97 Curriculum. "This course provides an in-depth knowledge of data communications and networking requirements including networking and telecommunications technologies, hardware, and software." [3] Most Computer Networks courses involve a lot of theory with little practical experience [1] [2] [4] [5] [7]. Students generally complete the course lacking a full understanding of computer networks and how to implement them. This course uses homework, labs, and projects to provide students with experience with network hardware and software. Many of the homework questions involve research on different hardware and software products used in computer networking. All students are expected to complete a series of small hands-on lab assignments. These labs supplement the material from the textbook. Each student also selects either a real-world hands-on project. These assignments are structured to reinforce many of the concepts discussed in class and to supplement the material from the textbook. It is difficult to find a Computer Networks textbook that is current. New developments and technologies emerge rapidly in networking. White papers provided by several networking hardware vendors are distributed to provide currency to the course. Students are encouraged to use the World-Wide Web as a research tool to add currency to the course and use e-mail as a vehicle for submitting their assignments. Each student is also expected to read journal articles either from print media or the WWW and report each week by e-mail or to an online discussion group on their readings.

Homework

Homework assignments from the textbook, **Applied Data Communications** [6] have been customized to provide more hands-on experience for the students. Many of the homework assignments require students use the World-Wide Web and professional journals to research a variety of hardware and software components of computer networks. These assignments provide additional relevancy and currency to the course. The students are expected to answer the assignments by submitting their answers electronically. Those Internet URLs pertinent and useful to the other students in the class are included in the class notes document on the instructor's web site. Listed below are several of the homework assignments that the students are expected to complete.

1. Gather job postings for networking related careers. What types of technical and nontechnical skills are required? What are the salary ranges? Do all jobs require experience?
2. Gather advertisements or product specifications for modems of various types. What are the price ranges of these modems? What are the various modulation techniques employed by these modems?
3. Using a modem advertisement, write a technical memo to a nontechnically oriented manager explaining the features of the modem. Prepare a cost / benefit analysis and make a recommendation.
4. Draw a simple network diagram illustrating the network printing set-up on the computer lab's network. Be sure to illustrate the number of printers, number of user workstations, and whether or not the printer servers are dedicated.
5. Use recent web or print publications to compare the functionality of the latest versions of Netware, OS/2, Vines and Windows NT. List the strengths and weaknesses of each LAN network operating system and predict the future market direction of each.
6. Investigate and report on high-speed local area networking standards including Fast Ethernet, 100BaseVG, and other standards you may encounter.
7. Gather product literature on a variety of bridges and routers. Prepare a comparative functionality chart detailing the operational differences, as well as price differences.
8. Gather articles on ATM. Summarize the current issues on ATM, focusing on obstacles to widespread deployment.

Lab Assignments

Lab assignments have been designed to provide students with a variety of experiences using a variety of network hardware and software. The following is a list of brief descriptions of the different lab assignments. Each assignment can be completed either individually or with one classmate. Students are asked to select different partners for each assignment in order to provide a variety of experiences. Each student is expected to submit a report on the lab by electronic mail.

1. Students used a World-Wide Web browser to find information on a topic in computer networks. They briefly discussed what they found by e-mail including any URLs that they found.
2. One of the local Middle Schools had a Netday several months earlier and required small tasks be completed to finish the networking in the school. This included attaching RJ45 connectors to CAT-5 cable, installing several hubs, and inventorying the remaining cable and equipment. The class was volunteered to do this work and were asked to report on what they did.
3. Students were assigned two computers, one with Windows 3.11 and the other with Windows 95. They were expected to install two different kinds of network cards and connect the two computers to the campus LAN and download a file from a computer on the LAN. One of the network cards used DIP switches to set the IRQ and other settings while the other network card's settings could be set by software.
4. Students were asked to install Windows NT 4.0 Server on a computer. This required installing the appropriate drivers for the network card and the CD-ROM.
5. Another assignment involved administering a computer network server. Students were required to administer a Windows NT 4.0 Domain and answer a series of questions. To answer the questions, the students needed to use the Event Viewer, the Disk Administrator, and the User Administrator.
6. Students were asked to use several TCP/IP software tools to administer a network. The students were expected to answer questions using programs like **tracert, netstat, ping,** and **route**. One lab was completed on a Windows NT network while a second with completed using a UNIX network.
7. To expose students to a Novell Netware network, students were required to install a Netware 4.1 client on a PC.
8. The final lab assignment required that the students select one of the levels of the OSI Model and develop an HTML document that explains the function of the chosen layer, identifying any hardware and /or protocols that are associated with the layer. [This can be found at http://cs.nmhu.edu/osimodel/].

Projects

Each student is expected to select a hands-on project or a research paper. For a hands-on project, students are required to design a web document describing the results of the project and present an oral report to the class. Students selecting a research paper are also expected to design a web document and present an oral report.

Each semester that these courses have been taught, we have had several excellent opportunities for school computer networking projects. Two of the neighboring school districts have used the Netday model to network their elementary, middle and high schools. Different students were selected to assume the duties of Network Designer for each of the schools to be networked. The students are expected to survey the needs of the school, draw the network diagram complete with riser diagrams, and

produce a list of equipment needed for the school. The students are then expected to direct the networking of the school on the Netday. Other students in the class have an opportunity to volunteer to assist in the networking of the schools. This provided invaluable practical experience in computer networking. The students not only understand the terminology but also the functionality of the different components in a computer network.
Other projects include designing an advanced computer network for the Computer Science Department, installing a variety of Internet servers on NT and UNIX networks, and installing Novell's NetWare. Research paper topics include TCP/IP, Switching Networks and others.

Conclusion

The Computer Network course described above has become a very popular course among our CS and MIS students. Although the students complain that there is a lot of work involved in the course, they also recognize the valuable experiences that they receive in such a course. It is common that the students will comment in their electronic journals that they now understand what a CSU/DSU is or how a hub works after helping install the devices at a school Netday. They have actively participated in installing several different computer networks. Students completing this course not only understand the material from the textbook, they have hands-on experiences that further this understanding.

References

[1] **CSC130 – Intro Computer Networking/Data Comm,** http://www.dist.maricopa.edu/eddev/artic/96/csc/csc130.html, February 1998.

[2] Davie, H. and Muir, D., **Computer Communications II – Local Area Networks,** http://www.elec.gla.ac.uk/coursedb/1bws.html, February 1998.

[3] Davis, G.B., Gorgone, J.T., Cougar, J.D., Feinstein, D.L., Longnecker, H.E. Jr., **IS '97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems**, ACM, AIS, AITP, 1997, pg. 19.

[4] Drew, Steve, **SY11507 Introduction to Computer Systems and Networks,** http://www.cit.gu.edu.au/~rwt/bcommtech/icsn.html, February 1998.

[5] Erbschloe, Michael, *Optimizing University Education for Telecommunications Management*, **Telecommunications**, February 1996, pp. 55, 62.

[6] Goldman, James E., **Applied Data Communications,** John Wiley & Sons, Inc., 1995.

[7] Jones, Ray and Wright, Chris, **Data Communications and Networks,** http://idun.unl.ac.uk/~ex14jonesr/soc/units/co210/intro.htm, February 1998.

[8] Nguyen, Tin, **Computer Networks I course Information,** http://www.docs.uu.se/~nguyen/datacom.html, February 1998.

[9] Schlieve, P.L., **CECS 5460: Computer networks in Educational Environments,** http://www.cecs.unt.edu/faculty/schlieve/cecs5560.html, February 1998.

[10] Smith, Mark W., *Establishing a Hands-on Lab Approach for a Course in Local Area Networking with Emphasis on Problem Solving,* **Proceedings of the Information Systems Education Conference** (ISECON), Orlando, FL, October 1997, pg. 180.

[11] Summers, Wayne, **CS457/557: Computer Networks,** http://jaring.nmhu.edu/notes/cs457/intro.htm, June 1998.

[12] Summers, Wayne, **MIS420/520: Networking in the Business Environment,** http://jaring.nmhu.edu/notes/Mis420/, June 1998.

[13] Varian, Hal, **SIMS 250: Computer-Based Communications Systems and Networks,** http://info.berkeley.edu/programs/syllabi/node25.html, created – Oct. 16, 1996, viewed - February 1998.

[14] Zic, John, **COMP3331 Computer Networks and Applications Home Page,** http://www.cse.unsw.edu.au/~cs3331/, last modified – Feb. 2, 1998, viewed February 1998.

The Database Course in Information Systems Education: A Microcosm of the Dichotomy of Academic Curriculum and Industry Training

William I. Bullers, Jr., Anderson Schools of Management, University of New Mexico
Albuquerque. NM 87131, 505-277-4901, bullers@unm.edu

ABSTRACT

The "database" course is one of the cornerstones of Information Systems (IS) education. In the IS '97 Curriculum [1] the IS '97.8 course, Physical Design and Implementation with DBMS, covers topics such as data modeling, database models, CASE tools, and systems development using a DBMS. Software such as Microsoft Access may be used in a PC-based development environment and a SQL-based DBMS such as DB2, SQL Server, Oracle, or Sybase is commonly used in a client-server based environment. Their usage permit students to demonstrate their mastery of the design process acquired in earlier courses by designing and constructing a physical system using such database software to implement a logical design. Through such application of a DBMS, students are able to attain the "application" level, or highest level of competency described in the curriculum recommendations. While IS '97.8 specifically builds upon earlier courses in the curriculum, particularly Analysis and Logical Design, much of the content is covered within the confines of a 3-credit hour class involving 45 instructional hours. While these 45 contact hours may be augmented by another 90 hours of homework and laboratory project assignments outside of class, there are significant time constraints associated with delivering the database content required by IS professionals.

The database course is only one of seven to ten courses typically offered in an academic IS curriculum. However, it can serve as a microcosm for exploring some of the difficulties associated with attempting to provide a comprehensive education in a complex, rapidly changing field such as information technology (IT). The U.S. Department of Commerce report, "America's New Deficit: The Shortage of Information Technology Workers" [2] notes that the United States and other countries must make a concerted effort to retain and update the skills of today's IT workers in addition to educating and training new ones. Forecasts suggest that an average of 95,000 additional IT workers will be required in the U.S. alone for each of the next ten years, yet barely 25% of that number currently earn a bachelor's degree with such skills in a given year. Since IT is an enabling technology, this shortfall of supply relative to demand could have severe consequences for America's competitiveness, economic growth, and job creation. In response to this challenge IS educators must continue to develop academic curricula and industry training programs that provide the necessary education and training. Partnerships between industry, government, and educational institutions can help serve to guide this effort.

One such partnership under development at our university is strictly internal, but involves a collaboration between the academic IS and administrative IT departments. This effort is directed towards providing database education in two forms: (1) a typical IS '97 course in database for academic credit, and (2) continuing education courses in a variety of database areas. The academic database course is typically for students preparing to enter the IT profession as entry-level systems analysts, while the continuing education courses will be for IT employees making a transition from a mainframe, legacy system environment (COBOL, file, and network-based DBMS) to a client-server, relational database, CASE environment (Oracle DBMS and Oracle Designer 2000). The rationale for developing the continuing education courses is largely motivated by time and expense considerations associated with sending employees to vendor-led training in database development and implementation using CASE technologies.

Unfortunately, attempts to develop the user-tailored continuing education courses for Oracle database and Designer 2000 CASE development have been dwarfed in part by the enormity of the task. Just to cover database development in a CASE environment, Oracle Education for example, offers a suite of approximately twenty classes encompassing sixty 8-hour class days or 480 total contact hours. CASE training alone in Oracle Designer 2000 covers eighteen class days. At a cost of $300 - $400 per class training day the training bill for such a program

approaches $18,000 - $24,000 per employee. This training bill does not even include expenses for out-of-town classes, nor more significantly the opportunity cost of an employee attending class full-time for twelve weeks instead of performing productive work. Such time and fiscal expenses makes extensive vendor-led training programs prohibitive for many organizations.

This research aims to explore pedagogic approaches to dealing with the immensity of the topics to be covered in a field such as database development in a CASE environment. It attempts to balance the time, course, and instructor competency constraints of an academic IS curriculum with the time, expense, and content requirements of an industry IT training program. Joint vendor/academic programs (such as Oracle's Academic Alliance Program) in which a vendor's educational unit collaborates with an academic institute to offer classes for academic credit is one alternative that is explored. However, AACSB requirements for 80% course coverage by full-time faculty limits participation by many academic institutions in such a program. The identification of appropriate competency levels for each knowledge unit to be addressed in such a training program is also examined. Learning technologies for different levels of competency, different concepts, and different software tools will also be considered. Other issues to be examined include classroom vs. hands-on-lab approaches, individual vs. cooperative paradigms, as well as ideas of iterative presentation of classroom material (e.g., depth-first, breath-first). The IS '97 Curriculum provides some guidance for these pedagogic issues to be considered, as do various computer science and software engineering curriculum recommendations. Finally, literature describing industry/academe collaborations, partnerships, and chasms will be reviewed for ideas, as will research on database development methodologies and CASE adoption. Through such research we will attempt to provide some additional guidance on narrowing the dichotomy between academic IS curricula and industry IT training requirements.

References

[1] *IS '97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems*, Association of Information Technology Professionals, 1997.

[2] "America's New Deficit: The Shortage of Information Technology Workers", U.S. Department of Commerce Office of Technology Policy, 1997.

Too many topics, too little time: Integrating Computer Science Topics in an Undergraduate Intelligent Robotics Course.

Lisa J. Burnell
Texas Wesleyan University

Abstract

For Computer Science departments with few faculty members (2 or 3) and few students, curriculum selections require that some courses be left out. Making these choices is difficult, since CS students need exposure to a wide range of sub-fields within the discipline. One approach is to combine topic areas in a single course. However, in this approach it is important for the students to perceive the course as a coherent, related set topics, instead of a collection of disconnected modules. We have developed an undergraduate course that uses the task of developing intelligent robots to teach concepts from software engineering, artificial intelligence, computer design and other CS areas. This paper describes our motivation for developing the course, the course topics, early reports of our successes and lessons learned, and our plans for the future.

Introduction

Small school, small faculty, small classes -- some CS departments cannot offer the variety of courses they would like to in order to adequately cover the breadth of computer science. Selecting the proper curriculum involves making trade-offs and inevitably omitting some courses. Still, CS students need exposure to a wide range of sub-fields within the discipline. If the school admission policy is inclusive, rather than exclusive, it is important for students to gain additional practice in key topic areas of CS. One solution is to combine topics in a single course, a task that is difficult to accomplish well. It is important for the students to see how the various topics relate to one another. The right project-oriented course can achieve this.

We have developed an undergraduate course that uses the task of developing intelligent robots to teach concepts from software engineering, artificial intelligence, computer design and other CS areas (Figure 1). The basic design of the course follows a research-oriented, exploratory approach. Students have the opportunity to select from several project topics, all of which require that they develop the ability to do self-directed research (with support, as needed, from faculty). Instead of starting from scratch each time, students must learn how to use and adapt the work of other students -- a skill not often taught in traditional courses. The course is taught in a new advanced computing lab, which houses the robots, work tables, assembly equipment, and computers running Unix, Windows and NT. This lab is also used by other upper-level CS courses. The lab was created on a shoe-string budget of approximately $3000 and is housed in one corner of a Physics lab.

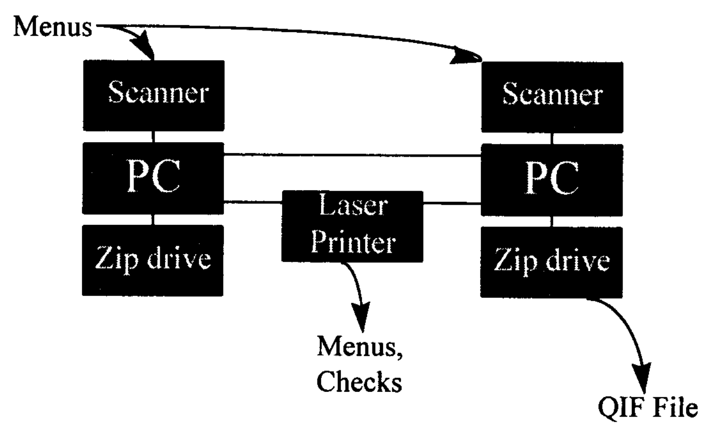
The primary goal of the course is to develop undergraduate students into knowledgeable, marketable, and enthusiastic computer scientists who have the capability and interest to achieve in graduate school and industry. In order to recruit and retain talented undergraduates in Computer Science, we believe that it is necessary to provide them with a challenging and exciting environment. This is particularly important in an urban university, where many students are non-traditional and first-generation college attendees. One of the best ways to provide such an environment is to establish an on-going program of undergraduate research in areas that are visually, intellectually and emotionally exciting to new or potential students. Intelligent robotics is such an area.

A research-oriented, exploratory course is hands-on with real-time results simulating a real world setting, thus offering an introduction to research that appeals to students' desire for "usefulness". In addition, because robotics involves other disciplines, students have the opportunity to experiment with recent technology and gain knowledge in electrical and mechanical engineering. Studying robotic programming grounds the concepts and ideas from other CS course (e.g., data structure, operating systems). Because the students are enthusiastic about working with the robots, there are fewer limits to student innovation. Students actually have an opportunity to begin building expertise.

Through working with physical robots, students can *visually observe* the effects of programming, how algorithms of different complexity and sophistication modify robot behavior, and how changes in capability (memory, sensors, etc.) effect program design choices and resulting robot capabilities. Students overcome the "fear" of doing research that keeps many of them from entering graduate schools. The students participate in research in individual and team settings, and are trained in literature searches, critical evaluation of papers, technical writing, and presentation of technical material. It is our belief that undergraduate students, when sufficiently motivated, are capable of carrying out these tasks.

Under the old process, menu sheets were printed by a local printer and provider information was filled in by the providers. A laser printer now prints the menu sheets and includes bar-coded and printed information on each provider at the same time. Completed sheets are scanned and computer-edited for unauthorized meals and summary reports are printed. A file of reimbursement amounts and associated data is generated in proper format for import into *Quicken* for printing of checks. Figure 2, below, shows the hardware configuration. The hardware mix includes two PCs, two flatbed scanners, two backup drives, and one laser printer. The PCs are both connected to the printer and to each other. Inexpensive external backup drives provide the needed data security as well as easy movement of data among otherwise incompatible systems.

Figure 2: Hardware Configuration



Software includes a spreadsheet for the master file; scanner software for printing and labeling menu sheets and scanning completed sheets; word processor for quick bar-code labels; file transfer software; antivirus software; an editor to process scanned data and produce summary data; and accounting software for check printing.

The Data Entry Problem

Essentially, the system revolves around accurate data entry. The old GIGO admonition was evident from the beginning. With the manual system, much of the inconsistency among forms received from providers was unimportant; the human information processors have great visual filters. Forms completed with various colors of ink and pencil were folded, spindled, and often mutilated. Sometimes it was possible to guess what was served at a meal without reading the form -- the evidence was dried on the form.

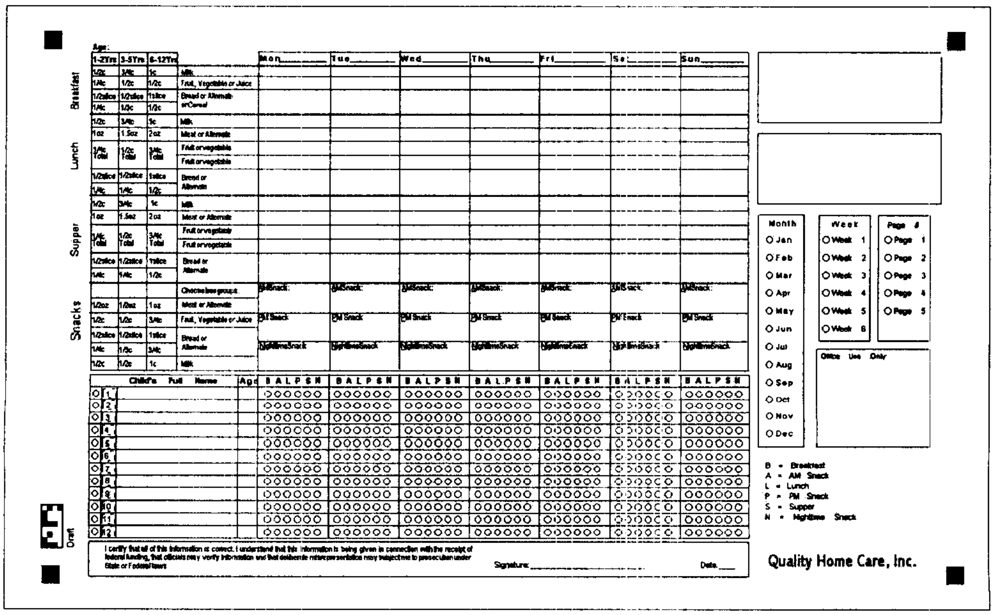
But, the scanner sheets had to be filled in with greater care and consistency. What at first was thought to be a major obstacle -- i.e., training harried daycare providers to exercise more care with their paperwork -- turned out to be quite manageable. The scan form was designed to look like the old manual form: the handwritten description areas were unchanged and the attendance area changed from boxes to option bubbles. To the surprise of the company, most of the providers embraced the new form with real enthusiasm -- many expressed excitement over being a part of a system which used computers.

In the first two monthly cycles with the new form, there were still staples, folds, incomplete erasures, lineouts, and other problems that interfered with accurate scans. In addition, software and hardware adjustments were made to improve scanner speed and reliability. By the third cycle, most of the providers had adopted new habits and submitted their forms with clean and accurate markings and in good physical condition. Scanning Accuracy improved sharply. After six months, scanning errors resulting from form condition and form preparation errors were virtually eliminated.

Nutritional requirements are still checked visually and any obvious problems with the forms are corrected before scanning. Once the forms are

At the beginning of each month, all of QCI's employees would gather at the company's office and begin the tedium of manually checking the menu sheets. The State required all claims to be submitted by the 8th of the month in order to be reimbursed during that month. For the daycare homes alone, QCI had to process close to 2,000 menu sheets by hand. Employees stayed into the night and spent weekends on the task, running up the overtime costs.

Figure 1: The Menu Sheet



Fatigue and tension was the order of the day during that processing period. And while the employees were tied up in processing menu sheets, the daycare homes and centers continued to operate without the benefit of services from QCI -- an opportunity loss of nearly 25% in consulting time.

Processing a menu manually involves visually checking entries on the top half of the menus sheets where providers write the quantities and types of food served at each meal. If nutritional requirements are not met, the meal is disallowed. The bottom half of a menu sheet shows a seven-day attendance record for up to a dozen children. If the child was in attendance when a meal was served, it is presumed that the child ate the meal. The attendance checks are tallied both by child and by meal and the sums verified. In addition to the nutritional requirements, there are various combinations of meals that are not authorized either by contract or by law. Those meal patterns must be discovered by visual inspection.

An audit of the menu sheets revealed an error rate in the neighborhood of 30% -- that is, nearly one in three of the providers were receiving incorrect reimbursements. No matter how conscientious the effort by the staff, the natural constraints in human information processing guaranteed errors.

The executive director of QCI concluded that if the company was to accept new clients, it would need to find a way to process an increasing volume of menu sheets as well as reduce the error rate. To her, the solution lay in IT, not in increased staffing. On the advice of her accountant, who was also a faculty member at a university, she sought help from the IS faculty at that university.

An Overview of the Solution

Table I summarizes the changes in the system for processing menu sheets for daycare homes. At the core of the solution was the addition of scanning and laser printing capabilities. The menu sheet shown in Figure 1, below, presents space for writing meal contents and an array of option bubbles for marking meals served to each child.

Connecting IS Majors With Small Business: A Case Study

John M. Anderson

Professor of Management Information Systems
Department of Production and Decision Sciences
Cameron School of Business
University of North Carolina at Wilmington
Wilmington, North Carolina 28403-3297

Abstract

Small companies are often reluctant to try innovative approaches to information management because of the cost of the hardware and software, the potential disruption of processes already dependent on overstressed resources, and the lack of in-house expertise. Changes in the external environment forced one small company to take the risk and integrate IT into their business, changing forever their internal environment. Among the benefits was a new relationship with the local university IS program.

Background

Quality Care, Incorporated (QCI - a pseudonym used in this paper) provides sponsor services to participants in the Child and Adult Care Food Program (CACFP). Their services include nutritional consulting to the operators of daycare homes and centers, and CACFP claims processing. In its claims processing role, QCI collects and processes data on homes and centers and provides information to the responsible government agencies.

The CACFP program reimburses daycare providers for certain meals and snacks served to their attendees. In order to participate in the program, a provider must meet a set of government standards with respect to facilities, times, personnel, etc.; and must enter into a contractual arrangement with an authorized sponsoring agency.

Recent changes in federal welfare laws resulted in a shift of much of the responsibility for administering programs such as CACFP to the states. QCI sponsors several hundred home daycare providers and daycare centers. Changes in administrative requirements that went along with states' adjusting to their new roles in the program were being met with reluctance among small sponsoring organizations. For some, the work required to process the claims under the new procedures was simply too much to accomplish manually and they balked at the prospect of *computerizing*. Those sponsors chose not to participate in the program and many chose to leave the daycare industry altogether. Many of their clients applied to QCI for help. Almost overnight, QCI was faced with the specter of demand increasing more rapidly than their ability to meet it.

Fortunately for QCI, the sea change in information technology had exposed IT solution alternatives that once were affordable only by much larger businesses. Plummeting costs for the applications used to gain competitive advantage by larger companies released those applications to the mainstream and undermined their utility as differentiators. These changes in the availability of sophisticated information technologies not only brought benefits to the smaller businesses which adopted them, but in so doing opened an enormous segment of the business world to IS programs in business schools. It is no longer the case that only larger companies provide fertile laboratories for faculty and students in information systems areas. QCI's predicament offered a wide array of interesting problems to solve and quickly attracted the attention of the IS faculty at the local university.

QCI's Problems

A sponsoring agency must collect detailed data on the number and content of the meals and snacks served for each child claimed by a provider. QCI requires its providers to complete daily entries on a form called a *menu sheet* which lays out by child what was served and when. Meal contents are evaluated by the sponsor and reimbursement is made for those that meet nutritional requirements and other guidelines. In late 1996, all of the evaluation was done by hand.

Please respond to questions 1-10 by circling the letters for your response:

SA	Strongly Agree
A	Agree
U	Undecided
D	Disagree
SD	Strongly Disagree

1. The Lab 5 Team Project demonstrated the necessity for clear documentation on individual module requirements.
2. The Lab 5 Team Project demonstrated the necessity for clear documentation on what values are communicated between modules.
3. The Lab 5 Team Project demonstrated the necessity for following standard naming conventions within a module.
4. The Lab 5 Team Project demonstrated the necessity for discussing and documenting the global variables, and file-related types and variables.
5. The Lab 5 Team Project demonstrated the necessity for clearly labeling extra code that was added for unit or integration tests.
6. The Lab 5 Team Project demonstrated the necessity for thorough system testing even though previous unit tests and integration tests had demonstrated that the code was working.
7. The Lab 5 Team Project demonstrated the necessity for a methodical approach to saving program and documentation files.
8. The Lab 5 Team Project provided me with team working experience that models what I can expect in industry.
9. As a result of the Lab 5 Team Project, I am better prepared to work in teams.
10. Based on my experience with the Lab 5 Team Project, I will change my initial approach when I work in teams.
11. What would you personally do differently if you were assigned to work on a similar team project next week?
12. What suggestions do you have for handling students who don't get their part done on schedule?
13. What suggestions do you have for improving the team lab experience?

Figure 2: Questions on Team Lab Project Follow-up Survey

Future Suggestions

Several suggestions for improvement of this team experience were gathered from student comments and observation during the labs. Some of the students needed a more detailed discussion of unit testing, and examples of ways to do unit testing when the module depended on other parts of the program. A number of students requested that the project description be handed out ahead of time. If the module assignments were also made ahead of time, then the students could be required to complete the module logic before coming to the first last session and the students could then concentrate on the unit coding and testing during the lab time.

Several students recognized that global variables that were given different names by different groups created a major problem when the modules were being combined. One way to avoid this is to have the lab section hold a group meeting at the start of the project to identify any global variables that their modules use, and agree on common names, or agree to have them passed as parameters. The other approach is to let the naming problem take place, and then discuss the problem as it arises so that students realize what is going on.

Since no group had a complete system test plan, this part of the assignment needs additional direction. One idea is to require the smaller groups (e.g. those working on Add, those working on Delete, those working on Modify) to develop a thorough written test plan of their section of the code. Another idea is to appoint some members of the class to be responsible for compiling the test plan segments into a complete test plan, and adding any missing test cases.

A big problem arose during the third lab period when the final system was being debugged. It is hard for the whole lab to participate in this process on one version of the program. A better plan would be to divide the lab in half (or thirds, or fourths) and have each smaller group responsible for debugging and testing their own version of the complete system. This would force all students to participate in the final system integration effort.

There also needs to be a well-defined policy for handling students who do not meet their deadlines and are holding up completion of the project. This could start with a point penalty and assigning someone else to help them, and move on to giving them a zero for the entire team effort, and substituting someone else to do that module.

Conclusions

Working on teams is an important skill for programmers to develop, but it can be difficult to manage and grade in a course setting. This paper has described one way of introducing students to working on a programming teams in a guided lab setting. Because students have individual responsibility for designing logic, coding and testing a particular module, and contributing to a test plan, they can be graded on their own effort. However, they also see how their module fits into an entire program, and gain experience working with other people on a small-scale. Their grade will be partly based on the success of the group effort. The students can see how failure to meet a deadline can impact the successful completion of the entire project. They get experience working with modules coded by other people, and performing testing at different levels. And they end up appreciating the importance of complete module documentation that carefully describes the inter-module communication requirements, as indicated in the follow-up survey. This controlled team project provides valuable lessons for the students as is, or could serve as a learning experience for the class before they are assigned a larger, out-of-class team project.

References

1. Goff, L. (1997, June 16). Information technology: big major on campus. Computerworld, v.31, n. 24, p. 100.
2. Goff, L. (1997, June 16). Workforce outlook: skilled for today or tomorrow?. Computerworld, v.31, n. 24, p. 101.
3. Kador, J. (1997, June). Ask the right questions. Datamation, v.43, n.6, p. 59.
4. Mitchell, J. (1997, March 16). 'Soft skills' prized by tech firms. San Jose Mercury News, p. 3E.
5. Molta, D. (1997, June 16). Coaching a winning team...wherever you play. Network Computing, v.8, n.11, p. 146.

A more serious problem was that some students did not complete their assigned unit coding and testing by the start of the second lab, or were absent from the second lab. In two of the lab sections, this was the crucial Find button click event, whose output was used by the three update buttons. This prevented other groups from proceeding with their module integration. One student who was absent was at least thoughtful enough to send in a diskette containing the missing code module.

Students also did not take responsibility for the completeness of the overall system test procedure. They just made sure they made a contribution to it. Even worse, they didn't foresee the need to save copies of the test procedure so that it would be available during the next lab period. In one lab where a student did save the test procedure, the diskette was bad at the start of the next lab period. Two of the six lab sections had to create their entire test procedure over again during the third lab period.

Results

At the end of the third lab, all six lab sections had a combined program containing all modules, which would run to some degree. As the deadline arrived, the group dynamics improved considerably, and everyone was suddenly interested in talking to each other to figure out the problems. Unfortunately, it was too late, and only two of the six lab sections got the entire program running correctly. None of the lab sections ended up with a thorough and cohesive test procedure of the overall system.

Follow-Up Survey

In the lecture following the third lab session, a survey was distributed to find out whether the students felt they had learned anything from the team project lab assignment. The survey contained ten questions which could be answered by circling a response in a range from "Strongly Agree" to "Strongly Disagree", and three additional questions that they could respond to in more depth (see Figure 2). Sixty-one students out of the eighty-five responded to the questionnaire. The results for the first ten questions are given in Table 1. In general the responses are positive. Over 81% of the students agreed (Strongly Agree or Agree) with questions 1-6 that the team project demonstrated a number of important concepts about working on programming teams. However, only 59% thought that this small team project was what they could expect in industry (Question 8) and only 49% felt it better prepared them to work in teams (Question 9). The written answers to questions 11 to 13 contained a variety of responses, some of which are mentioned in the next section.

Question	Strongly Agree	Agree	Un-decided	Disagree	Strongly Disagree
1. The Lab 5 Team Project demonstrated the necessity for clear documentation on individual module requirements.	24	26	5	5	1
2. The Lab 5 Team Project demonstrated the necessity for clear documentation on what values are communicated between modules.	24	27	7	1	2
3. The Lab 5 Team Project demonstrated the necessity for following standard naming conventions within a module.	33	23	3	1	1
4. The Lab 5 Team Project demonstrated the necessity for discussing and documenting the global variables, and file-related types and variables.	35	23	2		1
5. The Lab 5 Team Project demonstrated the necessity for clearly labeling extra code that was added for unit or integration tests.	22	30	7	1	1
6. The Lab 5 Team Project demonstrated the necessity for thorough system testing even though previous unit tests and integration tests had demonstrated that the code was working.	26	29	4	1	1
7. The Lab 5 Team Project demonstrated the necessity for a methodical approach to saving program and documentation files.	17	30	11	2	1
8. The Lab 5 Team Project provided me with team experience that models what I can expect in industry.	11	25	15	6	4
9. As a result of the Lab 5 Team Project, I am better prepared to work in teams.	7	23	20	7	4
10. Based on my experience with the Lab 5 Team Project, I will change my initial approach when I work in teams.	7	21	16	13	3

Table 1: Team Lab Assignment Survey Results

Example of a Small Team Programming Assignment

A file search and update problem is ideal for a team project, because there are a number of modules that need to access, search and update the data files. This gives many different students individual exposure to working with the file on their own sections of the program. In this particular assignment, a random access file containing employee IDs, names and pay was used. The records were stored in the file in the order received, but an index of IDs and record numbers was maintained to facilitate searching. When employees were deleted, the ID was removed from the index (shift up the ones below) but the record in the random access file was merely rewritten with zeroes and blanks.

This course was being taught using an event-driven programming environment (Borland's Delphi), so the user interface that was used is shown in Figure 1. When the program first started up, the specifications called for the index file to be loaded into a two-dimensional array. The Find button checked whether anything was in the ID box, called on a search module, and displayed the employee's name and pay, if found. This button also enabled or disabled the Add, Modify and Delete buttons. The three update buttons did appropriate error checking. Both Add and Delete called other modules (AddToIndex or DeleteFromIndex) to update the index. When the user closed the program, the current index in the array was written to the index file and the main employee file was closed. In all, nine modules were identified for students to design and code. These were:

- Form Creation
- Search Index Function
- Find Button Click
- AddToIndex Procedure
- Add Button Click
- Modify Button Click
- DeleteFromIndex Procedure
- Delete Button Click
- Form Close

Each of these modules included a loop and/or several conditional structures, as well as file and/or array accesses.

Once the individual modules were designed and coded, the modules were initially paired up for integration as follows:

- Form Creation with Form Close
- Find Button Click with Search Index
- Add Button Click with AddToIndex
- Delete Button Click with DeleteFromIndex

Time schedule

This assignment was used over three lab periods. The first lab period was for designing the pseudocode of each module and coding and testing that unit. The second lab period was for demonstrating any remaining unit tests, integrating the modules, and developing the overall system test procedure. The final lab period was for completing the test procedure, completing the integration of all modules into the final program, and performing final testing and debugging.

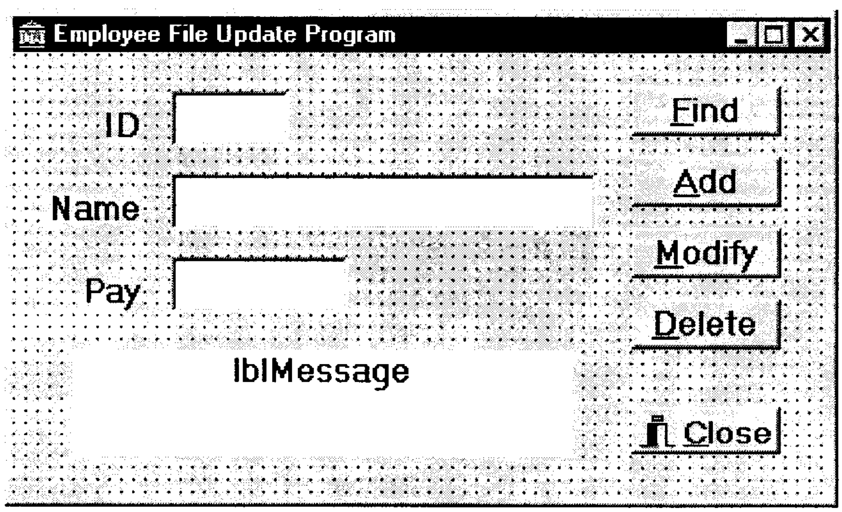


Figure 1: Team Project User Interface

Problems Encountered

As with any team project, a number of problems were encountered. First, the students who missed the initial lab were at an immediate disadvantage at the start of the next lab. Luckily, most of these people contacted the instructor prior to the second lab to get their module assignments. They were asked to do the pseudocode and unit testing on their own to get credit for it, even if someone else in that lab had already completed that module.

incorporated many of these principles. The desired outcome was that each lab section would work together as a team to produce a running program within two weeks. One way to ensure that each student participates in the assignment is for the instructor to plan out the program modules in advance. Each student was assigned the responsibility for the logic design, coding and unit testing of a particular module. A brief overview of each phase of this assignment follows:

1. Instructor Pre-Lab Preparation: The instructor prepared written documentation of the problem. This included the user interface layout, file and index descriptions, and a sample of the file populated with data. Most global variables were identified, named and described. In addition, the instructor divided the project into modules of approximately equal size and difficulty and wrote module descriptions, including input and output requirements. Several smaller modules were pre-coded and available for students to copy.

2. Student Preparation: During the lecture preceding the team project lab period, the general file layout and data structures of the program were described to the class using specific data values to illustrate the structures. Students were informed that they would be working with these files in the next lab period.

3. Module Logic Design and Unit Testing: In the first lab meeting, the lab instructor handed out the project description, and assigned a particular module to each student. In the larger lab sections, where more than one student was assigned to the same module, the instructor tried to pair a weaker student with a stronger student, so that the weaker student could learn the material from their partner. The students working on the same module were allowed to work together, but at most 2 students were assigned the same module. Students were expected to complete the pseudocode for their module during the lab period, and have it checked by the lab instructor. Once approved, the students then coded their individual module and devised a unit test for it, which was demonstrated to the instructor. The instructor's role was to ensure that complete testing was performed on the module to hopefully catch all logic errors. Nonstandard naming conventions that would interfere with module integration were overlooked, to serve as a lesson during the coding integration and testing phase.

Students who did not complete their pseudocode during the lab period lost points and were told to get it checked by their instructor prior to the next lab period, so they would not hold the class up. Students who missed lab were individually assigned a module, and told to create pseudocode as soon as possible so that the instructor could check it. These students then completed the unit coding on their own, to be demonstrated at the start of the next lab period.

4. Integration Coding and Testing: As soon as a module was successfully unit tested, students working on two related modules were asked to combine their modules and demonstrate that the modules could work together. This resulted in groups of 2-4 students working together. Some students gathered around one computer, and some chose to exchange copies of the code and concurrently try to combine and test the modules. Again, the working code was demonstrated to the lab instructor. When the two modules were successfully integrated, they were combined with another module or group of modules.

5. System Test Plan Development: During breaks in the coding process, while waiting for other students to complete their sections, students were instructed to contribute specific data values and expected results to a document that would be used as their final system test. Each student's contribution was to include his/her name. One computer in the lab was designated for this purpose. At the end of the test plan, the students were asked to add the expected contents of the final data file(s).

6. Final System Testing and Debugging: When the last modules were combined together and debugged, the students were expected to run their system test plan from beginning to end to see if they got the expected results.

7. Completed Project Deliverables: Each lab group turned in a single copy of the system test plan, the printout of the final code, and a diskette containing the final program.

8. Instructor Grading: Most of the individual grading took place as the team project progressed. The lab instructor took attendance each lab period, and individually checked off the pseudocode and unit test on the grade sheet. Successful integration tests were checked off for all members of that group.

This left reviewing the system test plan and testing the final program to the end. For the system test plan, each student received individual points for each reasonable entry they made to the test plan, and overall points for the completeness of the entire test procedure. The instructor ran each lab's program using a separate, complete test procedure. All students in the lab received points from the results of this test. The source of major errors was determined by looking at the source listing. If the error was related to one group's logic, that group lost more points than the whole class. If the error seemed to be related to combining all modules, then the whole class lost equal points. The final project grades for this team assignment were distributed 20% to attendance, 33% to the individual module logic and unit testing, 14% to integration tests, and 33% to the final code and test procedure.

Introducing Team Programming Projects in a Controlled Lab Setting

by

Susan Lisack
Computer (Information Systems) Technology Department
1421 Knoy Hall of Technology, Purdue University
W. Lafayette, IN 47907-1421
(765) 494-2568 sklisack@tech.purdue.edu

Abstract

Knowing how to work in teams is an important skill for Computer Information Systems graduates, but using team assignments in the classroom setting can be difficult to manage and assess. On large, out of class projects, the instructor cannot observe the team dynamics, to know whether the work is being shared equally, and whether all students are learning to apply the course material. Teamwork skills are needed in the Programming area as well as the Systems Analysis and Design area. While the interpersonal skills for dealing with people are the same, some of the technical aspects differ. Team assignments should help programming students see the need for thoroughly documenting inter-module communications requirements and doing thorough unit tests before combining sections of the program. If correctly managed by the instructor, team-programming projects can also offer a means for individual learning and assessment in a team environment. This paper presents a very small-scale, controlled lab exercise that was used in a second semester programming class to give the students experience working on a programming team, while at the same time allowing the instructor to assign and assess individual contributions to the team effort.

Introduction

Recruiters of Computer Information Systems graduates have often said that knowing how to work in teams is an important quality they look for in their employees [1-5]. But practicing that skill in the classroom setting can be difficult to manage and assess. The goal of most programming assignments is to apply one or more new concepts just presented in class. On out of class projects, the instructor cannot observe the team dynamics, to know whether the work is being shared equally, and whether all students are learning to apply the course material. Some teams will include students who don't have the time, inclination or ability to do the assigned work. But if that same team includes a hard-working, intelligent, grade-conscious student who does most of the work, that one student will achieve the main learning objective while all the students share the grade on the project.

Teamwork is important at all phases of the system development process. Students in a Systems Analysis and Design course can learn how to divide and share the workload on the front end of a project. Programming students can learn how to divide the responsibility for implementing well-defined pieces of a program. While doing this, the programming students would hopefully see the need for:

a) clearly documenting individual module requirements
b) clearly documenting the inter-module communications requirements
c) establishing standard naming conventions
d) establishing procedures for saving program and documentation files
e) documenting global variable requirements and names
f) clearly labeling extra code that is added solely for testing purposes
g) thoroughly testing individual modules or units of code
h) performing a thorough system test after the tested units are combined
i) communicating with each other during integration testing to share information they learned as they coded their part of the project.

If correctly managed, team-programming projects as a course assignment can still offer a means for individual learning and assessment. While large programming projects must be assigned as out-of-class, longer term assignments, it is possible to implement a small-scale program using teams in a computer laboratory setting over a two or three week period.

General Structure of the Team Lab Project

In the spring '98 semester, a team lab project was assigned in our second-semester programming course. In this course, the students learn about programming aspects of data, file and database structures while improving their programming abilities. At the time of the team lab assignment, 85 students were attending class. Each student attended a large lecture and one of six two-hour lab times. The lab sections ranged in size from 8 to 18 students. After four weeks of lectures covering applications of two-dimensional arrays, random access files, and indexes, the instructor assigned a file search and update project that

Additional Benefits of the Course

There are a number of additional benefits we have observed since beginning this experimental course. We list several of them here.

The course provides the mechanism for faculty to engage in research and to transfer the results to other courses, renewing their enthusiasm for teaching and their knowledge and experience in their discipline. New research activity gives a "hands-on", exciting way for students to study artificial intelligence and robotics, as well as other topics in Computer Science, e.g., data structures, software engineering, and programming.

Using "attention-getting" robots as teaching tools makes CS topics more relevant and interesting to many students. Student-teacher interaction and the level of interest by many students have increased as students sought more knowledge about the robots. Students also work together and share ideas in problem solving assignments that involve the more advanced topics in AI and robotics. The overall atmosphere is one of having fun, rather than working!

The course provides an avenue to improve inter-departmental collaboration. Psychology, Biology, Philosophy and Mathematics faculty could use the advanced computing lab in which the course is taught to support the study of learning theory, computational models of intelligence and behavior, and applied mathematics. The facilities to support inter-disciplinary courses are now in-place.

After gaining some real research experience, graduate study seems more attainable to students. The knowledge of what it takes to be an artificial intelligence or robotics expert grants students the freedom to explore and broaden their understanding of related fields of study.

The program benefits the external community. Demonstrations of the robots to secondary and elementary students encourage those students to stay in school and to study science and math. A robot is something that a high school or middle school student can see and touch. In our community, many middle-school students are at risk of not even finishing high-school; many more generally do not consider college. Talking about computers is not enough to spark these students' imaginations or to motivate them to consider a technical field of study. These students need to see something that they think is "cool" and, just as important, that they think they are capable of understanding.

Finally, an undergraduate robotics laboratory improves college recruitment efforts. We have presented our work on the robot to numerous high-school students visiting the campus. We have also given robot demonstrations and presentations in programs designed to encourage women and minorities to pursue careers in math and science.

Future Work

Our early experience with the course indicates that we are off to a good start, with some successes. Students are having fun and learning. They are enthusiastic. Some students that are not even enrolled in the course drop by with requests to come "play" in the lab, so they can test a theory they have to improve robot performance. Now it is time to try the advanced topics and see if students can quickly come up to speed on the work of prior semesters.

Bibliography

Allen, J., Hendler, J. And Tate, A., eds. 1990. *Readings in Planning*. Morgan-Kaufmann. 31-34.

Balch, T., Boone, G., Collins, T., Forbes, H., Mackenzie, D. And Santamaria, J. 1995. Io, Ganymede and Callisto - a Multiagent Robot Trash-collecting Team. Technical Report, Mobile Robot Laboratory, College of Computing, Georgia Institute of Technology.

Burnell, L.J. 1994. Decision-Theoretic Control of Failure Recovery. *Proceedings of the Second International Conference on Artificial Intelligence and Planning Systems*. AAAI, 202-206.

Latombe, J.C. 1991. Robot Motion Planning. Kluwer Academic Press.

Norvig, P and Russell, S. 1996. *Artificial Intelligence A Modern Approach*. Englewood Cliffs, NJ: Prentice Hall.

Pearl, J. 1988. *Probabilistic Reasoning in Intelligent Systems*. San Mateo, CA: Morgan Kaufmann.

Student projects will build upon an existing prototype for a failure recovery system that is based on Bayesian-Guided Diagnosis [Burnell, 1994]. This prototype diagnoses plan failures and dynamically selects from multiple failure recovery strategies when an execution-time plan failure occurs. Students will extend and integrate the prototype into existing robot code. Additional projects will include comparing existing alternative failure-recovery strategies. Key topics to be mastered by the students include planning algorithms, plan execution, plan failure recovery strategies, and uncertainty reasoning (e.g., from [Pearl, 1988]).

Successes and Lessons Learned

With only two semesters of experience with the new intelligent robotics course, we have already had some successes and made some key observations. We describe highlights culled from instructor experiences, student feedback (both during the semester and after the students have been working in industry for a few months), and comments from individuals outside the department and university.

One measure of success in a research-oriented course is acceptance to present student research at conferences. Each of the two semesters, a student has been invited to present his work at a regional conference (a first for the department). A student in the second semester of the course won third-place in an undergraduate student research competition. We consider this a good indication of success, especially considering that the first and second place winners were from universities that had graduate programs in Computer Science (our school does not). At each of these conferences, students and faculty from other universities showed keen interest in the work we were doing. Obviously, this only increased our students' enthusiasm for their work.

A second measure of success is positive student feedback, both during the course and, more importantly, after the student has graduated and found employment in industry. This feedback has generally been quite positive, particularly regarding the software engineering skills the students develop. The following outlines what students report they have learned about software development:

- requirements are not always clearly defined; they evolve as more is understood about the capabilities of the hardware, software and the domain
- sometimes, you have to learn a lot about the domain before you can even think about trying to solve a problem
- hardware and software tools are not always everything you hope for; sometimes you have use what you have available
- debugging and modifying a poorly written program is a lot harder than for one that is written well
- if you start developing code before the requirements are reasonably well understand, you will probably have to completely rewrite the code
- big problems can not be solved by hacking out a program -- you have to do design. It's easier to change a design than a program
- if the guy before you had documented what he did, life would be a lot easier for you now

All the observations listed above are taught in programming language and software engineering courses, but in the intelligent robotics course, they are reinforced. The students actually *experience* these realities.

There were some learning experiences for the instructor as well. The main lesson is that it takes undergraduates a lot longer than graduate students to get tasks accomplished. Part of the reason for this is understandable: undergraduates have less experience with everything: large programming tasks, the importance of design and analysis, and the research process in general. The strategy to deal with this lesson is simply to keep expectations reasonable for the level of performance that the students can achieve in a single semester. The other lesson is that the undergraduates, while enthusiastic about the project, need to be taught how to take initiative and to be reasonably self-reliant. To succeed in the class, and more importantly in industry, they must learn how to figure things out for themselves and take responsibility for getting tasks completed in a timely fashion. Therefore, it is crucial to not only discuss these attributes of initiative and self-reliance, but to create situations in which the student can demonstrate these attributes in progressively larger and more important tasks. Positive lessons learned include:

- students have a greater sense of accomplishment than in traditional programming assignments- they know they worked hard and that they actually produced something *that will continue to be used after they leave.* This latter point is very important to the students in the course.
- the validation of their work at conferences enhances motivation and the sense of importance and accomplishment the student feels. Competition and the desire to do well in front of others are strong motivators.

knowledge needed to conduct more complex tasks. Students engage in activities that seek to simulate "intelligent" behavior in the robots. Here, we mean that the robot is intelligent in that it can successfully navigate. The first project (the first time the course was taught) involved navigation in a well-defined environment with known obstacles (Figure 3). The second project (the second time the course was taught) considered navigation in a more complicated environment with unknown obstacles. This work built upon the software developed by students in the first project.

By attempting to model complex situated activities, students get a better understanding of why modeling is important. An immediate perception of the complexity of the domain in the abstract model level is possible. What kind of world is a room, hallway, or building? How does an intelligent creature navigate in such an environment? Trying to answer these questions clarifies the importance of investigating and experimenting with different robot and domain ontologies and how they affect the efficiency and efficacy of robot behaviors. For example, students apply basic planning algorithms to the task specification process. Theses include search techniques like beam search or opportunistic search, and special-purpose planning techniques such as opportunistic or reactive [Norvig and Russell, 1996]. Students predict performance for selected algorithms and evaluate actual performance.

At the robot level [Balch, et al., 1995], the lowest level of task planning, students realize the difficulty in translating abstract representations into robot movement. Students achieve a better understanding of how the robot's components (motors, sensors, etc.) control how tasks are planned or how knowledge of tasks is used to control the components. This emphasizes the differences between deliberate, adaptive, behavioral or reactive robot activities [Latombe, 1991].

Evaluation of the performance of task planning algorithms can also be made [Allen, et al., 1990]. Students evaluate algorithm efficiency, memory requirements, and results. For example, using algorithm "A", the robot successfully navigated a given path in an "intelligent" way in a given time. The robot then performs, or attempts to perform, the same activity using algorithm "B" in an "intelligent" way also. The two trials can be evaluated by looking at whether or not they completed the task, the time it took, and the actual path compared to an apparent optimal path, along with a host of other metrics the students help develop. Based on the data, students can decide the best algorithm for the task and use the experimental data to help judge algorithm robustness and scalability over a wide range of tasks.

Students can also use the performance of others' robots to judge their own. They can account for the benefits or challenges of differing attributes such as more memory, optical sensors, or audio sensors. They can begin to draw conclusions about the benefits and limits of various design approaches.

Advanced Project: Failure Recovery

An advanced project is how to get robots to select an appropriate behavior when an unexpected event occurs during plan execution. One dimension in which existing strategies differ is the degree of dependence on the reliability and availability of the robot's knowledge. The best strategy, however, may be dependent on a number of considerations, including the type of plan failure, the criticality of the failure, the availability of resources, and the reliability and availability of the specific knowledge involved in a given plan failure instance.

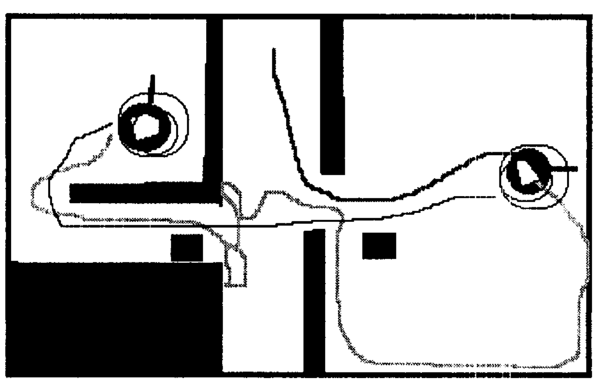


Figure 3. Sample navigation task for the first year. The dark line represent a good, or intelligent, path from one point to another within a simple environment, while the lighter line represents a poor path.

1. Introduction and Orientation (2 weeks)
   - Goals of the course
   - Course expectations, evaluation methods
   - The goals and methods of research. What makes a good researcher. Measuring success and failure in a research environment. Review of systems engineering methodology. Using the library and Internet for research. How not to get lost in a sea of information.
   - Robots and tools to be used (languages and other software, hardware, resources available)
2. Robotics (1.5 weeks)
   - The basics of hardware (sensors, actuators, etc.)
   - Software (sensing, acting, planning, etc.)
   - Software environments for the course robots
3. Research Techniques (1 week)
   - Literature reviews
   - Technical writing
   - Presentation techniques
4. AI Planning - The Basics (4.5 weeks)
   - Overview of AI planning: define planning tasks, goals of planning, planning versus executing
   - Early planning systems (STRIPS, etc.)
   - Modern planning systems (TWEAK, NONLIN, BURIDAN, etc.)
5. AI Planning for Robots- Overview of Advanced Topics (7 weeks)
   - Planning and Acting
   - Uncertainty in planning (types of uncertainty, techniques for dealing with each, belief networks)
   - Failure recovery (decision-theoretic planning and influence diagrams)

Figure 2. Sample outline of topics for the intelligent robotics course beginning with the third semester the course is offered.

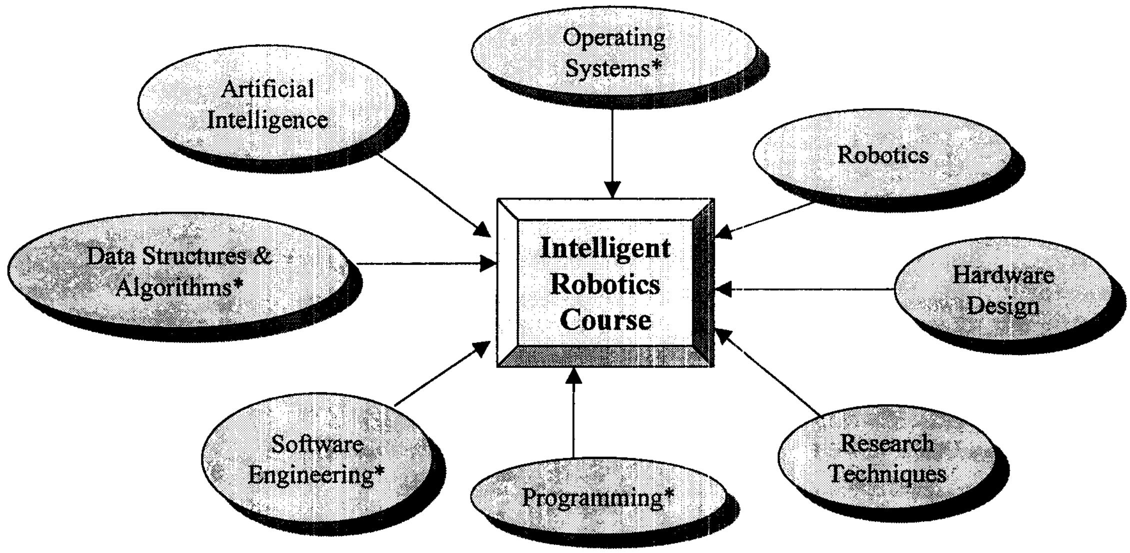
Lecture meets for 3 hours per week, with 2 hours of structured lab time per week. Lectures cover robotics, artificial intelligence (especially planning and uncertain reasoning), software engineering, research methods, technical writing, and presentation skills. Reviews of data structures and algorithms are introduced where appropriate. As part of the lecture section, students give presentations on selected topics. A proposed outline of topics for the course as it will be taught beginning with the third semester is shown in Figure 2. Subsequent semesters will follow a similar format, with results from the previous semesters incorporated.

During the structured lab time, students report progress, raise issues, and work on programs and experiments. Structured lab projects include gaining experience building small (non-robotic) planning systems not directly related to their research project. This will ensure that every student gets a broad perspective of the variety of tasks and problems in AI planning (one motivation for this is that local industry has a need for students skilled in planning and scheduling methods). The structured lab time is supervised by the instructor. Outside class and structured lab, student activities are project-based. The students choose from a predefined set of projects. Some of these are individual projects; others are team based. All projects require building upon past semester projects and may require coordinating efforts with other current students. Example projects, one basic and one advanced, are briefly described in next section. Near the end of each semester, each project team submits a research report detailing project goals, activities, accomplishments, and recommendations for future work. The top one or two reports are selected by the instructor to form the basis of a research paper to be submitted to a conference.

Each project provides ample opportunity for multiple project teams to explore areas of interest to them. Different project teams may choose to investigate different algorithms or implementations for the design and development of some module. For example, a run-time failure recovery module may be implemented using a number of distinct strategies for selecting an appropriate recovery strategy. One of the features of the course is that it consists of a number of relatively independent, but inter-related sub-topics. However, students are strongly encouraged to interact with other teams, and the instructor, to ensure correct interfacing among developed modules. This aspect of the research reinforces their software engineering knowledge and experience.

Basic Projects: Planning and Acting

In this section, we describe some of the activities on which students have focused in the first two offerings of the course. The goal is to establish some basic capabilities in the robots and to gain the necessary skills and



* Students have a course in this topic prior to (or concurrent with) taking the intelligent robotics course

Figure 1. Some of the topic areas covered in the Intelligent Robotics course.

Faculty members that are involved in at least some limited research stay technically current and have the ability to share their knowledge and enthusiasm with students, resulting in better classroom instruction for all students. Given that our department has no graduate program, no teaching assistants, and full teaching loads, the opportunities for faculty research strictly within the University are limited. Yet, a stated goal of the University is for faculty to perform research activities, with strong preference given to faculty that involve students in scholarly activities. By designing a course that builds upon the activities of past semesters, the possibility exists for respectable research results to eventually be produced by the faculty and students.

We describe the course next, followed by a discussion of our successes and lessons learned. We conclude with a discussion of future work.

The Intelligent Robotics Course

The Intelligent Robotics course was initially offered in 1997 as an upper-level, independent study course involving one to two students per semester. It has now been taught for two semesters. The rationale for this low enrollment is to experiment with the course content before offering the course generally. Typically, upper-level courses at our school have between five and ten students. The course is currently designed as a one-semester course offered once per academic year. The basic design of the course is planned to evolve to its final form over a three-year period.

The course includes lecture and lab components. In the lecture component, presentations are given by the instructor, students, and guest speakers (for example, from a nearby research school with a program in intelligent robotics). Outside work includes literature reviews, critiques of relevant research articles, preparation of class presentations on selected topics, writing research reports, and submission of papers to conferences. The lab portion of the course involves students working in project teams to achieve a particular goal.

In the first semester that the course was taught, the emphasis of the course was on obtaining student mastery in the basics of robotics and basic programming. This includes robot assembly, sensing, and the study and implementation of robot path planning algorithms. Student deliverables of the first semester were (1) fully assembled robots with basic navigation capabilities, (2) reports that detail the tasks performed and lessons learned, and (3) requirements analysis and design documents to be used by the students that take the course the next time it is offered (the second year).

Beginning with the third time the course is offered, the emphasis shifts toward the study and implementation of more sophisticated planning algorithms that include uncertainty reasoning and graceful recovery from execution-time plan failures. To do this, the students must become familiar with the work achieved (by other students) in the previous semesters.

scanned, an editor allows visual verification. After several cycles, it was obvious that the scanner and scanner software was accurately interpreting the forms, so complete visual editing of bubble patterns was replaced with sampling.

Edits and Reports

During the scanning process, form images are verified by the software to resolve ambiguities caused by variations in mark densities and stray marks. Image-editing software was developed for visual verification of the scanned images to confirm that the scanner *sees* what it is supposed to *see*. The output of the scanning process is a comma-separated-value file.

Line-editing software then checks meals patterns on each of the roughly 20,000 lines in the CSV file. Those found to be in conflict with the contract or the law are displayed for editing. When edits are complete, the meals are tallied and a detailed claim report is printed. In addition, the reimbursement amounts are automatically combined with information pulled from the master spreadsheet file to produce a *Quicken* import file to be used for writing the reimbursement checks. The editors also generate log files for changes made to the scanned data.

Benefits for QCI

The positive effects of the system on the company were many. At the top of the list was employee morale: the morale of the employees jumped immediately when a large part of the stressful manual checking process disappeared. Time once spent on administrative drudgery was made available for consultation with clients. Night work and overtime work was eliminated for most of the staff. Employees were happier and clients were happier.

The error rate dropped from around 30% to less than 1%. Disagreements between the sponsor and the providers over meal counts and reimbursement amounts require amended claims to be filed with the State. The number of providers involved in those amendments has dropped due to increased accuracy.

Finally, there was an unexpected result. After several cycles, the company began to receive calls from daycare providers who wished to change from another sponsor to QCI. Several said they wished to change sponsors because QCI's paperwork requirements were simple compared to their current sponsors!

Over the past year, the number of daycare homes sponsored by QCI has increased by more than 30%, while the time required to process claims has been reduced by at least that much. QCI's home claims system uses readily-available and inexpensive hardware and software components. The editors and reporting modules were developed in Visual BASIC.

Benefits for the IS Program

Six months after deciding to seek help with their data processing problems, QCI was using a system that has changed their business processes forever. The scanner project established a positive working relationship between QCI and the university and led directly to the establishment of internship opportunities for IS students and summer projects for IS faculty.

Conclusions

QCI's experience highlights the progress made in IT over the past few decades. To implement a similar system for a small business just ten years ago would have been infeasible. Reliable scanners and scanner software would have been cost-prohibitive. Affordable desktop processors would have choked on 20,000 records having 50 fields each. User-friendly systems were unavailable and IS staff was expensive.

Leaps in technology have made the infeasible feasible and have led to solutions for small businesses that were once only in the domain of the giants. But, politics and financial impact notwithstanding, the challenges associated with implementing a wide range of IT are often independent of business size. Granted, politics and finance are important parts of the implementation process, but they are usually insignificant parts of a student's internship experience.

The trends in IT continue to enhance the opportunities for research and service. But, more importantly, the enabling of small business to employ IT on a larger scale has opened a world of opportunities for the IS student to participate in real-world information technology projects. ■

Table I: Quality Care, Incorporated
Summary of Homes System Upgrade

Homes Processing:	Old	New	Benefit	Cost
Form Generation	Print Shop. Blank forms filled in by providers	Laser Printer. ID info filled in by computer	Timely. Better info for visits. Cost saving.	Computer: $2,000 Printer: 2,500 Software: 1,500
Form editing	Manual. Check nutrition req'ts. Count meals and get form subtotals.	Computer. Check Nutrition req'ts by hand. Computer edits for errors in meal patterns.	Almost total elimination of pattern errors.	Scanner: $2,500 Software: 5,000
Form tallying Summary Reports	Manual entry of subtotals into a Spreadsheet. Sums generated by spreadsheet and typed into report.	Computer tallies meals and produces summary claim.	Almost total elimination of Tally errors. Sharp reduction in staff time.	(covered above)
Amendments	Manual preparation of amended report	Make changes to stored data and re-run tally and reporting system	Accuracy and quick turnaround	(covered above)
Check Writing	Manual entry into *Quicken*	Import into *Quicken*	Reduced time and data entry errors. Auto update of accounts.	(covered above)
Data Security	Save menu sheets. and spreadsheet sums	Save menu sheets and reports	Easy off-site backup on diskette	Hardware: $150 per PC

Managing and Maintaining Personal Computers: A Hands-On Class Designed to Build on IS '97.1 and IS '97.4

Dr. John H. Reynolds, CCP, and Cynthia A. Martyn
Missouri Baptist College, St. Louis, Missouri
reynolds@mobap.edu

Introduction

During the process of revising the CIS curriculum at Missouri Baptist College, the faculty struggled to find a way to meet three competing needs with one class: reinforce the concepts of computer architecture in majors and minors, provide a hands-on class for majors to apply the concepts of computer architecture to PCs, and broaden the participation in CIS courses beyond the scope of CIS majors and minors. The IS '97 model curriculum suggests two classes that expose students to the basic hardware and software components of a computer: IS'97.1 and IS'97.4. As implemented at Missouri Baptist College, these classes are BCIS112 and BCIS243, neither of which includes a laboratory component. All baccalaureate degree-seeking students are required to take IS'97.1 though only CIS majors and minors are required to take IS'97.4. The proposed solution is BCIS 233/333 Managing and Maintaining Personal Computers. An experimental class was added to the Spring 1998 schedule since the new curriculum would not start until Fall 1998.

Course Design

The goals of the new course are to reinforce the concepts of computer architecture in majors and minors and to broaden the participation in CIS courses beyond CIS majors and minors by providing a hands-on class in which to apply the concepts of computer architecture to PCs. The content of the course correlates to Learning Unit #7 in IS'97.1 and to each of the Learning Units in IS'97.4. (Davis, 65, 74-75) The course is also designed to meet the content requirements of the A+ Certification Exam.

The course is organized into two components: lecture and laboratory. The text for the lecture is *A Guide to Managing and Maintaining Your PC: Comprehensive*, 2nd ed., by Jean Andrews. The laboratory exercises require the student to design, purchase, and build their own PC. This PC is then used as the computer on which they practice trouble-shooting skills. The decision to have students build a computer was made for two reasons: the college could not afford to have a laboratory of computers available for up to fifteen students to dismantle and assemble during the course of a semester; and, students would be more careful and observant if it was their own machine. Students who desire upper-division credit are required to complete a research paper on a new technology not covered in the text and then present their findings to the class.

To achieve the goals of this class, the faculty and business office worked together to provide a method of payment for the computer parts through student accounts by establishing a variable lab fee for the course. This implementation of the course was a block course that met two and one-half hours once a week for the entire semester. The schedule of the course called for the parts to be ordered during the first class period and the computers assembled in a classroom with tables over the following two class periods. Parts would be secured in a different room between class sessions during the two-week assembly period. Each student would be responsible for the storage or their computer after assembly and for bringing the computer back each class session.

Preliminary Results

Student evaluations indicate the class was well received. Approximately twenty-five percent of the students wrote positive comments and no students wrote negative comments. There were no negative ratings of any aspect of the class on the Likert scale items. Seventy-three percent of the class chose upper-division credit and completed the research paper. Students said these research papers added to the currency of the class and were an insight into new technologies. Less than half of the students enrolled were CIS majors but after the class one student added CIS as a second major. The experience gained by students in this class improved their confidence in their ability to work on and around computers. Twenty percent of the students indicated they planned to take the A+ Certification Exam after completing the class.

When teaching a lab session where students build computers, one problem is pacing the students. In any class there will be a mixed group of abilities and experiences. Convincing the more experienced students to slow down for the less experienced can be accomplished by teaming the more experienced with the less experienced students. This also offers the more experienced students the chance to reinforce their knowledge by mentoring their teammates. While the students learned from the team approach, some proved less likely to pay attention to the lecture portion of the class after they had built their “dream machine.” The next implementation of the class this summer will teach the labs in "lock-step," that is, determine what part(s) of the computer will be assembled for each session and then use demonstration-performance to guide the class.

One lesson learned from this class is that building the computers first is not the best approach so the next class will build their computers last. The text is not designed well for concurrent lab and lecture teaching since a large portion of the book has to be taught to allow students that have not previously assembled a computer to understand the process. The software bundled with the textbook did not prove to be very helpful to the students, either. Several students had trouble running NUTS & BOLTS® software on their machine, which made exercises in the book difficult to complete since they were designed to use that specific software. On the other hand, students were very pleased with the text itself, in spite of its 968 pages.

Logistically, several adjustments were made after the course started. The classroom used for assembly was moved next to the storage area to facilitate moving the computers each week. After the first few weeks the students wanted to take their computers home to use for schoolwork but quickly discovered that bringing them back and forth to class each week was a challenge. As a result, student lab assignments were modified based on these logistical problems.

Since the text was new and this class was using page proofs, there were no instructor materials available. Originally, the Review Questions that the students turned in each week were going to be the basis for the final exam. A pre-publication copy of the test bank became available during the last three weeks of the semester, so the students were given a take-home exam with questions from each of the eighteen chapters. The exam was 360 objective questions (including 20 bonus questions) covering 18 chapters. Though most students complained loudly, all agreed the exam helped reinforce the material.

Instructor:	Dr. John H. Reynolds	**Term:**	SP-98
MBC Phone:	434-1115 x2338	**Department:**	CIS
Home Phone:	423-3757 (before 10 pm)	**Division:**	Busines
Office Hours:	Posted outside of office (FAH 322)	**Date:**	1/16/98
Meeting Days/Time:	F 4:30-7:00PM	**Section:**	EMA*

I. **Course Name and Title:** CIS 293/393 – Managing and Maintaining Personal Computers

II. **Course Description:** Students will learn how to install and set up new software for a user, install new hardware, diagnose both hardware and software problems, and make decisions about purchasing new hardware. Students will be required to provide their own personal computer to upgrade or to purchase components to build a personal computer. Expenses for any necessary components will be included in laboratory fees.

III. **Prerequisite:** CIS 103

IV. **Credit Hours:** Three hours

V. **Frequency and Pattern of Offering:** Spring

VI. **Text(s):** *Managing and Maintaining Your PC*, 2nd Ed., Course Technology, 1998
How Computers Work, Deluxe Edition, ZD Press, 1997
Nuts & Bolts, Network Associates (formerly Helix Software), 1997
Pentium Class Personal Computer

VII. **Objectives of the Course:** The sophomore level of this course is for any student who wants to learn more about Intel-based personal computers The junior level of this course is for CIS majors/minors who will improve their ability to support Intel-based personal computers in organizations .Successful completion of an introductory course in Microsoft Office 97 and introductory computer concepts is assumed. After successful completion of the course the student will be able to:

- Setup and Install new hardware and software.
- Diagnose and Troubleshoot hardware and operating system problems.
- Make decisions about purchasing new hardware.
- Be more prepared to take the A+ Certification Exam.

VIII. **Scope of the Course:** Each student should plan to spend a MINIMUM of *three hours* each week (*six hours* is recommended for most students) studying for the course including reading the texts and working on their own computer practicing the concepts in the textbook and completing hands-on assignments.

IX. **Outline of the Course:** See attached.

X. **Assigned Reading and Research:** Students are expected to read and study the assigned textbook chapter(s) and project(s) prior to the designated class period. Students who are taking this course for upper-division credit will write a 10 page research paper on a new hardware/software technology not covered in either text book.

XI. **Special Projects and Activities:** See Evaluation Procedure below

XII. **Evaluation Procedure:** 10 point scale divided as follows

	CIS293	*CIS393*
Chapter Review Questions:	33%	25%
Hands-on Projects:	33%	25%
Research Paper:		25%
Final Exam:	33%	25%

Each student will answer the Chapter Review questions at the end of each chapter. These must be turned in at the beginning of class each week The questions on the final exam will be taken from these questions

Selected hands-on projects will be assigned throughout the semester. Students taking the class for upper-division credit will be assigned at least one of these each week. Upon completion of each project, these students will present their findings to the class in either report format or by demonstration the next week.

Upper-division students will research a new hardware/software development not covered in either text. The paper will have a body of 10-12 pages and conform to the MLA guidelines. Papers will be graded both on content and proper English grammar and style Students should have a minimum of 10 sources cited of which 5 should be from the Internet.

The Final Exam will have two parts: written and lab. The written portion will have questions from the chapter reviews. The lab portion will involve trouble-shooting problem(s) on your personal computer The student will turn in a written description of the problem(s), a log of the steps taken to solve the problem(s), and the solution to the problem(s)

Attendance: Students are expected to attend class and be prepared. Absences will not directly affect your grade, however, **class attendance has been shown to be directly proportional to final grades.**

Academic Dishonesty: Students caught cheating on exams may be given an "F" for the course. Students are *encouraged* to work together on lab assignments, but each student must keep their own notes. Each student is expected to turn in their own homework – copied files will result in BOTH students receiving a ZERO for that assignment. Repeat violations may result in both students failing the course.

Class Schedule

This Schedule is tentative and subject to change at the discretion of the professor to accommodate special needs or time constraints. Please make note of changes as they occur

Week	Tues Date	BEFORE CLASS FRIDAY	DUE FRIDAY
1	1/16	None	Choose the parts for your computer
2	1/23	None	Assemble Computers
3	1/30	None	Assemble Computers
4	2/06	Chapter 1&2	Review Questions
5	2/13	Chapter 3&4	Review Questions
6	2/20	Chapter 5&6	Review Questions
7	2/27	Chapter 7&8	Review Questions
8	3/06	Chapter 9&10	Review Questions
9	3/13	Chapter 11	Review Questions
10	3/20	SPRING BREAK	
11	3/27	Chapter 13	Review Questions
12	4/03	Chapter 14&15	Review Questions
13	4/10	Chapter 16	Review Questions
14	4/17	Chapter 17&18	Review Questions
15	4/24		Research Papers
FINALS WEEK	5/1		Final Exam

Figure 1 - Course Syllabus including Class Outline

References

Davis, Gordon, B., John T. Gorgone, J. Daniel Couger, David L. Feinstein, and Herbert E. Longenecker, Jr. IS ’97: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. AITP (Chicago, 1997).

What's New in Accreditation

Doris K. Lidtke, Professor
Computer and Information Sciences
Towson University

Accreditation in the computing sciences is facing several potential changes. Perhaps this should be expected, since the field of computing is rife with change. The three changes which are addressed in this session are: 1) the possible integration of the computing Sciences Accreditation Board (CSAB) and the Accreditation Board for Engineering and Technology (ABET), 2) CSAB's new criteria for accreditation of Computer Science Programs, and 3) an investigation of the feasibility of accreditation for information oriented program, frequently called Information Systems/Science, or Computer Information Science.

A group of representatives from ABET and CSAB drafted a memorandum of understanding (MoU) to integrate the two accreditation bodies. The MoU provides for the name of the new organization to be ABET (not an acronym) with a byline "professional accreditation for engineering, technology and computing sciences programs." A new commission will be established, called the Computing Accreditation Commission (CAC), similar to the Engineering Accreditation Commission (EAC), the Technology Accreditation Commission (TAC), and the Related Accreditation Commission (RAC).

CSAB has developed new criteria for evaluation Computer Science programs. The program must define its objectives and show how these objectives are met. There is more emphasis on outcomes assessment and the use of results from the assessment to improve the program.

For some time there has been an interest in accreditation of information oriented programs. In order to study the feasibility of such accreditation a grant proposal was made to the National Science Foundation to study this area and develop accreditation criteria.

These changes have many positive implications for the profession and indicate a maturing of the discipline.

Building TQM into Future IS Systems: A Necessity

Linda Taylor, President
Taylor and Zeno, Inc.

It is imperative today that most organizations do things Faster, Better, & Cheaper (FBC) to remain viable and competitive. Therefore, it is necessary that a part of the systems analysis, design, and development process focus on how the Information Systems (IS) are going to enable and support these goals.

It has been said that "If we are standing still, we are actually going backwards" and this has never been more true than today
in this era of continuous and continuously accelerating change. System's being designed and developed have to do more than just automate the processes currently in place. A process review and improvement activity should be an integral part of any requirements or systems analysis project.

Therefore, educators must incorporate more process analysis and design skills and emphasis into CIS curricula and related project and systems management courseware. Skills in analyzing the domain, current processes, and current systems and systems/software environment are essential to good IS systems design and implementation that will support and enable the user community to improve its services and productivity.

Additional emphasis on methodologies and tools for quickly and credibly evaluating the user community, its proficiencies, processes, and systems, as well as "readiness" for change to new processes and systems is needed.

A Framework for Planning Distance Education

Marcy Kittner
The University of Tampa
Information and Technology Management
401 W. Kennedy Blvd.
Tampa, FL 33606

Craig Van Slyke
.College of Business Administration
Management Information Systems
Ohio University
236 Copeland
Athens, OH 45701

Kenneth Trimmer
University of South Florida
Information Systems and Decision Sciences
4202 E. Fowler Ave. CIS 1040
Tampa, FL 33620-7800

Abstract

This paper proposes a framework to be used by educational institutions when developing a distance education presence. It examines the importance of planning and looks at existing frameworks as a preliminary to suggesting a framework that considers distance education from the perspectives of both the student and the institution. The Customer Service Life Cycle, Perceived Innovation Characteristics, and Technology Analysis are all included in the proposed framework.

Introduction

Costs of higher education have been rising rapidly thus forcing institutions to find novel ways to expand their reach while simultaneously lowering per student costs. Many universities are exploring technology-supported distance education (DE) as a possible solution. Complete courses, not to mention entire degree programs, are offered that enable students to complete these while spending little or no time on the actual campus. Peter Drucker, in the March 10 issue of *Fortune* magazine, predicts that due to the tremendous increase in off-campus lectures and classes, "universities won't survive 30 years from now." Should he be correct in his predictions, all universities should explore and possibly adopt distance education in some form. Information Technology (IT) educators should also consider a move towards this approach to course delivery.

Planning for a DE program is a difficult process. Technology changes daily, and while these changes open many previously closed doors, it is an arduous task to keep abreast of them. It is also difficult to determine which students will benefit the most from DE. A third obstacle in planning a DE program is that of determining which courses or programs would best be suited to DE. In order to plan a DE program, institutions must investigate these three areas. This paper proposes a framework to be used which addresses each.

The paper is organized as follows: First, the need for DE planning is addressed. Then the components of the framework, including the theories from which they are derived, are presented. Next, examples of how the framework might be used are provided. The paper closes with a discussion of the implications this work holds for IT educators and researchers.

Need for DE Planning

Interest in DE is, and has been, growing at a phenomenal rate (Burge, 1996; Campbell, 1995; Hilz, et. al., 1997). For more than twenty years, computer mediated communication (CMC) has supported workgroups of various types (Hilz et. al., 1993). As this approach migrates to educational institutions, educators need to thoroughly examine the implications of it. If institutions are to successfully take advantage of the opportunities that DE affords, they must engage in planning.

In this section, some recently proposed DE models and frameworks are discussed. Next the section illustrates

frameworks are discussed. Next the section illustrates how the planning framework presented here is unique. The section concludes with a short discussion of the importance of DE planning.

Existing Models and Frameworks

The interest in DE is illustrated by the number of recently developed DE-related models and frameworks. These seek to provide those interested in DE with organized means of understanding the phenomenon. A number of these efforts are described in Table 1 below.

Frameworks and Models	Description	Reference
Electronic commerce framework for education	Reengineering education by offering value-added services	Hamalainen, et al. (1996)
Framework for using the Internet to deliver training	Represents mode, content and approaches to Internet training	Brandt, (1997)
Strategic framework for planning for DE	A framework that includes the elements of: A New Approach to Learning, A New Compact with the State, and Governing for Change.	The Higher Education 2010 Advisory Panel, (1994)
Generic model for DE	Model to help conceptualize DE by depicting the elements involved.	Letters With Einstein, (1995)

Table 1 - DE Frameworks and Models

The framework proposed here is unique in one very important aspect. This framework approaches DE planning by considering DE from the perspective of the institution and also from the perspective of the student. The previously proposed frameworks and models do not generally deal with both perspectives. Including both perspectives prompts the institution to consider not just the benefits to their internal processes but also what should be done to lead students to adopt the new form of interaction.

Importance of Distance Education Planning

Planning is absolutely imperative for a successful DE program. Although many institutions are establishing a DE presence, few of them are sufficiently planning their DE efforts.

The importance of Information Systems (IS) planning is well established. Considering IT-related issues when planning is an ongoing concern of information systems executives (Niederman, et. al., 1991). It remains one of the "top-ten" key IS issues according to a recent survey of IS executives (Brancheau, et. al., 1996). Further evidence of the importance if IS planning is provided in the literature, including the work of Earl (1993), Premkumar and King (1992) and Jarvenpaa and Ives (1990).

The importance of planning for DE is also becoming recognized. Institutions are recognizing the necessity of planning for technological requirements, course development, and student needs (Deloro, 1997; The Higher Education 2010 Advisory Panel, 1994).

Having discussed prior efforts at providing means for institutions to understand DE and establishing the importance of planning for DE, attention is now turned to the proposed framework.

Distance Education Planning Framework

The proposed framework, shown in Figure 1, contains three components, which correspond to the three issues that must be investigated when planning for DE. Each component will be discussed in turn.

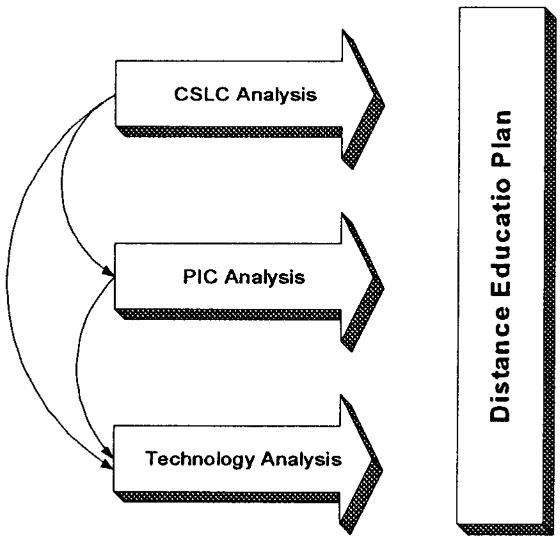


Figure 1 - Distance Education Planning Framework

Application: Customer Service Life Cycle

Haley, Carte and Watson (1996) used the Customer Service Life Cycle (CSLC) to address the issue of how organizations are using the Web. The CSLC can similarly be applied to the task of identifying where DE can be applied--the first issue in establishing a DE plan for IT.

The CSLC breaks the relationship between an organization and its customers into a recurring cycle of four phases: requirements, acquisition, ownership and retirement. We will examine these four phases in terms of institutions and students. Table 2, which is derived from Ives and Learmonth (1984) and Haley, et al (1996) defines the CSLC phases and provides DE-based examples of activities within each phase. Interested readers are referred to Ives and Learmonth (1984) for further details.

Phase	Description	Example
Requirements	Supporting the customer in determining needs prior to any actual sale	A student checking course schedules.
Acquisition	All activities associated with the purchase process	Students registering on-line for classes.
Ownership	Supporting the customer during the ownership of a product or service	Answering curriculum-related questions for the students.
Retirement	Activities that assist the customer in the disposal of the product or service	Process for assisting students in disposing of used textbooks or hardware.

Table 2 - CSLC Phases

Using the CSLC as a guide when investigating how to institute DE is relatively straightforward. Planners would simply complete each step below. Note that knowledge of both the institution and DE is required in order to perform the CSLC analysis.

1. Identify the activities within each CSLC phase.

   For each CSLC phase, planners analyze all interactions with students and prospective students. For example, planners might identify "choose applicable courses" as an activity in the requirements phase. The output of this step is a list of appropriate courses to be taught through DE.

2. Identify how DE might be applied to each activity.

   For each activity, planners identify ways in which DE can be applied to the activity. This step should be a relatively high-level activity, somewhat akin to brainstorming. Technological requirements are not identified nor should the potential conversion be evaluated on its technological viability. This analysis comes later in the process. An example of a DE application might be to allow students complete a course from a distant site. The output of this step is a list of potential applications.

3. Identify the institutional benefits of converting each activity to DE.

   For each application identified in the previous step, planners identify potential institutional benefits. Benefits to the student are not identified at this point and will be analyzed later. An example of an institutional benefit of applying DE to the course offering activity might be saving costs associated with on-campus facilities. The output of this step is a list of benefits associated with each activity.

The CSLC provides a means for institutions to organize their thinking regarding how information technology (IT) can be used to support. However, it is not enough to simply understand where DE can be applied and the potential institutional benefits. Institutions must also consider the issue of customer (student) adoption (Reich & Benbasat, 1990). Diffusion of innovation theory provides insight into this issue.

Adoption: Perceived Innovation Characteristics

Diffusion of innovation theory provides the basis for understanding how innovations are communicated among the members of a social system (including how potential adopters decide whether to adopt or reject an innovation (Rogers, 1995; Gatignon and Robertson,1985). Research has paid particular attention to the impact that potential adopters' perceptions of the characteristics of the innovation have on the adoption decision (Tornatsky & Klein 1982). These perceptions have also been studied in the context of IT (Teo, et. al., 1995). Understanding how students might perceive DE-based interaction with the institution can help planners gain insight into students' decisions.

Although a number of perceived innovation characteristics have been studied, five--relative advantage, complexity, compatibility, observability, and trialability--have been studied most frequently (Tornatsky & Klein, 1982). These characteristics are generally thought to be positively associated with adoption, with the exception of complexity which is negatively related to adoption (Rogers, 1995). It is important to note that it is the adopter's perception of the characteristic that matters, not some expert's assessment. Each characteristic is described in Table 2, which is derived from Rogers (1995), and Moore and Benbasat (1991).

Characteristic	Definition
Relative advantage	Degree to which an innovation is seen as being superior to its predecessor
Complexity	Degree to which an innovation is seen by the potential adopter as being relatively difficult to use and understand
Compatibility	Degree to which an innovation is seen as being compatible with the existing values, beliefs, experiences and needs of adopters
Observability	Degree to which non-adopters can observe the results of an innovation
Trialability	Degree to which an innovation can be used on a trial basis before confirmation of the adoption must occur

Table 3 - Perceived Innovation Characteristics

After using the CLSC to identify potential DE applications, planners can use the perceived innovation characteristics to evaluate potential student adoption. The main goal of this step is to identify how students might view the technology when compared to current, non-DE means of interaction. For each DE application identified earlier, planners should analyze students' possible perceptions of the characteristics of the DE application. Table 4 illustrates one potential application. The example uses a simple high/low evaluation, but a numeric scale could be employed for a more detailed analysis. Note that the illustration is not exhaustive.

Application: Distance Education Course Offerings Over the Web		
Characteristic	**Evaluation**	**Rationale**
Relative advantage	High	Students won't have to travel to campus
Complexity	High or Low	Depending upon student's previous knowledge
Compatibility	High or Low	Depending on student's self-motivation
Observability	N/A	Not a major factor
Trialability	High or Low	Depending on student's existing Web access

Table 4 - Innovation Characteristic Analysis

Planners who complete the CSLC and Perceived Innovation Characteristics analyses should have a good understanding of 1) how DE can be applied to student-institutional interaction, and 2) how students might view factors that influence their adoption of the applications. Now the planners must turn their attention to the technologies required to implement the applications.

Technology

Once the planners determine the CSLC phases to be addressed and what factors might lead to student use, they must consider technology issues. Two areas must be analyzed. First, planners must identify the necessary technologies. This analysis depends on the potential applications identified previously. For example, if planners consider off-site course offerings over the Web as a promising application, then communication technologies become important. Second, planners must evaluate the institution's competency with the technology. If the institution already has experience with communication technologies, then the competence level is high. Should they have no previous experience, the competence level is low. Although many other technologies may also be required, discussion of these is omitted here in the interest of space. However, this analysis should be completed for each potential application.

Application	Technology	Competence	Comment
Off-site courses offered over the Web	Web server	High	Possibly additional personnel
	Firewall	Moderate	Necessary protection
	Microcomputers	Low	Needed at both "ends"

Table 5 - Technology Analysis

Planners should complete a similar technology analysis for each potential application. This will help the planners in prioritizing applications when completing the DE plan, which is the subject of the following subsection.

Completing the DE Plan

Once the CSLC, PIC, and Technology Analyses are completed, the organization should have a relatively complete picture of how DE might relate to their institution. By performing the CSLC analysis, DE planners better understand how DE may be applied to student-institution interaction. The PIC analysis gives planners a more comprehensive insight into the potential for student adoption. The Technology Analysis aids planners in more thoroughly understanding what technologies are required for each potential DE application and also helps in assessing the institution's competence with these technologies. . This is not to assume that this is the only planning process that should be performed. Note that the proposed framework does not directly consider costs or the institution's strategic plan. The purpose of applying the framework is to develop a foundation for completing the DE plan. There is a large body of literature on aligning IT with organizational plans. There is also considerable work on estimating IT costs. The proposed framework is directed at helping organizations understand some of the unique aspects of DE and how it relates to customers and the organization.

DE planners must use the information gained from applying the framework to construct an implementation plan. This plan should be based on the information coming from the framework along with the organization's strategic plan and implementation and operation cost data. It is important that IT planning be consistent with overall organizational planning. The same can be said for DE. It is, of course, also important to consider both implementation and operational costs when developing the final DE plan. By adding these final pieces to the DE puzzle, the institution can develop a sound DE plan.

Conclusions and Implications

The framework presented in this paper provides DE planners with an organized, theoretically sound means of examining three important areas of this method of educational delivery. Technological needs, appropriate programs, and student acceptance must all be examined and then addressed in the planning process. This framework should only be used as one tool in the process. Other areas, such as cost and the institution's strategic plan, also need to be investigated and included in the comprehensive planning process.

References

Applegate, L., Holsapple, C., Kalakota, R., Rademacher, F. and Whinston, A. (1996). Electronic Commerce: Building blocks of new business opportunity, *Journal of Institutional Computing and Electronic Commerce*, 6(1), 1-10.

Brandt. D. Scott (1997). The Multiple Personalities of Delivering Training Via the Web; *World Wide Web, Information Today, Inc.*, 17(8), pp. September, 51-55.

Burge, Elizabeth J. (1996). Inside-Out Thinking About Distance Teaching: Making Sense of Reflective Practice, *Journal of the American Society for Information Science*, 47(11), pp. 843-848.

Campbell, Olin (1995). Interactive Distance Learning: Issues and Current Work, *Journal of Instruction Delivery Systems*, Summer, pp. 32-35.

Davis F. (1986). Perceived usefulness, perceived ease of use, and use acceptance of information technology, *MIS Quarterly*, 13(3), 319-340.

Deloro, Joe (1997). Interactive Distance Learning Puts College & Corporate Classrooms Online, *Information Access Company*, 3(8), August.

Hamalainen, Matti, Whinston, Andrew B., and Vishik Svetlana (1996). Electronic Markets for Learning: Education Brokerages on the Internet, *Communications of the ACM*, June, 39(6), pp. 51-53.

Hilz, Starr and Turoff, M. (1993). *The Network Nation: Human Communication via Computer*, MIT Press, Cambridge, MA.

Hilz, Starr and Weldon, Barry (1997). Asynchronous Learning Networks as a Virtual Classroom, *Communications of the ACM*, September, 40(9). pp. 44-49.

Ives, B. and Learmonth, G. (1984). The information systems as a competitive weapon, *Communications of the ACM*, 27, 1193-1201.

Letters with Einstein: Collaboration in Theory Building in Distance Education (1995). Page prepared by Richard Caladine, http:www.uow.edu.au/ads/Einstein/generic_model.ht.ml

Reich, B. and Benebasat, I. (1990). An empirical investigation of the factors influencing the success of customer-oriented strategic systems, *Information Systems Research*, 1(3), 325-347.

The Higher Education 2010 Advisory Panel (1994), Education Unbounded--A Vision of Public Higher Education Serving Oregon in the Year 2010, http:/www.osshe.edu/dist-learn/unbound.htm.

Yadav, S. and Shaw, N. (1997). A comprehensive framework for understanding electronic commerce, in *Proceedings of the* 8th *International Conference of the Information Resources Management Association*, Vancouver, B.C., Canada, May 1997, 446-450.

MANAGING THE PAPERLESS CLASSROOM

Gerald F. Braun, Ph.D., C.D.P.
Elaine Crable, Ph.D.
Department of Accounting and Information Systems
Xavier University

Abstract
This paper identifies five major areas of classroom delivery which can be used to support a paperless classroom. These areas include administration, support materials, assignments, exams, and discussion. An integrated approach to managing these components is described. Criteria for implementing the model include the use of readily available and inexpensive tools, and full integration within a World Wide Web based environment. While building the initial Web site and support materials can be time-consuming, with proper planning and organization, the process can be of considerable benefit to students, faculty and the environment.

Introduction

For the past decade or more, the Internet has provided instructors with technologies for electronic classroom support. Newsgroups, electronic mail, file transfer protocol (FTP) capabilities could replace paper transactions for various components of a course. The more recent introduction and explosion of the World Wide Web has provided us with significantly more opportunities to make us less dependent on the drudgeries of paper-intensive classroom activities -- handouts, assignments, reports, projects, exams, etc. (Bialac and Glover, 1997).

Using technology to teach technology makes good sense for Information Systems (IS) professors. By using informational technologies in the classroom to complete course activities, they will be better prepared to compete in the ever-evolving information age. This is especially true in the introductory courses for non-IS majors who may not otherwise be regularly exposed to such materials (Bialac and Glover, 1997).

Many professors in Information Technology and in other disciplines (Trapp, et.al., 1996) use various components of the Web and the Internet to support their classes and reduce the role of paper in the classroom. However, building an integrated paperless classroom with full Web support for multiple classroom activities, is a much more time-consuming endeavor. One approach (Chimi and Gordon, 1997) uses multiple tools, such as the Web for administrative support, FTP for handling assignments, and a Newsgroup reader for discussion forums. While these tools can help to support a truly paperless classroom, they require the student to work with (and learn) multiple software products to complete assigned activities. This has the positive effect of exposing them to a wider range of software utilities, but it can detract from the overall presentation and administration of the paperless classroom. Tools such as Learning Space from Lotus Notes, allow faculty to create comprehensive courses accessible from Web browsers without knowing Notes programming skills. However, for professors already skilled at using HTML and Web development tools, this requires an additional learning process. Also, to fully implement a paperless classroom in a Notes environment can be quite expensive.

This paper outlines an approach for building a paperless classroom using readily available (and generally free or very inexpensive) tools and techniques. Five basic components, 1) administration, 2) support materials, 3) assignments, 4) exams, and 5) discussion, are identified and explained. All components are well integrated around the use of the Web, and are easy to use even for the least technically competent student. This approach is currently being used in several of our courses at both the graduate and undergraduate levels. It was first implemented in a cross-disciplinary, introductory World Wide Web Fundamentals course and in a cross-disciplinary Hardware/Software Overview course required for IT minors, and is easily extended to accommodate other courses.

Components of a Paperless Classroom

While the Web has presented an opportunity for many professors to automate various aspects of their classroom delivery, we have identified five major areas of classroom delivery which lend themselves to automation.

- Administrative materials (syllabus, agenda, etc.)
- Classroom resources and support materials
- Assignments (distribution, collection & feedback)
- Exams (distribution, administering & grading)
- General feedback and discussion forums

Administrative Material generally lends itself to Web support. In our case, this includes an online syllabus and agenda, as well as a message board for each class. The message board is used to post regular messages concerning exams, textbooks, procedures, changes in office hours, etc. Office hours are posted on a Web page for access from other pages. Guidelines for correspondence are also posted on a Web site.

A ASign In@ page is being developed to have students enter their full name, casual name, e-mail address, and optional phone number on a form to be processed by a CGI script for internal Web access our own Intranet as well as access by an e-mail client for mass mailings.

Resource and Support Materials include readings from magazine and journal articles, an annotated bibliography which is maintained electronically, PowerPoint presentations, and resource Web pages to support class lectures and activities.

Many readings are readily available from sources such as Byte Magazine, PC World, PC Magazine, and Internet World. Selected readings are used to supplement textbook materials in order to summarize key components of the course and to present the most up-to-date materials on Information Technologies. In addition to the readings, an online bibliography is maintained to reference additional topics in both electronic and paper format. The bibliography supports multiple courses in both IS and Accounting, an is supported by faculty and students. It is segmented by category for easy reference. Appropriate bibliographic information along with a brief abstract of each article and URL of the Web site, if it is an on-line article, is entered through forms and processed by a CGI script. Articles are categorized by topic and sent to separate Web pages based on category selection. These pages are periodically reviewed to purge non-relevant or out-of-date articles.

PowerPoint presentations are stored on the Web server, and a Web site is available for each class to allow students to easily view or download slide presentation. All campus computers have PowerPoint installed as a plug-in so that students can merely click on the appropriate link to access the slides in order to view them or print an outline of the presentation. Students who have PowerPoint on their off-campus computer can also access the slides, or if they do not have the software, they can easily download the free PowerPoint viewer from Microsoft. Slides are stored in both Windows95/97 and Version 4.0 formats to accommodate students with different computer platforms. An extensive Web Resource Site supports the Web classes. It includes six primary sections:

- Overview
- Searching the Web
- Site Development
- Multimedia Resources
- Communications on the Web
- E-Commerce

The Overview section includes content on Web history and growth, browsers, service providers, IP addresses, and domains. The Searching section provides extensive information on search engines and directories, meta search tools, finding people and businesses, off-line browsers, newsgroup searching, and other search tools. The Development section includes style and development guidelines, a review of development tools, HTML support, site analysis, and guidelines for publishing pages. The Resources section provides access to forms and script archives, image map tools, viewers and editors, as well as graphics and multimedia archives. The Communications section provides summaries of communications resources, including Internet telephones, collaborative tools, video conferencing, e-mail clients, newsgroup readers, and groupware. The final section, includes an overview of E-commerce, selected sites, a review of software tools, and an E-commerce glossary.

The Web Resource site includes hundreds of links to informational sites, vendors and download sites. It can be accessed at <www.xu.edu/colleges/cba/classes/resource.htm>. The site is designed specifically to support the World Wide Web Fundamentals course, but may be of more general use for other Web-based courses as well.

A similar site (Hardware/Software Resources) is being built to support the Hardware/Software Overview course. The site currently includes support for CPU and memory (with a schematic of a motherboard), video technology, storage technology (with extensive coverage of removable storage), the history of computers, remote-access software, and virus protection software. This site is currently in the developmental process with new sections being added regularly, and can be accessed at <www.xu.edu/colleges/acct-info/hardware.htm>. Specific support pages will probably be developed for other courses also.

Assignments

Managing regular assignments electronically can be quite time-consuming without appropriate standards and tools. However, with proper organization and management, this can show benefit for both students and faculty.

Assignments, including article reviews, are a standard part of the Hardware/Software and Web courses, as well as other classes. An Assignment Board page for each class is used to distribute assignments and provide guidelines for submitting article reviews. All students have an e-mail account on the academic VAX computer. They use Eudora Lite as a standard e-mail client. Eudora Pro is used by professors to receive assignments and send responses. Attachments can be sent with either Word Perfect or Microsoft Word for text documents. Program listings and executable code for programming assignments can also be sent as attachments.

Special procedures have been designed by the Academic Computing Center to provide students with an easy mechanism for maintaining a mailbox on diskette for access from any station on the Xavier network. Outside access to VAX accounts from home or business is relatively easy to set up with Eudora, and detailed instructions plus documentation, are provided by the computing center. These documents are also made available in .pdf format on the Web for easy access with Acrobat Reader. A special account is set up on the Academic VAX for each class for students to send assignments to. Students in the INFO374 class send to the INFO374 account, INFO960 to the INFO960 account, and so on. Special instructions are given on the Assignment Board for setting up Eudora for submitting materials. Students must include certain keywords in the subject line. These keywords (e.g. assignment, project, etc.), coupled with the account, allow assignments, project materials, and other correspondence to be filtered into appropriate folders with Eudora Pro.

Automatic responses are sent to students as they are filtered, to let them know that their mail message was received. Each new message is read and graded with grades posted in a grade book. (I guess this could be done electronically, but I find that good old paper is easier for this.) A reply is sent to students if there is a particular problem or to give specific feedback to a student with regard to the submission. For most students, the automated response with no other reply lets them know that the assignment was satisfactory . If an attachment is required for the assignment, it can be read by either Word or Word Perfect by clicking on the attachment button. If comments are necessary, they can be made with either tool. (Word highlights the commented area and Word Perfect puts comment balloons in the margin.) Macros are not accepted, to minimize virus problems, although an up-to-date virus protection program scans incoming messages. The file can then be re-sent to the student. Each folder is sorted by sender to give a snapshot of students= performance to date.

Programming assignments can be handled fairly easily, in the same fashion. Code can be sent as a text file, and an executable version of this program can also be sent electronically as an attachment. Overall, processing assignments electronically is still time-consuming, but it provides a convenient mechanism for storing and reviewing student work.

Exams

Perhaps the most challenging aspect of the paperless classroom is the administration of exams. This is not a problem with take-home exams, but several issues arise for in-class testing. We are still working on this aspect of the process, but it is hard to get away from the standard procedures that we have been using. Multiple choice exams can be generated from test banks and graded by computer. Perhaps someday Web based exam banks will be available. For now, we are working on a CGI script to allow multiple choice exams to be easily entered for processing and presentation as a Web page form. Responses could be checked instantaneously and immediate feedback given to the student with the correct answer and a grade passed to an electronic grade book. This script is a bit more complex than standard form processing. A shareware product called WebForms currently provides similar functionality (Chimi and Gordon, 1997), but seems to be a bit cumbersome to use. We feel that a custom designed product would streamline the process. Furthermore, online testing assumes that each student has access to a computer while taking the exam. We do not currently have such accommodations.

Testing with essay questions, short answers, or problems, presents a different issue. While it is easy to generate an online test with simple HTML forms, students with remedial keying skills would be at a significant disadvantage. They may expend more thought processing energy on working the computer than on answering the question appropriately. Maybe in a number of years when we can assume that all students are as comfortable with computer interaction as they are with writing on paper, this may work.

For now, we are still using paper for in-class exams, and will continue to do so until appropriate facilities are available and other circumstances change.

Feedback and Discussion

While tools are readily available for feedback and discussion, they have their disadvantages. Newsgroups can be used for threaded discussion, but they take the student away from the Web environment and are not necessarily user friendly to technical neophytes. Lotus Notes Domino Server, and other groupware tools such as MS Exchange Server, Novell=s Groupwise, and Netscape Collabra Server, provide nice threaded discussion formats but are not free like other resources. There are some nice script-based discussion formats available from the Web that can be integrated (for free) into a standard Web-based delivery platform. There are also a number of other

Commercial products available ranging from $59 for a 2 board, 10 conference version of WebBoard from O=Reilly & Associates, to high-end packages which cost several thousand dollars. Greg Alwang (1998) presents a nice review of 10 of the most popular packages in a recent PC Magazine article (available at <http://www.pcmag.com>). Some of these look promising, but may be priced beyond the typical classroom budget.

We plan to implement a freebie Web-based script for threaded discussion, customized for our own needs. We will have an open forum for all students interested in Information Technology (IT) and specific forums to support each class. We expect that they will get heavy use at exam time. They will also be quite useful in our project courses to support team efforts. We are also thinking of implementing an AAsk the Professor@ page from which students could submit questions related to IT. A response (along with the question) would be posted on a Web page.

Currently, we use e-mail for correspondence and feedback. Mass mailings can be made to an entire class, or individual messages can be sent to specific students. However, the Message Board is the tool of choice for delivering information to multiple students.

Maintenance of Web Sites and Correspondence

Netscape is used as a campus standard for browsing the Web and editing pages. Composer is used to build and maintain sites. Composer integrates very well with the Netscape browser to easily make modifications. Pages are primarily text based for fast loading and accessibility, and we find that the Netscape editor (which is free) is a nice tool for this purpose.

Most administrative materials (syllabus, office hours, etc.) are easily modified at the beginning of each semester. PowerPoint slides are updated and loaded to the server using the WS_FTP file transfer utility. The message boards are modified as needed -- at least on a weekly basis. If there is no breaking news for the class, updates on school events (such as the progress of the women=s basketball team) might be posted to the board to encourage students to check the board regularly. Information about exams also encourages participation. In order to encourage regular use of the board for some classes, a different letter of the alphabet is posted each week, and at the end of a specified period of time, they must unscramble the letters and search the Web to answer a question with regard to the unscrambled word. Correct responses receive extra credit.

The assignment board is maintained on a regular basis. Guidelines for submitting article reviews and for completing projects are posted at the beginning of the term, while assignments are posted weekly or as needed. This is a simple matter of browsing to the page, selecting AEdit Document@, making changes to the page, and publishing to the University Web server. Composer does not require that you save the document locally, and keeps track of relative server information such as directory structure and password.

Maintenance of resource support pages is an ongoing process for courses with dynamic content. SiteSnagger, a free offline browsing utility from PC Magazine, is used to check for dead links on resource pages. By setting options to search only two levels deep with no images, a background download of the site will identify any bad links in a relatively short period of time. These support pages reference a considerable number of external sites which may or may not be around after several months. New content and links can be added fairly easily to keep the site up-to-date. Minor changes to content or reference to a new site can even be accomplished rather simply during a class session. If a student suggests a useful resource, a link to the resource can immediately be added to the page.

Eudora Pro is used instead of Netscape=s Messenger because of its ability to easily access multiple mail accounts and its superior filtering options for automatically filing documents and sending reply messages. Eudora Lite is freely available, and supported the use of diskette quite easily for use on the campus-wide network. Mail folders are backed up on a weekly basis. Eudora will allow messages to remain on the server for a specified period of time before automatically deleting them. This provides an interim backup for student work to supplement the weekly backups.

Observations and Conclusions

Administrative tasks are fairly easy to implement. Once an initial template is set up to support activities such as a syllabus, agenda, and assignments, it is easy to set up for other courses and for other sections or future offerings of the same course.

An electronic syllabus is easy to maintain and modify. Corrections or omissions can be immediately rectified without recopying and re-distribution. Materials are readily available to all students and they cannot be misplaced or Aeaten by the dog.@ Students seem to appreciate the convenience of the electronic media, especially if it is presented in a consistent and easy-to-use format.

Implementation of discussion groups is also straightforward, especially if you use readily available tools such as newsgroup readers, or the Lotus Domino server. The biggest problem here is getting students to use them. We are working on ways to encourage their use for assignment and exam presentation. Hopefully, as students become more familiar with the process and as we more closely integrate it with the other Web components, they will recognize the many benefits of such a forum.

Building and maintaining support materials is by far the most time-consuming. However, they appear to be well used and much appreciated by the students. And once they are built, they are fairly easy to maintain. This can be a lot easier than maintaining paper-based support materials and can greatly reduce the use of paper for distribution of handouts, articles, etc. They are most useful in courses like the Web Fundamentals and Hardware/Software Overview course, where comprehensive and up-to-date textbooks which match the course, are hard to find. Support materials for these classes change so rapidly that textbooks cannot keep up.

As mentioned in the previous section, processing assignments electronically, although can reduce the flow of paper, it often requires more work on the part of the professor and does not necessarily provide less work or other added benefit for the students. However, the use of an e-mail client such as Eudora Pro can assist the instructor with organization of materials. He or she can easily review the status of any student with regard to required or optional activities. The automated date-stamping of e-mail messages provides a clear picture of an individual student=s progress through the course.

The electronic administration of exams can also be very time-consuming with minimal apparent benefit to the professor or student, although Chimi and Gordon (1997) did find that students prefer electronic exams -- at least for multiple choice. They also pointed out that such exams can be more difficult to set up than with the simple use of a question bank and the use of marked sensing forms for scanning. Furthermore, it is still hard to get away from grading problems and essay questions by hand (on paper).

Overall, we have found that the use of the described model provides an easy-to-manage format for implementing the paperless classroom. It is easy for students to use and generally well accepted, but there are still some unanswered questions which we hope to address in the future, and some segments of the model we hope to improve. Some of these questions and improvements include the following:

- Better tools for automating the testing procedure
- Better integration of discussion forums
- To what extent do students use support materials -- is it worth the time?
- How much of the online material do students print?
- Are we really saving paper, or just using a printer instead of high-speed copiers to generate materials?

We hope to address these and other related issues in the near future.

REFERENCES

1. Alwang, G. (1998), AMeeting of the Minds: Web-based Discussion Software.@ PC Magazine, 17:4, pp. 179-192.

2. Bialac, R., and Glover, H. (1997), A Paperless Classroom in Introductory Courses.@ *Proceedings of 12th Annual International Academy of Information Management.* pp. 167-168.

3. Chimi, C., and Gordon, G. (1997), AUsing Innovative Information Systems Techniques to Teach Information Systems.@ *Proceedings of 12th Annual International Academy of Information Management.* pp. 161-166.

4. Ouellette, T. (1996), ANotes-based Program May Facilitate Remote Training.@, *Computerworld,* 30:42, pp. 76.

5. Trapp, A., Hammond, N., and Bray, D. (1996), AInternet and the Support of Psychology Education.@ *Behavior Research Methods, Instruments and Computers.* 28:2 pp. 174-176.

Web-based Support for Cooperative Learning Teams: Report and Results from a National Science Foundation Grant Project[1]

Catherine M. Beise, Merle King, Martha E. Myers, Diane L. Willey
Kennesaw State University

Abstract

This paper presents the objectives, activities, outcomes, and preliminary assessment of a project funded by the National Science Foundation (NSF). The project's goal was to use the proposed equipment to develop Web-based resources for facilitating collaboration among students working on team projects. Activities included faculty development and delivery of Web-based course materials to students at off-campus locations as well as in the classroom. Students used the resources for communication, coordination, and development of team projects in numerous classes. A preliminary assessment of the project results indicate that faculty using the resources observed increased instructional effectiveness, increased student-faculty interaction, and increased student-student interaction (compared to more traditional approaches). The project met its stated goals, but also had broader impacts on both students and faculty. The purpose of presenting this paper at ISECON is to disseminate the results of the NSF-funded project and share the authors' experiences in acquisition, use, and diffusion of technology resources to support teaching and learning in Information Systems. (Readers may also be able to use the results of this project to argue for additional funding for instructional resources.)

Introduction.

This paper presents the objectives, activities, outcomes, and preliminary assessment of a project funded by the National Science Foundation (NSF). The project requested and received funding for instructional equipment to support the development and delivery of Web-based resources to facilitate collaborative learning experiences among student teams working on information systems analysis, design, and development projects. One purpose of presenting this paper at ISECON is to disseminate the results of the NSF-funded project and share the authors' experiences in acquiring, using, and diffusing technology resources to support teaching and learning.

The institutional recipient of the funding is a commuter campus with both graduate and undergraduate programs. The university currently has a student body of 13,000, all of whom commute to school and nearly half of whom fall into the category of "non-traditional" students, many of whom work full-time and carry family responsibilities along with going to school. Forty-eight percent of current students are over age 25, and the average age of Bachelor's degree recipients is 29. Administrators, students, and employers all are demanding more flexible delivery of courses, both in scheduling and in remote access. The goal of this project was to increase that flexibility by acquiring state-of-the-art hardware and software to design and develop on-line course materials, to increase student access from off-campus, and to support collaborative learning and teaching.

Instructional Context and Background.

The recipient department currently offers two major degrees, in information systems (IS) and in computer science (CS). An important feature of both programs is an emphasis on teamwork and group projects. The department is committed to supporting team-based student work to prepare students for the realities they will face (or already face) in their organizational workplaces.

Many employers complain that although the graduates they hire may be technically excellent, they lack group and project skills. As a

[1] NSF ILI DUE-9651132.

result, interest has grown in helping students learn to work together in teams in computer-related curricula (Collings and Walker 1995; Rein 1995; Swigger, Brazile et al. 1995). Such projects are required in this particular program in the following courses: Project Management, Database Processing, Systems Analysis & Design, Systems Design & Implementation, and others. Many student projects are "real-world" since many of the students have contacts in the local community.

As organizations become more global in scope, project teams increasingly must coordinate from remote locations, adding an additional challenge to what teams are already faced with, in having to accomplish the task as well as maintain a productive group process. Educators are thus incorporating this distributed aspect to student team projects as well (Hiltz 1994; Knoll and Jarvenpaa 1995; Ocker, Hiltz et al. 1995). Working in remote locations, yet functioning as a team, is an especially critical issue on a commuter campus such as the authors' institution.

Challenges which arise in requiring students to work on teams include planning, scheduling, and general communication and coordination; finding times and convenient places to meet face-to-face; convenient exchange of information, especially formatted documents and graphical images, for team member review; uneven distribution of workload; and achieving a true cooperative learning experience, rather than a simple division of labor.

A typical team project in one of the targeted courses begins with assignment of students to teams at the beginning of the term. In a systems development project, the teams are assigned a case or more often they bring a real-life case to use for their team project. The projects have interim deliverables, which correspond to the sequence of material covered during the term. Depending upon the specific course, the student teams are required to produce a project plan, data and/or process models, a database and/or system design, prototypes of screens and reports, and/or implementation of other aspects of the system, such as the database or the user interface.

The Cooperative Learning Process.

Ideally, even if some of the work is divided up, the whole team reviews, discusses, and modifies what individuals may have drafted. The instructor may review and comment on the interim deliverables, and the team again gets together to discuss needed modifications. This collaboration process is intended to enhance learning, based on evolving theories of learning which maintain that students learn more effectively when they actively construct their own knowledge from problem-based experiences by working together in cooperative teams (Alavi 1994, Koschmann, 1996). Due to constraints on the ability of these student teams to meet face-to-face, however, actual collaboration probably occurs less often than the instructor intends.

Technical Environment.

At the time the grant funding was requested and received, course materials such as chapter objectives, homework assignments, handouts, examples, tools, etc., could be stored on a shared DOS disk drive for students to access. However, students could access these only when on campus, and could not upload their own documents to share or to turn in, except by e-mail. Existing campus resources were very limited in providing access to the Web, or in providing tools for Web development for instructors or students.

Project Objectives.

Ideally, the student teams would have a shared workspace on the Web which would allow them to upload and download documents and graphical models; view each others drafts; discuss, annotate, and modify drafts; and turn in both interim and final versions for review by the instructor. Further, it would allow them to conduct their teamwork from any location (home, office, or even traveling). Another benefit of putting student course deliverables on the Web is giving the students' "client" organizations access to intermediate deliverables electronically and from their offices, to provide feedback to the student teams without having to meet with them face-to-face.

An additional goal of the project was to make it easier and more efficient for the instructor to develop, disseminate, and dynamically update course materials, and to review and give more extensive and detailed feedback to individual students and teams on a more timely basis. A final goal of the project was to develop ways to evaluate the project outcomes with respect to teaching and learning.

Project Activities.

With these goals in mind, the equipment requested included hardware and software resources to facilitate faculty and student development and use of Web-related course materials and deliverables. The major acquisitions for the project consisted of a Silicon Graphics workstation with a set of multi-media Web development tools and a Web server, and a set of multi-media laptop computers, including licenses for useful software and Internet tools.[2]

The SGI has been used mainly to provide space for both students and faculty to develop, store, and access Web-based course materials. Student teams in some classes developed Web sites for clients as their system development projects. Students also used Web sites to share project management documents, such as schedules and responsibilities. Student teams uploaded components of their team deliverables so that other students, the instructor, and/or the client could review them from remote locations.

Over the two years of the project, the laptops have been loaned out to both faculty and students for a variety of purposes. Students borrowed laptops to work on both individual and team projects off-campus. Several faculty have used the laptops to develop course materials, to deliver the materials via the Web, and to present dynamic demonstrations in the classroom to support various pedagogical goals.

The resources have also been used by directed study students for special projects involving advanced software installation, demonstration, and evaluation, and to present their project deliverables to classes, to faculty, to clients, and at an annual undergraduate research symposium.

Finally, the resources have been used by both faculty and students in various combinations with other campus resources as they have evolved, such as e-mail, electronic bulletin boards, and electronic discussion lists. Since most classrooms at this institution are now networked, the laptops can be used during class to link to the Web and dynamically incorporate local and global internet resources into the class pedagogy.

[2] Other equipment purchased included hardware and software to support multi-media development, such as licenses for MS Office 97 and FrontPage, a digital camera, color printer, X-windows software, and video cameras

Project Outcomes.

Over the two years of the project, campus technology resources in general have improved such that the resources acquired in this project are no longer the only ones available to faculty and students. However, they have served to accelerate the speed and breadth at which faculty have experimented with and incorporated technology resources into their standard pedagogical styles.

One measure of success described in the project proposal was to observe the rate at which additional faculty incorporated use of these resources, especially into other classes not initially within the scope of the proposed project. Over the two years of the project, the number of faculty participating gradually increased from 1 to 9, the number of course sections supported per term increased from 1 to 19, and the number of students affected per term increased from one class of 37 to over 600 students. (See Figures 1 and 2.)

The faculty who made use of the resources also responded to a survey which asked about their perceptions of improvements in teaching and learning resulting from having the resources available. The survey included both Likert-scaled and open-ended questions. The results of the survey demonstrate positive perceptions of increased instructional effectiveness, instructor-student interaction, and student-student interaction. (See Figure 3.)

Faculty Comments

- *"I had the students download the assignment handouts from the class web site, which made them use a resource (the web), that I was having them study."*
- *"Developing programs 'from scratch' in class [using laptop] (with a pre-planned objective) is an effective teaching method. The result can then be posted so students are not tied to the note-taking."*
- *"Using the Web delivery model of instructor and peer prepared materials affords the student easier access to learning opportunities."*

- *"[The SGI] provided] online access in real time to key materials."*
- *"[The SGI] provided a critical, central resource that allowed students to post their work for peer review ... resulting [in] ... revisions, adoption of better approaches, and ultimately better solutions."*
- *"[The SGI] and the laptop has been the single best resource provided by this institution to support creative, collaborative instructional materials."*

Conclusion.

Our experiences on this project have led us to the following tentative conclusions about technology use for teaching and learning.

The portability of the laptops from office to home to classroom, and the accessibility of the Web from all the same locations, were key success factors in this project. Another factor was that the SGI was available as an experimental resource on which faculty and students could try out innovative uses of technology without worrying about the impacts on other on-going uses.

Faculty need flexible, user-friendly resources that they can adapt to their own pedagogical styles. They also need time and opportunity to experiment with new technologies in incremental steps. Faculty are more likely to adopt technology resources for instruction when it is voluntary and when they can observe how their colleagues are using them. The faculty involved in this project mixed and matched a variety of resources, including portable hardware, e-mail, bulletin boards, listservs, and the Web, to adapt to different needs in different courses. One technical necessity is an easy transition from one tool to another.

Students can effectively collaborate without having to schedule face-to-face meetings. This more accurately simulates what distributed project teams in global organizations are doing on a growing, in some cases daily, basis.

More research is needed to verify the impacts of technology use on teaching and learning effectiveness. However, the results of this project suggest that given a set of flexible resources, enough time, and an appropriate diffusion process, faculty and student use of technology can have positive outcomes.

Bibliography.

Alavi, M. (1994). Computer-mediated collaborative learning: An empirical investigation. *MIS Quarterly*(June): 159-174.

Berge, Z. L. and M. P. Collins (1995). *Computer Mediated Communication and the Online Classroom.* Cresskill, NJ, Hampton Press.

Collings, P. and D. Walker (1995). Applications to support student group work. *CSCL 95: Computer Support for Collaborative Learning*, Bloomington, IN, Lawrence Ehrlbaum Associates.

Davis, J. R. and D. P. Huttenlocher (1995). Shared annotation for cooperative learning. *CSCL 95: Computer Support for Collaborative Learning*, Bloomington, IN, Lawrence Ehrlbaum Associates.

Gutwin, C., G. Stark, et al. (1995). Support for Workspace Awareness in Educational Groupware. *CSCL 95: Computer Support for Collaborative Learning*, Bloomington, IN, Lawrence Ehrlbaum Associates.

Hiltz, S. R. (1994). *The Virtual Classroom: Learning without limits via computer networks.* Norwood, NJ, Ablex.

Knoll, K. and S. Jarvenpaa (1995). Learning to work in distributed global teams. *Hawaii International Conference on Systems Sciences*, Hawaii, IEEE.

Koschmann, T. D. (1996). *CSCL: Theory and practice of an emerging paradigm.* Mahwah, NJ, Lawrence Erlbaum Associates.

Ocker, R., S. R. Hiltz, et al. (1995). Computer support for distributed asynchronous software design teams: Experimental results on creativity and quality. *Hawaii International Conference on Systems Sciences*, Hawaii, IEEE.

Rein, G. (1995). Teaching IS design and development in a group learning setting. *CSCL 95: Computer Support for Collaborative Learning*, Bloomington, IN, Lawrence Ehrlbaum Associates.

Swigger, K. M., R. Brazile, et al. (1995). Teaching Computer Science students how to work together. *CSCL 95: Computer Support for Collaborative Learning*, Bloomington, IN, Lawrence Ehrlbaum Associates.

Figure 1

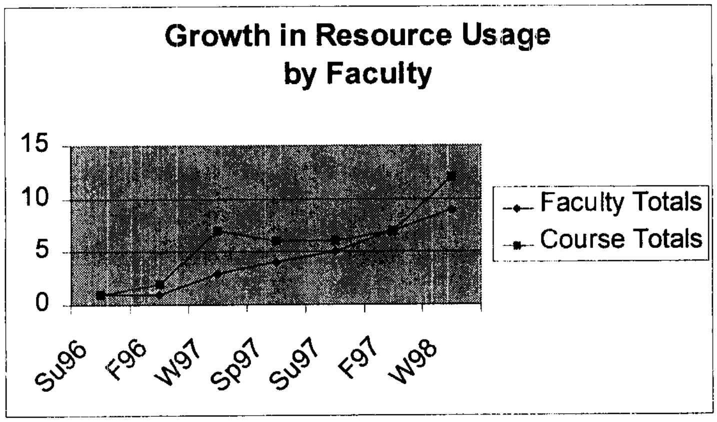


Figure 2

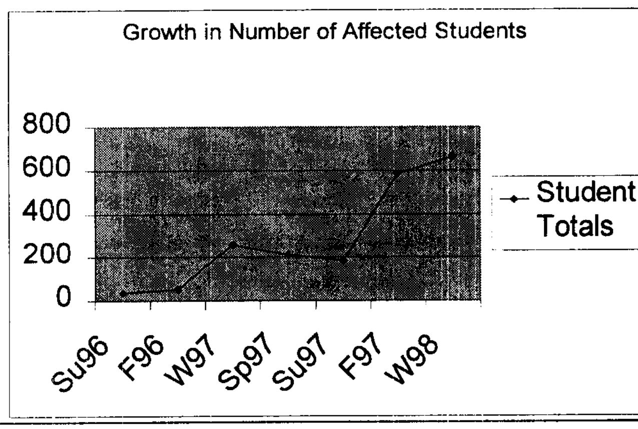


Figure 3 - Faculty Perceptions	
Use of the laptop increased:	
Instructional effectiveness	4.56*
Instructor/student interaction	4.00
Student/student interaction	3.11
Use of the SGI increased:	
Instructional effectiveness	4.33
Instructor/student interaction	4.22
Student/student interaction	3.78
**Scale: 1-5, where 1 = strongly disagree, 5 = strongly agree*	

USING WEB TECHNOLOGY TO REDUCE ADMINISTRATIVE LOAD AND INCREASE LEARNING OPPORTUNITIES IN CLASSES

Thomas Janicki & Geoffrey Steinberg
Kent State University, School of Business Administration, Kent OH 44242

INTRODUCTION

The administrative management of classes may comprise a significant portion of an instructor's workweek. The time required for syllabus development, maintaining a current syllabus, grading, posting of grades, creation of homework, tests, and projects, as well as repetitive communications with students may use all available work-time in a week. Potentially this leaves minimal time for the development of new and creative lesson plans. Technology has reduced the time required for repetitive activities in businesses. Information technology may also be used to reduce the repetitive activities for instructors.

Several of the time consuming activities that comprise a significant portion of an instructor's work-week are: 1) grading of projects, homework, and exams; 2) the time to maintain a grade book or roster, and the communication of these grades to students; 3) providing individual feedback on exams; 4) maintaining up to date information on the class syllabus; and 5) communicating changes in requirements for the course to the students.

Creative uses of information technology, can help improve learning. Alavi [1994] reports that no single or unified learning theory exists, but three attributes of effective learning processes can be readily identified. They include active learning and construction of knowledge, cooperation and teamwork in learning, and learning via problem solving. She concludes that Computer Based Technologies (CBT) technologies can enhance all three of these learning keys.

This working paper will discuss the development and implementation of a web based integrated learning and evaluation system that reduces the administrative time for an instructor. In addition, this web-based system has components to enhance learning options for the students. These components are increased evaluation opportunities, increased and rapid feedback, and tutorial modules.

INTEGRATED WEB BASED SYSTEM

The integrated system has two basic focuses. The first is to reduce the chore of maintaining a gradebook, syllabus, and appropriate communications in a class. The second focus is to increase the learning opportunities available to students through increased homeworks, projects, on-line tutorials, and on-line tests that provide increased feedback and evaluations.

The system assumes that the instructor has no knowledge of HTML (HyperText Markup Language), as it has been developed to be menu driven. A class can be thought of one directory on a computer, It contains the information for the syllabus, homeworks, tests, and grades for all students in one unified area. Updates to the syllabus for additional projects or a change in the weight factor of an assignment or test will be reflected immediately on the individual student grade rosters.

Go Status Report
Go View Syllabus
Go Quiz List
Go Study Guide
Go Assignment List
Go Submit Assignments
Go Graded Assignments
Go Handouts
Go Change Personal Data
@email Dr. Steinberg
Go Close

Figure 1 -Sample options available to a student

ADMINISTRATIVE FEATURES

1. On-line development of a course, from syllabus to handouts, to homeworks, to projects
2. On-line development of tests and exams
3. On-line testing and automated grading, providing comprehensive feedback to the instructor and student
4. Automatic gradebook maintenance
5. On-line individual student progress reports and grade projections
6. Automatic grading of homeworks and projects in a wide variety of common file formats
7. On-line class communications via e-mail, web pages, and live web-based group discussions
8. Comprehensive security system for the instructor and student.

Syllabus Development

A course begins with the development of a syllabus. User friendly screens prompt the instructor for the basic elements of a syllabus. These include office hours, textbooks, basic course requirements, grading scale, etc. Once these basic elements are entered the HTML is generated for the instructor. Included in the development of the syllabus is a list of items that will be required from the student, included are such items as homeworks, quizzes, exams, projects, and extra credit opportunities. As each of these items are added to the course requirements, the instructor will be prompted for grading options, such as percentage of grade, pass/fail, minimal passing, or drop the lowest grade. Figure 2 demonstrates a sample input screen for a graded item.

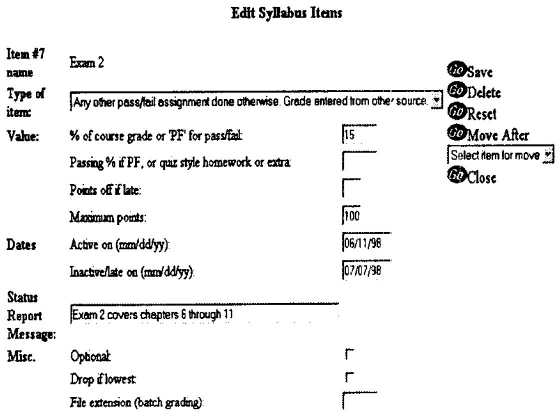


Figure 2 - Adding an item to the Gradebook

On-Line Test Development:

Creation of on-line exams is a simple task. Exams or quizzes can be comprised of multiple choice, true/false, or short answer questions. For the short answer questions, the system looks for certain key words to be in the response of the student. Exams can also be imported from word documents or other popular software packages, or built on-line via a web page as shown in Figure 3.

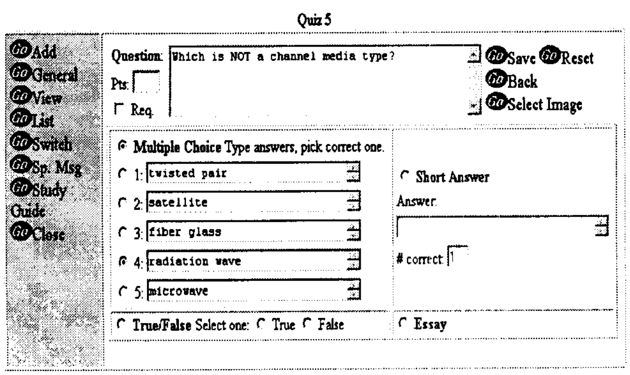


Figure 3 - Creating a question for an exam

Automated Homework Grading:

A feature of the system is to automatically grade homework assignments for Microsoft Office Products. The program can check Access, Excel, PowerPoint, or Word files for certain key attributes. In addition it can check HTML documents and other popular file formats. Each assignment is evaluated and if 'Passed' the gradebook is updated. If the assignment has not been passed, the student is given comments and feedback.

STUDENT FEATURES

1. Personal course status report
2. On-line exams with feedback for every exam and every question
3. On-line study guides with practice exam questions
4. On-line tutorial and comprehensive quizzes
5. Electronic submission of homework from labs, dorm rooms, or home with immediate feedback.

Individual Status Report

An impressive part of the system is the on-line grade roster an individual student receives. They can obtain an up-to-date summary of their progress from any web location once they enter a password. Not only do they see their progress to date, but also comments on homeworks not completed, due dates, and their answers to on-line quizzes. This reduces the number of phone calls and grade corrections at the end of the semester.

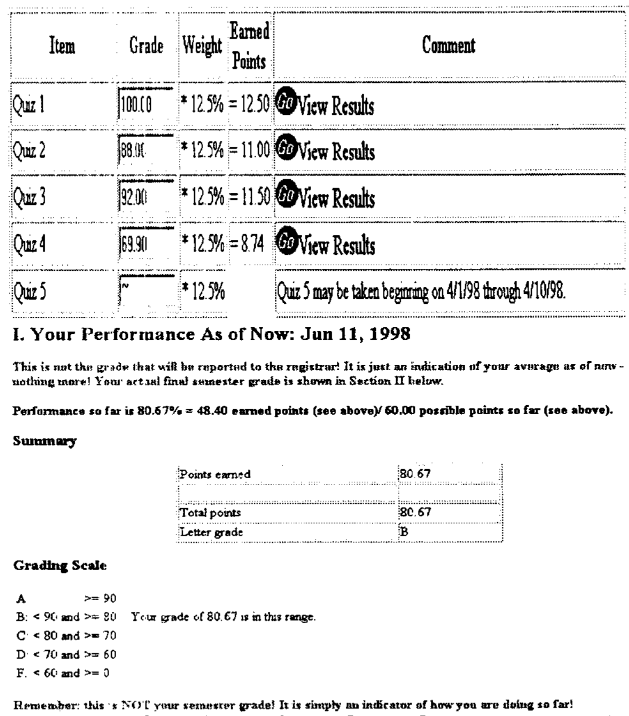


Figure 4 - Sample portions of a student status report

On-Line Tutorials

Course tutorials may be built, for student re-enforcement. Tutorials may be either for material not covered in the classroom or as additional problem solving activities. In addition, sample quizzes may be created to permit the student to gain confidence and feedback before taking an actual graded exam.

REFERENCE

Alavi, M. Computer mediated collaborative learning, an empirical evaluation, *MIS Quarterly*, **18 2**, June 1994, 159-174.

For more information contact: gsteinbe@bsa3.kent.edu or tjanicki@bsa3.kent.edu.

The K-12 Web -- Using Student Consultants to Teach the Teachers

Dr. Ronald W. Chorba, Professor, School of Business, Clarkson University

Abstract

Computer literate university students are trained as consultants to teach K-12 educators how to use the Internet to enrich their classes. University students are an underutilized community resource who need professional internship experience to enhance their credentials. Schoolteachers need training and technical support to fully exploit investments in information technology being made in schools across the nation. Clarkson University's Internet Consulting Group (ICG) is providing a solution and wants to show other post-secondary institutions how organize similar student enterprises. This paper describes the ICG's student training and experiences, operational procedures, resource implications, and lessons learned. The project is sponsored in part by the U.S. Department of Education, Fund for the Improvement of Post-Secondary Education (FIPSE).

Exploiting information technology is becoming a national priority in the nation's classrooms. President Clinton wants to connect every classroom to the Internet by the end of this century. Are the teachers ready for this? Clarkson University is putting to educational use those young people who have grown up in a computer culture. Frequently, they know more about computers than their instructors, and they are in a better position to learn and teach the latest technology. By using computer experts who are still in school to teach the teachers of the younger students, we are leveling the playing field for the beleaguered K-12 instructor and are making staff development affordable to the schools. Universities throughout the country host entire departments of computer-capable young people who need to acquire the practical, professional, social, and pedagogical experience offered by a program such as ours. We offer a model to fill a computer generation gap.

Clarkson University's School of Business (http://phoenix.som.clarkson.edu/) extends education beyond its classrooms by providing its students with workplace experience and skills. We are putting our students to work helping local K-12 schools. Schools want technology to enrich the educational experience. Unfortunately, overburdened teachers have little time to acquire Internet skills that will give them ready access to classroom materials on the Web or to participate in generating new materials. Few K-12 teachers have access to qualified instruction and fewer still have the time to plow through the too numerous and too thick books on the technology. As a result. millions of dollars worth of computer equipment, networks and software are underutilized in education. Since computers become obsolete in three years, failure to train teachers squanders a very expensive resource [3].

Clarkson has an entrepreneurial program called the Internet Consulting Group (ICG) (http://phoenix.som.clarkson.edu/~icg/). The group consists of computer proficient students from Management Information Systems, Computer Engineering, Computer Science, and Technical Communications. Education is the number one industry in our area, rural Northern New York. Therefore, teachers constitute a large group of customers in need of Internet Consulting Group services. We use these young "computer gurus" to teach Internet and other computer skills to K-12 teachers. Young people are generally acknowledged to acquire computer skills faster than their instructors do. The solution is apparent enough: Let the students teach the teachers.

Conventional wisdom has it that one should choose a young dentist and an old doctor. An old doctor works from years of experience with patients, while the young dentist knows the latest in materials and equipment. The K-12 teachers, like the old doctors, are content experts who are in need of the help of the computer technologies. Young computer technology experts might best teach them. Our experience shows that while manuals can be helpful, the fastest way for the neophyte to learn about computers is through hands-on exercises under the eye of a tutor. The closer we get to a one-on-one tutor-teacher ratio, the faster a beginner can progress to the stage at which he/she can work independently, requiring only the occasional question to be answered via e-mail. Our student consultants are able to provide such service to a wide rural area where educational alternatives for the K-12 teacher are few.

Rationale: Experiential Learning and it's Benefits

This project offers the opportunity of improving K-12 and post-secondary education at the same time. Post-secondary students participating in this program gain an early opportunity to use their very real expertise. They

*The project is sponsored in part by the U.S. Department of Education, Fund for the Improvement of Post-Secondary Education (FIPSE) (http://www.ed.gov/offices/OPE/FIPSE/).

gain professional experience they might otherwise have to wait years to acquire. They have to react to customer demands and offer advice on problems in a way that shows we really value our customers. Current members of Internet Consulting Group (ICG) are making positive impressions with prospective employers. In employment interviews, recruiters ask about our student's experiences with ICG. The training and experience we give these students enhances their preparedness for the workplace.

The ICG concept pleases recruiters because our students develop improved interpersonal skills, professional attitudes and sensitivity to customer needs. Parents, too, like to know their children are acquiring employable skills and a positive work ethic. As a high-tuition private university, Clarkson must clearly establish its value-added contribution in competition with state-subsidized public institutions. Clarkson has always been proud of its reputation as being the place to go if you want to get a good job when you graduate. We take pride in our experiential approach to education at Clarkson. Our mission statement emphasizes that students at Clarkson work closely with faculty in a professional setting.

The K-12 schools receive cost-effective services that they would not otherwise be able to afford. Teachers learn how to use existing Internet materials in their teaching area, and they are able to share their own materials with their peers. Participating teachers develop long lasting ties to the University and to peers. These contacts will be able to help them with future problems. Students in K-12 schools receive the benefits of Internet-enhanced instruction and have access to teachers who can show them how to use the network for themselves. Overall, our project has impact on people at four different levels in the education system. University teachers advise and train university students who, in turn, teach and support K-12 teachers who are, finally, developing learning experiences for K-12 students.

We contend that universities and K-12 schools in other parts of the country can do the same. There are ample numbers of universities with programs in information technology. Their students seek professional experience during their study. and many local K-12 schools need their expertise. Our model provides a low-cost, self-sustaining means to bring continuing training and support to schools.

The Student Experience

The Internet Consulting Group (ICG) is constantly refining and adding to its portfolio of workshops. Currently, the ICG is offering or developing the following:

Web Systems

- Web Browsing and Email
- Basic Web Writing with HTML
- Effective Website Design
- Web Server Administration

Office Systems

- Working with Windows 95
- Building Effective Documents
- Creating Graphic Presentations
- Administering Labs and Networks in Schools

To prepare for developing and delivering these workshops, student consultants undergo training prior to and during their first year with the ICG. While all students at Clarkson receive training in office tools, the following are regularly scheduled, elective Internet courses offered at Clarkson:

- World Wide Web Publishing
- Internet for Business
- Advanced World Wide Web Design
- UNIX Web Systems Administration
- Novell LAN Administration
- Windows NT Administration

All students are expected to have taken either of the first two courses or have equivalent experience prior to their involvement with the ICG. Early in their first semester, new recruits also receive ICG training in:

- Effective Workshop Presentations
- Working in Teams

A student can then be involved in teaching Web Browsing and Basic Web Writing with HTML. Additional training modules are taken at other times during the first year. A student must take the advanced course before being involved in Advanced Web Writing or Web Server Administration workshops. Finally, our students take courses in Novell LAN and NT administration prior to delivering the Administering Labs and Networks workshop.

Student consultants are organized into two teams, Web Systems and Office Systems, for development and delivery of the workshops described above. They are each responsible for content, promotion, quality and delivery of their product line. ICG stresses teamwork and customer satisfaction in all pursuits. Teams are encouraged to explore ways to add workshops that go beyond what is normally available to our customers from competitors. Our student consultants are the most knowledgeable professional development staff for computing in the region and we strive to use this to our competitive advantage. Our students' learning is enhanced by looking for ways to communicate the usage of leading edge tools to our customers. While teaching enhances mastery of a subject matter even for mundane topics, we also try to keep our minds alive with a constant stream of new challenges.

A third team called House Systems deals with non-teaching tasks necessary to ICG's success. This team is responsible for the ICG Website, (http://phoenix.som.clarkson.edu/~icg/) , which is not only promotional but also serves as support for workshops and helpdesk activities. We are trying to support our customers with continuing information and help after they leave our workshops. Many of the materials we use in the workshops are included on the Website. House Systems also administers the help desk that is supported by problem-tracking software, adapted for our use from software used by our University computing center. House systems handles all financial matters including pricing, contract negotiation, collections, promotion, scheduling and administering our own office systems. We include development of marketable computer applications under House Systems since this is still a fledgling activity. We are developing applications for schools, which involve query and update of databases using a Web browser as interface. Currently, we are developing a community bulletin board for schools, which allows query and update of event calendars, lunch menus, announcements, sports schedules and results, and student activity news. Only a web browser is required by users to do queries and updates through forms.

As ICG undertakes new activities, we try to keep the volume of work within our capabilities to perform at a high level of quality. The nature of work should provide learning experiences but not become repetitive. We keep in mind student schedules for classes and breaks. For example, we cannot be effective as same-day trouble-shooters for operations problems or take on projects that require attention during summer or holiday periods. ICG is primarily a learning experience.

Lessons Learned

After completing two years, the last year under FIPSE assistance, ICG is approaching its goals of delivering a quality product, being operationally self-sufficient, and providing a significant educational experience. While we have not completed data capture and analysis from our evaluation effort [1] and [2], we can report, anecdotally, about some lessons we have learned.

Price/Product Strategy. During 1996-97, ICG's introductory Internet workshop was very popular. Teachers were eager to learn this new medium as their schools acquired connectivity. While we began to offer Web authoring with HTML, the basic Web browsing course was our cash cow. But inn 1997-98 we found little interest in the Web browsing workshop and even cancelled one session with only one subscriber. At the same time we observed many comparable mini-courses being offered within the K-12 training establishment. ICG could not compete with these offerings, because they were subsidized with public funding and priced below what would yield a break-even return to us. Further, professional educators who knew their customers better than ICG's technical students with little experience in the K-12 education profession presented the courses. Our niche lay nearer the leading edge, with advanced topics our consultants understood and which had not found their way into the repertoires of K-12 training competitors.

We developed and introduced Website Layout and Design to augment our basic HTML workshop. This appeals to those teachers who are already beginning to produce their own materials and who are advising students who were producing web documents for student activities. We focus on making Web documents usable and appealing to readers. Examples of what we want teachers and their students to avoid may be found in http://www.webpagesthatsuck.com. Many of our student consultants are Technical Communications majors or study Web design from courses in that Department. We are well equipped to offer knowledge to the local community on this topic.

ICG is also developing a workshop in Web Server Administration and Lab and Network Administration for Schools. The past year saw school administrators realize that these tasks rightly fall within the scope of local school administration. Reliance on centralized services gives long response times to problems and inadequate results. Yet there are very few individuals in our region with the training and experience to fill the need. Most often a teacher takes the lead in administering these systems, but with serious gaps in their knowledge. ICG's new workshop will provide a means to fill the gap until the personnel shortage gap closes. In addition, we are hoping our help desk efforts and on-line forum will encourage sharing of knowledge among technical support staff people in the schools.

Student Time Management. Many potential customers, both in schools and business, asked us to provide services which university students, with their complex schedules and non-traditional work habits, found difficult to deliver. Building Web documents for customers seemed a natural fit, and we tried that in our first year. However, we soon realized that a Website is always under construction. Customers always want to add something new. Many sites needed refreshed content with weekly and even immediate turnaround. Students are not prepared to offer such a response level. They are geared to semester projects, term papers, and next week's exam. Trying to telephone a student in a dorm room, apartment, or Greek house to discuss an assignment is an arduous endeavor for off-campus customers. Also, students are unavailable during holiday breaks and summer, and projects are put on hold for longer periods than most customers are willing to tolerate. The same is true for any network trouble-shooting or computer maintenance tasks we might be asked to take on. ICG students simply cannot give the rapid response and continuous availability customers demand.

Business vs. School Customers. During our first year, most of our initial effort was put into developing a local, small-business customer base. An early supporter of ICG was the Nicholville Telephone Company, the first commercial Internet provider in the Northern New York region. The author was instrumental in convincing this firm to become an Internet service provider, and they were eager to build customers. The company invested in ICG to encourage business customers to create Websites with them. After a full year's effort, ICG was able to launch only one new customer for the new ISP. In addition to the problems of student-maintained Websites mentioned above, the North Country of New York was barren territory for Web marketing.

At the same time, ICG initiated a series of training workshops for local schoolteachers. The K-12 schools were partners with the Clarkson Business School on other projects, and we were helping them fulfill a commitment to use the Internet as a communication and dissemination tool. The effort promised to raise some cash while we got our business clientele established. Soon, our consultants were spending the majority of their time developing and leading these workshops. By the end of the year we found that 80 percent of our revenue arose from the K-12 training market. Plans for 1997-98 were drastically shifted. The author responded to the K-12 success by applying for grant support from FIPSE for the purpose of developing ICG's capability to train K-12 teachers. The application was successful, and this year, we dropped most interest in the small business marketing effort.

Our connection to small business was not totally abandoned however. As with so many enterprises, luck often counts more than planning or good intentions when finding the way to success. One teacher, who attended a workshop in fall 1997, brought along her husband to take the course as well. He was a member of the Board of Directors at Nicholville Telephone. We sufficiently impressed him that he arranged for ICG to deliver a series of workshops to company employees and some of their business customers. We are training 20-30 workers in Microsoft Windows 95 and Office 97 tools. Other business customers are now exploring contracts with ICG. Finally, it appears that our K-12 customers are now becoming as interested in training for office tools as for Internet applications. Our designation as the "Internet" Consulting Group may no longer be appropriate.

Revenue Sharing, Credit and Continuity. Student consultants have always had the option of working for academic credit. Those not enrolled for credit have been paid a small stipend when called upon to do especially useful and time-consuming tasks. Some of the graduate students, who assist the advisor in managing ICG, are assigned as teaching assistants. But some of our student consultants are in their third semester of earning Independent Study credit for being ICG members, and this is not satisfactory. Only recently have we identified what we think is a reasonable solution.

Beginning fall 1998, new ICG consultants will enroll in a course designated by the title "Internet Consulting Group". They may enroll in this course for one semester only. If they are pleased with the experience and the membership thinks they are making a sufficient contribution, they are invited to continue as partners in the group and share revenues. Fifty percent of ICG net revenues for a semester are paid to student consultants at the end of the semester. Shares are apportioned according to a formula, which rates each member's contribution. The details of the formula continue to be in flux. This approach solves another problem for us. We want to keep and reward good members over many semesters with at least fifty percent of the membership carrying over each semester. The revenue sharing plan offers incentive to participate and contribute to the success of the enterprise over a longer time.

Institutional Support. With fifty percent of revenues being held by the "company", operating expenses are covered and money is available for investment in equipment, software, learning materials, and pizza at meetings. The Business School and University also contribute much to our expenses in the form of office space, telecommunications, furniture, secretarial support and occasional gifts of equipment. FIPSE funds over the three years of our grant are used to develop training methods and materials and promote the venture within Clarkson and the community. FIPSE expects us to be a self-supporting innovation and integrated into the curriculum in a continuing fashion. We will be able to fund our own consultant training after the development period. FIPSE also is funding us to disseminate our innovation to others, which is partially being accomplished by this paper.

Sustainability

During the development period, six faculty are involved: the principal investigator and advisor, an advisor for Web Systems, an advisor for the lab and network administration workshop, two consultant skills trainers, and an evaluation consultant from a neighboring School of Education. A single faculty could not duplicate the talents being applied during this critical period. Delegating these responsibilities also creates a sense of ownership of the program among a broad base of faculty, which contributes to the credibility, and visibility of ICG within the University.

The Business School supports the principal investigator and chief advisor by recognizing his advising role as part of his teaching load. ICG is now a course offered each semester. All participating faculty receive stipends from FIPSE during the development period. Such support, coupled with a concept, which will continue to provide marketable technical consulting services to the community, ensures the financial viability of ICG. ICG is also featured as an inducement for potential students to enroll in the Business School. Our accomplishments and the concept of the group are attractive to new students, future employers, parents, and alumni. In plans for a new Business building, the ICG will be given generous and highly visible space. It is clear that ICG will be a continuing component of Business School education at Clarkson.

Those of us who contribute to ICG's success are committed to promote the concept and objectives to other Universities. Even without FIPSE support, we are convinced that our project would have been successful. While we appreciated the help, the funding was not a critical success factor. We would like to assist faculty at other institutions get started by sharing what we've learned. The root notion that the technical knowledge of post-secondary students can be applied to enrich the host community as well as contribute to the preparedness of the students is valid. Success is dependent on the same factors as are found in any entrepreneurial venture. One must identify a needed product and marshal the resources to deliver that product. The challenge with information technology is that the needed products are constantly shifting and the required knowledge and skill shifts as well. Continuing success requires constant attention and new approaches. That's why ICG is a continually refreshing educational experience. It never gets boring or repetitive.

References

[1] Fitz-Gibbon, C.T. and Morris, L.L. (1987). *How to Design a Program Evaluation*. Newbury Park, Sage.

[2] Mohr, Lawrence B., *Impact Analysis For Program Evaluation.* (1995). Thousand Oaks, Sage.

[3] The National Foundation for the Improvement of Education. *Teachers Take Charge of their Learning. (1996).* Washington, D.C.

[Internet URLs]

Clarkson University School of Business, http://phoenix.som.clarkson.edu/

Internet Consulting Group, (http://phoenix.som.clarkson.edu/~icg/)

Web Pages That Suck: Learning Good Design by Looking at Bad Design, http://www.webpagesthatsuck.com

U.S. Department of Education, Fund for the Improvement of Post-Secondary Education (FIPSE),

http://www.ed.gov/offices/OPE/FIPSE/

Incorporating Visual Design into Programming Courses: A Beginning

Jeffrey A. Griffin
Computer Information Systems and Technology, Purdue University
South Bend, IN 46634-7111
jgriffin@iusb.edu

and

John Campbell Finnegan
Technical Graphics, Purdue University
South Bend, IN 46634-7111

Abstract

Technological changes and industry trends have led many university computer technology programs to adopt visual programming languages as a first language. This has led to the expansion of these introductory programs to include many new topics such as event-driven programming, working with objects and visual programming courses, in addition to the general concepts of programming. The result of this has been an increasing tendency to overlook the development of the programmer's solid visual design techniques.

This paper explores the opportunity to add some basic principles to a visual programming course providing the student with the background necessary to create effective graphical user-interfaces (GUI). Although this is still a work in progress, there is information the instructors can use to build their own knowledge base. The information could then be introduced in the instructor's own curriculum.

Introduction

Greatly improved technology has eliminated many of the barriers to good interface design and unleashed a variety of new display and interaction techniques wrapped into a package called the Graphical User Interface, or, as it is commonly called, GUI (pronounced "gooey") [1]. The amount of programming code devoted to the user interface now exceeds 50 percent [2]. With this ever increasing trend toward the visual interface for human computer interaction, its importance can be summed up by the following: "Designing a clear, logical, readily-understood client GUI is like doing stand-up comedy; it is harder than it looks and when you fail, a lot of other people suffer"[3].

With the advent of desktop computers and visual programming tools making it easy for any programmer to create visual applications, does the programmer really understand what makes a good visual interface? Visual programming languages are only tools, as are paintbrushes that must be mastered and applied with discipline and an understanding of the basic visual design principles.

Programmers don't know how the top interface designs of today were developed. The result is a template-like approach of "plug it in here" because that's what has worked for others in the past. No new territory is explored; no old territory is understood, either.

With the industry trend moving toward visual and/or object-oriented languages, our department, like so many others, has changed directions in an effort to continue to prepare graduates for current and emerging careers in the field of information technology and visual communication management.

There are several visual programming languages such as Delphi, Smalltalk, Visual Basic, and Visual C++ which are widely used to teach visual programming. A faculty committee recommended that our courses utilize Visual Basic as the visual language in introductory programming courses. The wide acceptance and ease of learning for the beginning programmer made the Visual Basic language a logical choice.

Incorporating Visual Design into the Course

During their first two years, students in our program take a two-course programming sequence. The first course focuses on the basics of programming, including program design, structures, variables, program control statements, file processing, and testing, as well as an introduction to event-driven programming concepts and language syntax.

Interface design, various file structures, file access methods, database access, and other language features are introduced to the student in the second course. The introduction to interface design at this phase allows students to familiarize themselves with the language before having to deal with visual design issues.

The interface design portion of this course is still in the development stages with some trial and error occurring. The biggest obstacle being faced is determining how this topic can be adequately incorporated without compromising the remainder of the course. The scope of this topic is so broad that defining the essential elements is proving to be difficult.

If visual programming courses contained even the barest essentials of visual design and the study/understanding of visual psychology, those concerned with interface design might break new ground in the field of human interaction with the computer. Better, but unrealistic, would be the requirement of a semester of two-dimensional design where the focus is on exploring two-dimensional visualization without the computer.

The interface design portion will consist of lectures and laboratory exercises over a two-week period. One of the topics to be discussed in this phase of the program, is "Characteristics of a Graphical User Interface" including direct and indirect manipulation.

"Primary Windows Components" such as the use of frames, title bars, menu bars, tool bars, status bars and scroll bars is a second segment of interface design.

The following "Principles of Graphical User Interface Design", as discussed by Galitz, will also be included [1]:

- Aesthetically Pleasing - visual appeal
- Consistency - having a similar look, actions and operations throughout the design
- Directness - providing intuitive ways to accomplish tasks
- Forgiveness - preventing errors when possible and protecting against catastrophic errors
- Control - allowing the user the ability to determine what to do and how to do it
- Simplicity - providing as simple an interface as possible

Given adequate time, it would be beneficial to provide students with the opportunity to fully explore design principles. Students could be given an introduction to the basic elements of visual design. This should be done without the use of computers in an effort to encourage creative thinking, create less dependence on the software features and more reliance on imagination and visualization. Basic art supplies such as colored paper, pens, and collage techniques will be utilized in lieu of the computer at this stage of the course.

Background in Visual Design Principles

The Gestalt school of psychology is an accepted starting point in 2D design. Max Wertheimer's text, *Principles of Perceptual Organization* is a primary source in this field of study [4]. The focus of this text centers on the concept of unity in visual organization. Wertheimer stresses that the manner in which an individual sees and perceives things can be useful in controlling how visual information is organized and how the audience perceives and interacts with this visual information. Another useful approach is that of Wucius Wong, author of *The Principles of Form and Design* [5]. Together these texts could provide students of design with very powerful tools and vocabulary with which to facilitate purposeful and intentional design choices that effect planned, predictable and desired results.

Eugene Larkin, in his book *Design, the Search for Unity*, details the Gestalt principles and their hierarchy as the basis for strong design. The use of this fairly concise and descriptive vocabulary could prove to be helpful in assisting the beginning visual designer in solidifying a process for approaching any visual design centered problem as in interface design.

The following ideas/theories/concepts constitute the base knowledge set anyone concerned with the design of human interface needs to explore. This basic set of principles will equip the novice and experienced programmer with the additional tools necessary to create exciting and new interface designs.

Balance, symmetry and asymmetry are key design principles that are almost assumed. A clear understanding of the use of these principles and their effect on the user's perception is essential in successful design. Symmetry, although fairly simple for any user to achieve, can result in a less than exciting design in that it places equal value on all forms within the field. This results in lesser sense of emphasis and importance for key forms. Asymmetry becomes important then in creating the visual road map which the viewer must explore as they interact with the design.

Use of **positive and negative space** is another seemingly minor, yet essential ingredient in visual design. The student must understand that form occupies space (positive space) and that there is space around each form (negative space).

Repetition, rhythm and pattern are design principles that complement each other, according to Larkin. Repetition is an example of grouping similar forms in an effort to satisfy the user's perceptual need for a sense of order and wholeness. The user recognizes these traits and the eye is drawn to it. Repetition is the most powerful when the variables of size, shape, texture and color are equal.

The use of rhythm is the designer's ability to use sustained repetition to assist in the provision of a sense of order. Pattern is simply the expression of this rhythm over a continuous area.

The concept of **direction** addresses the horizontal and vertical alignment of forms in the frame. Direction, when used effectively, can manipulate the viewer's line of sight in order to create emphasis and focus. Direction is effective when used in a logical approach such as the arrangement of forms in a right to left pattern - the way in which most Western countries read text. However, breaking the logical directional expectation can also be useful in guiding the user to a particular point in the visual field.

The design student should be knowledgeable about the impact of **color, texture** and **contrast**. These tools can be used to create emphasis, focus, hierarchical importance and pure aesthetic appeal. Instruction in the use of these tools could be a course in and of itself.

Value is the lightness or darkness of a form that supports the perception of the user in developing focus and appeal. This concept must be grasped early in the visual design learning process. Greater or lesser value is assigned to an item dependent on its relative value to other items in a group or items in proximity to itself. A common use of this technique is the "graying out" of items that in a particular context are not available or needed.

Information can be organized over an area or on a screen with the use of **grid systems**. This technique has been employed in graphic design for centuries. The key to using this tool lies in the designer's ability to utilize an underlying and invisible grid to aid in the alignment of visual information. The development of this skill can be exciting and empowering to the student. A related challenge exists in learning how and when to deviate from this grid.

Other key vocabulary terms that should be addressed with design students include:

- **Figure** and **ground** (sometimes called **field**) - two inseparable ideas in visual design. Referred to as framal reference by Wong, this is the reference to the arbitrary frame that exists around everything in order to provide a context for the perception to focus on.

- **Interruption** - the perception that something within the frame needs our attention. Dialog boxes and system warnings certainly are interruptions in the framal reference. This can also be utilized in the arrangement of elements on the screen.

- **Grouping principles** of **proximity, similarity, continuation** and **closure** as explained by Larkin are key ideas in the organization of visual elements and their relative importance to each other and the user. There is a hierarchy of perception to these grouping principles [4]. Greater importance is perceived in objects that are in close proximity to each other. The converse is also true in that we tend to diminish the importance of the relationship between two objects as they recede from each other. Viewers have a tendency to assign greater importance to objects that are similar. Similarity is given greater weight than proximity. Items that are in close proximity but also form a continuation or the perception of a continuation tends to take precedence over both similarity and proximity.

- **Upright** and **horizontal** – viewers are very comfortable with things that are level and plumb. Deviating from these norms can be disconcerting, but can also be utilized to create an emphasis and focus.

- **Perception of the whole and closure** - Wertheimer's research in the area of visual communication shows that these elements fulfill an overriding psychological need for viewers [6].

- **Symbols and icons** –how and why the symbols and icons were developed and employed in a specific and particular way is a critical issue. A lesson in interface design history could prove to be very enlightening to design students.

Conclusion

Although it would be best for programmers to immerse themselves at some point in their schooling in the practice and use of these design principles, the reality is that there is not time in most undergraduate programs to accommodate this luxury.

One option would be for instructors to become more aware of the principles of visual design. This would enable them to incorporate these principles into their Computer Science, Computer Technology or MIS programs. This would dramatically improve the interface design skills of most students.

We have started down the path toward embracing this philosophy, but have we gone far enough?

Many Fine Arts programs are adding a programming component to their digital design tracks. Many of these tracks already include intensive study in the area of 2 dimensional design. Computer Science and MIS programs need to entertain the notion that their students should supplement their programming skills with design knowledge and sense in order to compete with visual designers who can write code.

References

[1] Galitz, Wilbert O., "The Importance of Good Screen Design", *Essential Guide to User Interface Design*, New York: Wiley Computer Publishing, (1996).

[2] Myers, B.A., & M.B. Rosson, "survey on user interface programming", *Proceedings: CHI '92,* May 3-7, Monterey, CA, (1992).

[3] Bever, G., Electronic Data Systems Corporation, Private communication, January 1997.

[4] Larkin, Eugene, *Design, The Search for Unity,* Iowa: Wm. C. Brown Publishers, (1985).

[5] Wong, Wucius, *The Principles of Form and Design,* New York: Van Nostrand Reinhold, (1993).

[6] Berryman, Gregg, *Notes on Graphic Design and Visual Communication,* California: Crisp Publications, (1990).

Curricular Infrastructure for Internet-Based Applications Development

Mayur Mehta, Southwest Texas State University, San Marcos, Texas
George Morgan, Southwest Texas State University, San Marcos, Texas

Abstract

Changing user needs, recent advances in technology and the pull provided by corporate strategic level planners have all played a significant role in shaping the modern computing landscape. This, in turn, has required developers to become proficient in methodologies and development tools that were non-existent just a few years ago. Likewise, students of computer information systems (CIS) need to acquire the right mix of introductory skills that will insure some degree of success in developing enterprise-wide information systems. This paper discusses the key issues involved in preparing future IS developers and suggests one approach to introducing these skills through an improved CIS curriculum.

Introduction

Three major factors continue to drive the development efforts within business to reengineer their information systems. Technological advances, changes in business user requirements and/or a need to gain a strategic competitive advantage in the market place typically fuel such efforts. The ultimate objective however, remains the development of an information system that enables an organization to carry out its business processes in an efficient and effective manner.

Recent advances in technology, such as high-speed networks and powerful desktop computers, have enabled users to access and process internal and external information on a real-time basis. Consequently, decision-makers are able to use powerful decision-support tools to help them make more intelligent and informed decisions. Technological improvements have therefore enabled many organizations to gain a strategic and competitive advantage in the market place as well as make the necessary system enhancements dictated by internal and external forces.

The primary impact of these computing environment changes has fostered a gradual shift from host-based processing to client-server and now to the more distributed environments of Internet/Intranet computing. In most cases, this has forced developers to look at alternative ways of analyzing, designing, implementing and deploying enterprise information systems to ensure compatibility at both the hardware and software levels. The traditional systems analysis and design methodologies used in the host-based processing environments have been found unsuitable for developing the enterprise-wide information systems that are essential in the emerging computing environments. Even the more advanced tools and methodologies used to deploy client-server applications must be refined in order to effectively operate in the distributed computing environments.

Changing Development Strategies

Every decade since the sixties has had its star technology. The 1970s saw the birth of Management Information Systems (MIS) and on-line terminal systems. The 1980s showed the growth of decision support and executive information systems (DSS/EIS); fueled primarily by the availability of powerful and affordable desktop computers. The decade of the nineties has already given us empowering technologies such as mobile computers, high speed local and global networks, distributed and client-server computing architecture and, of course, the Internet.

The emerging technology has been a major force in shaping the methodologies used for developing and deploying information systems. Trade literature often refers to this concept as the "Paradigm Shift". Availability of newer and empowering technologies during each decade has pushed developers towards adopting alternative ways of designing information systems to fit the computing climate. We have seen this change from a traditional Systems Development Life Cycle (SDLC) approach to a more event-driven approach as we moved from host-based processing to client-server computing environments (first-generation paradigm shift). The more recent technology developments are now taking developers through a second-generation paradigm shift. This second-generation shift is the result of moving from a two-tier client-server, intra-organization computing environment towards an N-tier, globally distributed computing environment. Developers will again be forced to turn to alternative ways to develop and deploy information systems utilizing methodologies and tools that are better suited for the distributed, inter-organization and object-oriented computing environment.

The Ubiquitous Network

Perhaps the technology that has had the greatest impact on the modern computing environment is the Internet. There has been a dramatic increase in the use of the World Wide Web (WWW). The number of Internet/WWW users are estimated at anywhere from 8 to

10 million (16,17). The number of Web servers in use has correspondingly increased from 130 to about 120,000 in just over three years (11,16,17). A large number of these web servers are used to conduct day-to-day business and are administered by their respective corporations. These third-generation web sites are much more than just information stores for hyperlink documents. These web sites are actually being used to conduct commercial transactions. Companies like Dell Computers, FedEx, UPS, and American Airlines have harnessed the power of the Internet to conduct significant amounts of their business (1,9,16,17). For example, Dell Computers went from being a $4 million a year company to being a $12 billion a year company in just over 5 years. In recent years, Dell has earned revenues of $3 million a day from business transactions conducted over the Internet (10). Their just-in-time inventory and manufacturing models, along with the requirements that have their trading partners implement a full-scale Electronic Data Interchange (EDI) system, has resulted in substantial cost savings.

This increase in the use of the distributed computing environment for conducting business has not been limited to just domestic commercial enterprises. A similar trend is evident among governmental agencies as well foreign companies (17). In many cases, our government and other countries have embarked on the design and implementation of EDI infrastructure. These examples are clearly indicative of the fact that the Internet and WWW have become the most viable vehicles for creating the enterprise-wide information systems of the future for commercial ventures and governmental agencies. The Internet has become the ubiquitous network. Through it's many routers and gateways, the Internet enables communication from literally anywhere to anywhere else in the world. Moreover, information being disseminated and shared by organizations is not limited to just numeric or textual formats. With technological enhancements, it is now possible to work with information in multi-media format over the Internet. Consequently, true EDI and the creation of paperless systems can now become a reality. Such electronic trading is reshaping marketplaces, trading relationships, and even international trade boundaries (6,14,16,17).

Issues Of Internet-Based Application Development

How does this second-generation paradigm shift impact information technology (IT) professionals and students of CIS curriculum? Yourdon (19) suggests that IS developers need to focus on several specific design issues if they wish to succeed in developing a full-scale Internet-based distributed application. Some of the important issues Yourdon has suggested include:

- Providing support for a user interface that is platform independent.
- Developing proficiency in the use of visual applications development tools that provide a common, yet integrated, development environment.
- Ensuring security of data as well as sensitive (strategic) business transactions occurring over the Internet and WWW.
- Determine alternatives to integrate "normal" Internet and Web functions, such as e-mail, FTP, and HTML, within traditional information systems applications.

Of these, issues pertaining to security, developing proficiency in high end visual development tools and the advent of a common user interface are perhaps the most critical for IS developers and students of CIS curriculum to understand.

Security

Security was downplayed in the design of traditional client-server applications. Most did not provide any security measures beyond simple username and password authentication. It is, however, a major concern when it comes to Internet-based applications. Considering that strategic and sensitive commercial data may be traversing the network over national and international boundaries, it is imperative that security be given a top priority in the design of information systems for deployment over the Internet. Developers will need to have a much greater understanding of security measures and be able to identify security needs. They will need to become familiar with tools and network transmission protocols (such S-HTTP and SSL) that will empower them to deploy applications that ensure secure data access as well as secure transmission of confidential data across the Internet (6,14,16,19).

Development Tools

In addition, developers will need to gain proficiency in a different set of tools as an increasing number of IS applications migrate to the distributed computing environment of the Internet. They will need tools that are substantially more powerful than standard HTML text editors and web-design tools such as Microsoft FrontPage. While these tools are sufficient for a corporation to create web presence, IT professionals will come to rely on powerful visual tools. They will need to work with tools, such as Microsoft's Visual InterDev and Borland's JBuilder, that are based on Java and Java-like object oriented programming languages as they move into the world of "real" Internet programming and electronic commerce (1,13,19).

Common User Interface

There are two issues that IS developers need to be most aware of as they begin to move through the second-generation paradigm shift. The first issue pertains to providing support for flexible common user interface. The second issue pertains to Internet-based applications development tools that provide integrated development environment (19). As increased number of IS applications are ported to the Internet, it will become imperative to maintain a standard, common user interface (CUI) across all platforms to retain the same look and feel. Moreover, the development tools will have to provide capabilities necessary to generate just such a CUI. In short, developers will have to acquire proficiency in the use of development tools that will empower them to design platform independent applications. Additionally, such applications will have a very narrow window of opportunity for deployment if they are to provide any strategic advantage to the hosting companies. Consequently, development tools will have to support extensive re-usability of code, inheritance, and portability across multiple hardware and software platforms in a distributed computing environment (1,7,8,13,18,19).

Implications for Development

These important design issues translate into major implications for the IS developers of the future. The Internet Web browsers will play a significant role in the design of information systems for deployment in a distributed computing environment. The web-browser, in effect, will become the "Internet" operating system to drive the Internet-based applications. Furthermore, Java and Java-like programming languages that incorporate re-usability, inheritance, and portability features will form the foundation for tools that support component-based, platform independent applications development.

It is, therefore, imperative that students of information systems acquire a good understanding of the concepts for design of IS applications for deployment in the Internet environment. More importantly, they should acquire at least an introductory skills set in the use of development tools if they want to succeed in a full-scale internet-based applications development environment. Likewise, CIS curriculum needs to be refined to reflect the changing environment and respond to the second-generation paradigm shift. It is essential that departments that teach CIS curriculum create an infrastructure that is designed to respond to the growing demand for "Internet" professionals Recognizing the need for preparing students to succeed in such an environment, the following curricular infrastructure is suggested as one possible approach to providing students with hands-on experience in technologies available for developing Internet-based IS applications.

Suggested Curricular Infrastructure

As illustrated in Figure 1, the suggested infrastructure would consist of five major sections to address the four design issues suggested and discussed earlier. A detailed course structure is provided in Attachment A to this paper. The attachment outlines what a typical course would look like. It includes a detailed description and rationale, a set of

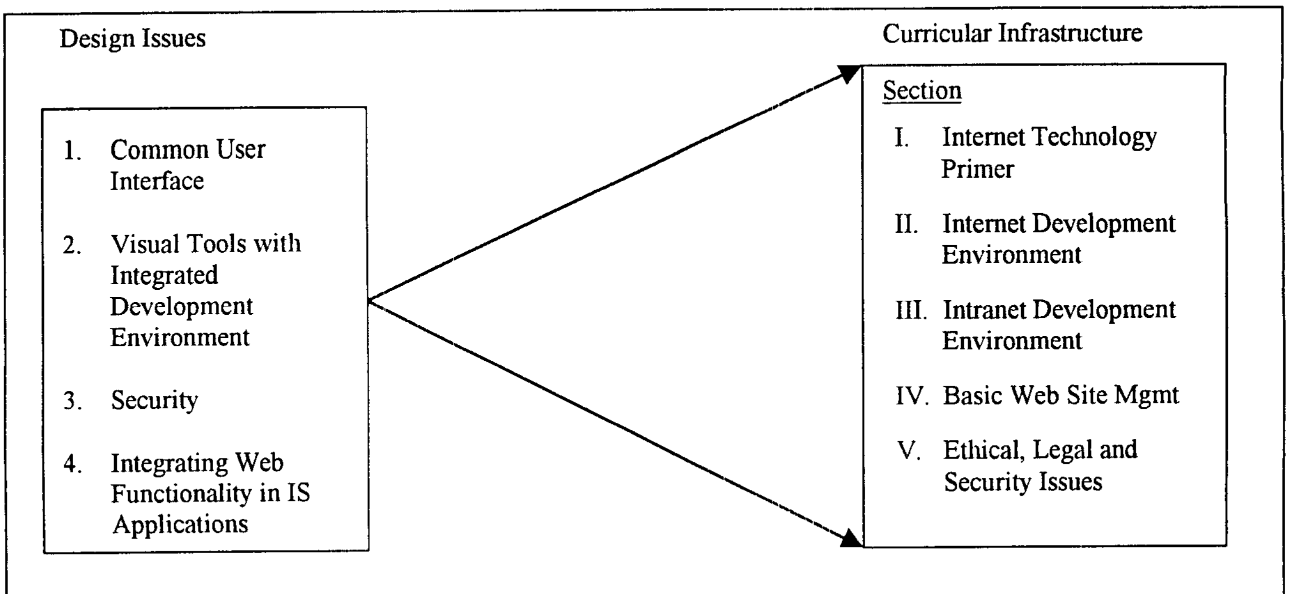


Figure 1: Suggested Curricular Infrastructure for Internet-Based Applications Development

objectives, suggested topical outline as well as suggested instructional methodology and assessment plan. A list of text books, journals and trade magazines is also presented as a potential source of supplemental information.

Section I

The primer will familiarize students with the Internet technology in general and will focus on the basics of conducting commerce on the Internet. This section will also provide the student with an initial introduction to the web browsers and some of the development tools available for commercial web site design and development.

Sections II and III

A majority of the concepts and skills required for Internet development are introduced in this section. Students are shown approaches that will be used in planning IS applications for deployment across the Internet. They get an exposure to typical commercial web content in a variety of formats, including multi-media. Additionally, students learn ways to incorporate these content-rich web documents into electronic business sites. Students generate methods for data capture, data processing, information reporting, and database access on the Internet. They are also exposed to approaches for distributing functional processing between web clients and servers via basic Java applets, CGI scripts as well as Remote ActiveX and similar COM automation servers to implement business rules and database processing. Section III extends the concepts of Section II above to apply to the Intranet environment as one approach to deploying IS applications used for business processing internal to an organization.

Section IV

This portion of the suggested curricular infrastructure prepares students for a basic understanding of web site administration and management tools. Students become familiar with web server hardware and software as well as the process of selecting these. They receive an opportunity to learn and practice the basic steps that are necessary to install and configure web servers. Students learn server side scripting to manage active web documents (e.g. active server pages) as well as process data captured via client-side web forms.

Section V

Finally, students are made aware of the need for security when designing applications for the Internet and Intranet environments. The material in this section informs students of the various security technologies and tools available for controlling access to commercial web servers, user authentication, and encryption in the Internet as well as Intranet environments. Students also learn implementation of these emerging technologies related to security. In addition to security issues, students become aware of some of the legal issues pertaining to copyrights laws, use of trademarks and domain names as well as government regulations, at both the national and international levels.

References

1. Baer, Tony. "There's a Web – Is There a Way? " Software Magazine, April 1997, pp. 53 – 56.
2. Cannavino, James, A., "The Future of Object Technology," Object Insider, Nov-Dec. 1994, pp. 12-14.
3. Chauvet, Jean-Marie, "A New Convergence for Object Models," Object Magazine, April 1997, pp. 46-49.
4. Foody, Michael, " Making Objects Deliver in the Client-Server World," Object Magazine, March 1996, pp. 63-74.
5. Freeman, Eva. "Is OO app dev worth the cost?" Datamation, March 1997, pp. 82-86.
6. Frye, Colleen, "EDI Users Explore Internet as Tool of Trade," Software Magazine, December 1995, pp. 83-89.
7. Grimes, J. and Potel, M., "Software is Headed Toward Object-Oriented Components," Computer, August 1995, pp. 24-25.
8. Halfhill, T. R., "Today the Web, Tomorrow the World," Byte, January 1997, pp. 68-80.
9. Http://ecworld.utexas.edu/
10. Http://www.dell.com
11. Http://www.meclerweb.com/
12. Korson, T., "Managing Reuse: Applying the Law of Gravity," Object Magazine, April 1996, pp. 34–36.
13. Lewis, Ted, "Where is Software Headed? A Virtual Roundtable, " Computer, August 1995, pp. 20–32.
14. Nejmeh, Brian A., "Internet: A Strategic Tool for the Software Enterprise," Comm. Of the ACM, Vol. 37, No. 11, November 1994, pp. 23-27.
15. Parks, S., Benner, K., and Faris, C., "Managing Object-Oriented Framework Reuse," Computer, September 1996, pp. 52 –62.
16. Press, Larry, " Commercialization of the Internet," Comm. Of the ACM, Vol. 37, No. 11, November 1994, pp. 17-21.
17. Technology Forecast: 1996, Price Waterhouse World Firm Services BV, Inc., 1996, pp. 375-395, 617-622.
18. Tracz, Will, "Java and the Reuse Question," Object

Magazine, September 1997, pp. 49-52.

19. Yourdon, E., "Java, the Web, and Software Development," Computer, August 1996, pp. 25-30.

Attachment A

Course Title: Internet-Based Applications Development

Course Description: An introduction to the advanced computer technologies used in creating applications for the Internet and Intranets. Students will be introduced to the design, implementation, and management of business applications that create presence on the World Wide Web as well as Intranets using technologies such as graphics, animation, hypertext, multimedia, GUI, CGI, Java and VBscript. Prerequisite: A 3-hour programming Course using a Visual programming tool.

Course Rationale: In recent years, the Internet, WWW, and Intranets have become very powerful tools for communicating. In fact, they have become an essential set of tools for a modern business. These technologies have empowered businesses to migrate to non-traditional methods of conducting business, including cyber-marketing and electronic commerce. The Internet, Intranets and WWW hold the key to increasing an organization's strategic competitiveness via improved communications and may possibly change the way business information processing applications are computerized. It is, therefore, essential that information technology professionals become familiar with these emerging technologies. This course will provide coverage of the technologies currently available to set up and administer business information processing applications on the Internet, WWW and Intranets.

Course Objectives: Upon completing this hands-on course, the student will be able to:

- Create sophisticated web documents, including forms for data capture and retrieval.
- Plan an Internet and Intranet site, including determining necessary hardware, software, and specifying the appropriate connectivity methods.
- Use CGI, Java and Vbscript to create applets for business information processing.
- Use Web authoring and management tool to create and manage a Web site.
- Determine security needs.
- Add support for FTP, World Wide Web, and database connections.
- Examine legal and ethical issues involved in creating presence on the Internet and Intranets.

Course Outline:

1. Internet Technology Primer

a. The Internet
b. WWW
c. Intranets
d. Conducting Business on the Web

2. Internet Applications Environment

a. Planning Applications for the WWW and Intranets
   i. Fundamentals of creating Web Documents
   ii. Components of web documents: Text, Graphics, Animation, Multimedia - Audio and Video
   iii. Designing and Creating web documents using computer-based tools
   iv. Introduction to web forms, CGI and Java scripts.
   v. Using Java and CGI scripts to create applets for business processing.

b. Use of Multimedia Technologies
   i. Basic Concepts
   ii. Multimedia Design
      a) Multimedia Components - Hypertext, Graphics, Audio, Video, and Animation
      b) Creating Multimedia Components
      c) Creating applets for multimedia

c. Connections to Web Database
   i. Technologies for Web database publishing
   ii. Database locations
   iii. Selecting database connection
   iv. Database access methods

d. Designing Reports for Web Display
   i. Report layout for display in web browser
   ii. setting up queries
   iii. Running reports

e. OLE Automation objects and Remote OLE Automation Servers

f. Application Partitioning with database stored procedures

3. Intranet Applications Environment

a. Planning your intranet Environment
   i. What is an Intranet
   ii Using Web Services on Intranets

b. Building Blocks for Creating an Intranet
   i. Extending the Internet/Web Concepts to Intranets
   ii. Creating Contents
   iii. Designing web site for internal use
   iv. Intranet Development Tools

c. Database Connectivity Options
   i. Building databases for Intranet Access
   ii. web front-ends to enterprise data

d. Creating Applets and Applications for business information processing on the Intranets
   i. OLE Automation objects and Remote OLE Automation Servers
   ii. Application Partitioning with database stored procedures

4. **Basic Web Site Administration for the Internet and Intranets**
   a. Concepts of web server administration e.g. HTTP, HTML,, access control, visitor logging
      i. selecting web server software and platforms
      ii. Study existing web server software packages and publishing tools
      iii. Staff and organize web site team.
   b. Install and configure a web server implementation
   c. Using Scripts to Process Data (Forms connected to databases)
   d. Managing Web Sites using Tools

5. **Ethical, Legal and Security Issues**
   a. Ethical and Legal Issues
      i. Copyright laws
      ii. Trademarks and Domain names
      iii. Relevant Federal Laws
   b. Security Issues
      i. Overview of Security Terms
      ii. Available Current Security Technologies including,
         a) Server-Access Controls
         b) Username/Password Authentication
         c) Encryption
         d) Firewalls
      iii. Implementation of Security Technologies

<u>Suggested Textbook:</u> Kottler, Jay and Glenn Fincher, *Visual InterDev Unleashed*, Sams.Net, 1997. Online www resources will supplement text.

<u>Instructional methodologies:</u> Lectures, Software demonstration, Discussion, Group/Individual Design and Applied projects,.

<u>Assessment of Student Learning:</u> Objective tests, projects, presentations, and instructor evaluation of participation.

<u>Course Bibliography:</u>

A. Text Publications

1. *Visual InterDev Unleashed by* Jay Kottler and Glenn Fincher, Sams.Net Publishing, 1997
2. *Teach Yourself Microsoft Visual InterDev in 21 Days* by L. Michael Van Hoozer, Sams.Net Publishing, 1997
3. *Developing Intranet Applications with Java* by Jerry Ablan, Sams.net Publishing, 1996
4. *Building Intranets with Information Server and FrontPage* by Steve Waterhouse, Prima Publications, 1996.
5. *Build a Microsoft Intranet: Get Connected using Internet Information Server for Windows NT*, by Dennis Lone and Mark Riley, 1996
6. *Microsoft FrontPage '97 Unleashed* by William R. Stanek, Que Publishing, 1996.
7. *Teach Yourself IntraBuilder in 21 Days* by Paul Mahar and Ken Anderson, Sam Publishing, 1996.
8. *Web Programming with Visual Basic* by *Craig* Eddy and Brad Haasch, Sams.net Publishing, 1996.
9. *Web Site Construction Kit for Windows 95* by Christopher L. T. Brown and Scott Zimmerman, Sams.net Publishing, 1996.
10. *Web Site Construction Kit for Windows NT* by Christopher L. T. Brown and Scott Zimmerman, Sams.net Publishing, 1996.
11. *Webmaster Expert Solutions* by Michael Morgan, Jeff Wandling, and Rich Casselberry, Que Publishing, 1997.

B. Typical Journals and Trade Magazines

1. American Programmer.
2. Application Development Strategies
3. IEEE Software
4. International Journal of Electronic Commerce
5. International Journal of Information Management
6. Java Developers Journal
7. Journal of Computer-Mediated Communication
8. Journal of Information Technology Management
9. WebMaster Magazine published monthly by CIO Communications, Inc.

C. Internet/WWW Sites

1. www.cio.com - every conceivable journal pertaining to IS and Internet can be found here
2. www.zdnet.com - site of publications by Ziff-Davis Publishing (e.g. PC magazine, etc.)
3. www.dbmsmag.com - online internet and database journal
4. www.colybrand.com
5. www.Yahoo.com\~internet

USING A TEACHING LAB CLASSROOM FOR ACTIVE LEARNING

Albert L. Harris
Department of Information Technology and Operations Management, Appalachian State University, Boone, NC 28608, (704) 262-6180, EMAIL: HARRISAL@APPSTATE.EDU

Jacqueline M. Harris
Department of Mathematical Sciences, Appalachian State University, Boone, NC 28608
(704) 262-6601, EMAIL: HARRISJM@APPSTATE.EDU

ABSTRACT

The traditional classroom setting of students facing a teacher with a blackboard is giving way to computers and projection equipment. Instead of "chalk and talk," students see presentations and demonstrations. However, in some types of classes this is not going far enough. This paper discusses the development and use of teaching lab classrooms. Using an NSF grant, two somewhat identical teaching lab classrooms were created, one in the Department of Mathematical Sciences to teach business calculus and the other in the College of Business to teach computer skills for business. Each lab was equipped with a laptop computer, connected to the local area network, for each student and an instructor's computer connected to an overhead projector. Thanks to the coordinated efforts of professors from two different colleges within the university, these teaching lab classrooms have resulted in an environment of active learning for students with coordinated hardware and software.

INTRODUCTION

The classroom in most colleges and universities consists of desks for students centered around a teaching area for the professor. Many times the teaching area is traditional, still containing little more than a desk and a blackboard. This works fine for a lecture or discussion type class with the opportunity to emphasize points using the blackboard. If the professor is lucky, the teaching area is computer-assisted, containing a computer connected to an overhead projector. This allows the professor to use PowerPoint presentations or other software packages to create interesting multimedia presentations. However, even this is not enough for some types of classes.

Teaching an entry-level hands-on course is especially challenging. This type of course may range from a computer skills course, perhaps covering internet or Web skills and Microsoft Word, PowerPoint, and Excel, to a hands-on business calculus course using Microsoft Excel and Word and mathematics software, such as Derive. In these types of hands-on courses, students must watch the professor demonstrate specific skills that must be mastered and then attempt to perform projects or solve problems using the demonstrated skills. Teaching hands-on courses generally requires the computer-assisted classroom. However, even this type of classroom is not efficient since there can be considerable time between when the student sees the skills demonstrated and when the student can practice the skill.

One way to solve the problem described above is to use a teaching lab classroom for hands-on classes. A teaching lab classroom is a classroom that contains a computer connected to an overhead projector for the professor and a workstation, consisting of a computer with all of the needed software, either loaded on its hard drive or obtainable through a network, for each student. In the teaching lab classroom scenario, the professor can demonstrate a skill or technique and the students can emulate or practice the skill or technique soon after seeing it demonstrated.

Students enter the College of Business at the start of their junior year. To be admitted, they must take a core set of general college and business classes during their freshman and sophomore years. Two of the classes they must complete are Computer Skills For Business and Business Calculus. In the Computer Skills For Business class, students learn to use Word 97, PowerPoint 97, Excel 97, Netscape, and e-mail. This class is meant to give them the skills to use the computer for whatever tasks needed in their college career. The Business Calculus course teaches students to utilize mathematics and calculus concepts to solve business problems. The teaching lab classrooms were to integrate and coordinate computer skills of these two courses .

This paper discusses the experiences of two professors that have used a teaching lab classroom in their hands-on classes. One professor teaches an entry-level hands-on course in computer skills using Microsoft Office and the internet and the other professor teaches a business calculus course using Microsoft Excel and Word and Derive. Both professors believe the teaching lab classroom stimulates students' interest and creates active learning by students.

DESCRIPTION OF THE TEACHING LAB CLASSROOMS

In the summer of 1995, four professors, two from the College of Business and two from the Department of Mathematical Sciences, applied for and received a National Science Foundation (NSF) grant to coordinate the computer-oriented instruction of future business students. This grant was approved and provided the initial funds for creating two computer teaching lab classrooms, one in the College of Business and one in the Department of Mathematical Sciences. Each lab was initially equipped with 26 laptop computers as well as the overhead projector with a computer attached. The teaching lab classroom in the College of Business was quickly expanded to 32 laptop computers. Each laptop computer had 8 megabytes of memory, an 800 megabyte hard drive, a built in touch pad, and a PCMCIA Ethernet card. All software was downloaded from the local area network. Conventional mice were later added to the computers. The laptop computer's biggest advantage was size. We could fit more laptops on a table in much less space than we could fit the more conventional CPU, keyboard, and monitor arrangement.

The room in the Department of Mathematical Sciences was set up with four long tables at which students could sit on both sides. The tables were "wired " with electricity and Ethernet hookups for the laptops. The room in the College of Business was a more normal classroom setup with five rows of tables facing toward the front of the room. They too were "wired " with electricity and Ethernet hookups for the laptops.

Software used in the teaching lab classrooms includes Microsoft Office 97 applications of Word 97, PowerPoint 97, and Excel 97, Derive mathematics software, and Netscape's browser for internet access.. All computers used Windows 95 as their operating system.

TEACHING BUSINESS CALCULUS IN THE TEACHING LAB CLASSROOM

Business calculus is a prerequisite class for admission to the College of Business at Appalachian State University. It is a freshman-level course offered by the Department of Mathematical Sciences and taught by mathematics professors. It has gone through several evolutions over the years. Initially, it was an "easier" calculus class that covered the basic calculus concepts, but with slightly easier homework problems. Next came a calculus class with business application problems. The student was introduced to the calculus concepts and then had business application type of word problems. Currently, the Business calculus course fits business-oriented problems to calculus concepts. In effect, the course now takes the approach of starting with business problems and see what types of mathematics can be used to solve these problems.

The use of the computer in the business calculus class is somewhat new. Until the NSF grant allowed the purchase of the laptop computers, calculators were used for the computations. Since business students were expected to use the computer, the use of the computer has increased. To use computers, a computer lab had to be used for hands-on instruction. Since lab space is relatively scarce, this approach was not considered optimal. The teaching lab classroom was considered a prefect solution that enabled computers to be used in the business calculus class without ting up a computer lab during the day.

The first few semesters, this newly designed course was taught using overhead projectors connected to a computer. The students took notes and then tried their hand at solving the problems on the computer out of class. Occasionally a lab was reserved so that the teacher could help the students that were having difficulties in a hands-on environment. Tests were administered in the computer lab. Handouts on how to do the problems using the computer were frequent, but students still had difficulty watching the professor solve the problems and then taking notes that aided the student in solving the same problem. During the early phases of this course, we were using Lotus123 as our spreadsheet software and Derive as our mathematical software at that time.

After the teaching lab classroom was created, students could actually follow the professor as the math problems were worked. Each student had a computer for his/her own use. They could practice what was demonstrated by entering the data and observing the output. Of course mistakes were made, but now the professor could quickly (usually) figure out what the student had done incorrectly and get him/her back on the right track with a minimum of frustration for both student and professor. To standardize spreadsheet instruction with the College of Business, Excel became the spreadsheet of choice, but Derive was still used for the "calculus" portion of the mathematical analysis. As Excel has become a more powerful spreadsheet and mathematical tool, more of the problems have been solved exclusively in Excel. It would be nice if eventually Excel was all of the mathematical analysis that was needed.

The teaching lab classroom is kept open Sunday through Thursday from 6pm to 8pm with trained student tutors for students needing extra help. This teaching lab classroom has classes scheduled from 8am to 4pm during the week. It is the most used classroom in the Department of Mathematical Sciences and possibly one of the most used classrooms in the university.

TEACHING COMPUTER SKILLS IN THE TEACHING LAB CLASSROOM

The Computer Skills For Business course is a freshman level course focusing on Microsoft Office's Word, Excel, and PowerPoint and the Internet. Faculty from the Department of Information Technology & Operations Management in the College of Business teach the course. The objective of the course is to give students a working knowledge of the computer skills they will need to succeed in College and in College of Business classes.

Like the Business Calculus course, it was traditionally taught using a "mobile cart" that contained an overhead projector connected to a computer. Students took notes and then tried to duplicate the skills outside of class. Occasionally a lab was reserved so that the teacher could help the students that were having difficulties. Projects that covered the desired skills were assigned as homework. Tests were usually multiple choice. Handouts on how to perform some skills were used, but students still had difficulty watching the professor demonstrate the skills and then taking notes that aided the student in performing the same skills in the lab or on their own computer.

After the teaching lab classroom was created, students could follow the professor as the skill was demonstrated and then practice using the skill. Each student had a computer for his/her own use. Many times the professor would have practice assignments for class. If the students had problems, the professor could assist the student and get him/her back on the right track with a minimum of frustration for both student and professor. Graduate students and Instructional Assistants (seniors who received 1 hour of credit for assisting with a class) were used in many classes since there were 32 students in each class.

ADVANTAGES AND DISADVANTAGES OF THE TEACHING LAB CLASSROOM APPROACH

The initial reaction to the teaching lab classroom concept as now used at Appalachian State University is usually "this is the lab concept, but using laptop computers instead of desktop computers." This is true, but we have found some very unique advantages and some unforeseen disadvantages to using laptop computers instead of desktop computers in the classroom.

The teaching lab classroom concept, using laptop computers, has many advantages:

1. Students become active learners. They can hear, see and do, all in the same classroom.
2. The classroom becomes a learning place. Students can help each other. Cooperative effort is easy because students are relatively close to one another and can interact easier than in a traditional lab.
3. Students can receive immediate feedback and assistance from the professor when they are using the laptops to solve problems or do assignments.
4. Laptop computers take less room on a table and can be easily moved so others can see the screen. The instructor can easily see three or four screens at once to compare work or help several students who have the same problem at the same time.
5. The teaching lab classroom in the College of Business had a cabinet that could store the laptop computers. If the classroom was needed without the computers, they could be stored. This made the classroom more useable and provided some degree of security for the laptop computers.

Using laptop computers and this approach as resulted in some unforeseen and unique problems. They include:

1. Laptop keyboards do not have a numeric pad. This makes entering numeric data more difficult. Many accounting students are especially used to the numeric pad.
2. We found the hinges of laptops especially susceptible to damage. Constant opening and closing has resulted in several hinges being broken. We now ask the students to leave the laptops open when they leave the class.
3. The LCD screens seem susceptible to damage. On several occasions, students shut the laptop while leaving the computer on. The screens, in the closed computers, got so hot that they were damaged. Both the screen and hinge problems seemed to be eliminated when we started leaving the screens open.

CONCLUSIONS

This paper has presented a description of the teaching lab classrooms as they have been developed at one university. This was a coordinated effort between the College of Arts and Sciences and the College of Business. The teaching lab classrooms are somewhat unique because they utilize laptop computers instead of the conventional desktop computers. In addition, software has been standardized, making it easier for students to use the same software for mathematics and business courses.

Students have responded well to the teaching lab classroom concept. They get a much better feel for the concepts being taught, whether it is business calculus or computer skills. They can immediately, during class, practice on the computers.

These teaching lab classrooms are the result of coordinated efforts from professors in two different colleges within a University, the College of Arts and Sciences (Department of Mathematical Sciences) and the College of Business (Department of Information Technology & Operations Management). These coordinated efforts have resulted in diverse classes integrating their learning needs (software and hardware) to benefit students.

Teaching Systems Analysis and Design: A One-Semester Course

Neelima Bhatnagar
Assistant Professor, Finance & Information Systems
University of Pittsburgh at Johnstown
Johnstown, PA 15904
Phone: (814) 269-2971
Fax: (814) 269-7255
Email: Bhatnagr+@pitt.edu

ABSTRACT

This paper looks into how the course has evolved over the years (for the author) and how it is currently taught by the same. At the community college level the course was taught as a capstone course for students graduating with an Associate's degree in Microcomputer Applications Technology, and it also incorporated core values. The focus of this paper is to discuss these core values, how these core values correlate with employers' expectations of college graduates, their incorporation into the course, and how the course is taught in its current format. Examples of how students use the core values identified will be discussed, as well as specific problems that have occurred over the years.

INTRODUCTION

The profession of Systems Analyst is projected to be the fastest growing profession from 1996-2006, according to the U.S. Department of Labor [4]. So it comes as no surprise that skills developed in a systems development course will be more crucial than ever. Many authors of Systems Analysis and Design textbooks state that understanding systems development is not only important for analysts, but also for end-users in general. Today people in different functional areas of an organization are bound to run into systems, no matter what.

Most of this paper stems from having taught a Systems Analysis and Design course for six years at a community college in Ohio and now, for the first time, at a four-year branch campus of a major university in Pennsylvania. The course has truly evolved over the years.

CORE VALUES

In an attempt to better prepare students for employment after graduation (and to make students aware of the life-long learning process), faculty, staff, and administrators at Edison Community College took it upon themselves to identify six core values, develop them conceptually, and then incorporate them in as many courses as possible throughout the college. How core values would be used in each course were identified by linking specific course outcomes to course goals and objectives, along with program goals.

First a general definition for core values is provided followed by specific definitions for each of the six core values.

General definition: "The core values are a set of principles which guide Edison Community College in creating its educational programs and environment. They will be reflected in every aspect of the College. Students' educational experiences will incorporate the core values at all levels, so that a student who completes a degree program at Edison Community College will not only have been introduced to each value, but will have had them reinforced and refined at every opportunity." [1]

- **Communication** - "Communication, a skill basic to all college students, involves listening, speaking, and writing for the purpose of understanding and of being understood. A lifetime process, communication also involves the ability to use appropriate and reasonable language and dialects, acknowledging that audiences are diverse." [1]

- **Ethics** - "The ethics core value is defined in terms of decision making. A distinction is made between values and ethics. Values are either "good" or "bad." Ethics either exist or don't exist. They are decisions and behaviors that are based on values. Thus, the faculty will endeavor to present material across the curriculum in a manner that will cause students to consider the decision-making process in terms of ethics." [1]

- **Critical Thinking** - "Critical thinking is the ability to think with dimension. Thinking becomes the ability to apply internalized standards of thought: clarity, relevance, analysis, organization, recognition, evaluation, accuracy, depth, and breadth. Critical Thinking requires detachment, the ability to examine critically one's own ideas and thoughts, as well as examining the ideas and thoughts of others. Possessing the fundamentals of critical thinking enables an individual to reason across a variety of disciplines and domains and to critique one's own thinking from many perspectives. The development and use of critical thinking is a lifelong activity which enables us to continually improve our thought and the consequent products of our thought in our lives and society." [1]

- **Human Diversity** - "Diversity describes the coexistence of many cultures in society. By making the broadest range of human differences acceptable to the largest number of people, multiculturalism, as a function of cultural diversity, seeks to overcome racism, sexism, and other forms of discrimination. Historically marginalized groups within society include, but are not limited to, Native Americans, African Americans, Asian Americans, Hispanic Americans, Appalachian Americans, physically/mentally challenged, women, and people with alternative life-styles." [1]

- **Inquiry/Respect for Learning** - "Inquiry is the information gathering process through which the learner formulates essential questions, locates appropriate resources, and evaluates the applicability of the data for a particular situation. Students at Edison will learn how to apply these learning processes in each field of study." [1]

- **Interpersonal Skills/Teamwork** - "Interpersonal skills promote personal effectiveness when interacting with others, whether the interaction is one-on-one, in a small group, in an organization, or with an audience. To be skilled interpersonally, a person must first asses any situation to determine the expectations of others involved, and then adapt to those expectations." [1]

These core values are very much in line with employers' expectations. In a study conducted by the National Association of Colleges and Employers, the following skills were identified as those necessary for students to possess. Each skill is rated on a scale of 1-5 (where 1=least important and 5=most important) [3].

Skills	Rating
Oral Communication skills	4.7
Interpersonal skills	4.6
Teamwork skills	4.5
Flexibility	4.3
Analytical skills	4.3
Written communication skills	4.3
Proficiency in field of study	4.1
Leadership skills	4.1
Computer knowledge	3.9

Table 8: Desired Skills

How these skills relate to the core values defined above is as follows: by completing team projects, students must learn to interact with each other thus improving their interpersonal/teamwork skills. It also requires them to make use of effective written communication skills as well as use the core values of Inquiry and Critical Thinking. Through presentations students must also learn to communicate effectively and use oral skills. The project leader must identify his or her strengths and weaknesses in terms of leadership skills. And all must use their analytical and computer skills to their utmost.

COURSE STRUCTURE

The course is being taught for the first time, by the author, at the university level this semester. It is mainly being taken by students enrolled in the Finance/Information Systems major within the Department of Business. The process used to teach the course is as follows:

1. Allow students to form teams. Each team has at most 3-4 students each. Each team must also appoint a project leader. In the past team members were also assigned to each group. Every member except for the project leader had team leader responsibilities on a rotation basis.

2. As teams and then as a class, all come to an agreement about what the duties and responsibilities are of the project leader and team members. The professor gives copies of the agreement, which becomes a contract that all students must adhere to.

3. Each team must identify an Information System to be studied and developed. Most are CBIS, or computer-based information systems, that will require design and implementation. Teams make their own selections.

4. Each team submits a written proposal about their chosen projects. The professor must approve all projects prior to each team initiating the systems development process.

5. Teams submit exercises assigned from the Project Workbook for Systems Analysis and Design and the Transition to Objects by Sandra Dewitz. This forces each team to stay on track.

6. Students individually complete Visible Analyst Workbench (a CASE tool) tutorials. They will use the tool for their projects.

7. At two week intervals, students (on an individual basis) also submit journals. In these journals students are asked to indicate how the teams are progressing with the project, how they each feel about their roles in the group, what they have learned and how they are using the information to complete the project. Students may also include anything else they wish to share with the professor.

8. At the end of the semester each team will submit a detailed project, guidelines for which are given in the syllabus, and make formal presentations using a presentation media of some kind. All students are also expected to dress professionally, in business attire.

9. The professor also meets with each team on a regular basis.

COURSE CONTENT

The use of traditional systems development, and a structured system development life cycle (SDLC) is emphasized. Additionally, newer systems development techniques such as RAD (Rapid Application Development), JAD (Joint Application Development), and OOSD (Object Oriented Systems Development) are also introduced.

PROJECT GRADING

In addition to regularly scheduled exams, and assignments, most of a student's grade is based on the group projects. The grade is based on three things: the project, the presentation, and the extent of the student's participation in the group (determined by peers). The presentation grades are determined both by the professor and peers.

Most of the students enrolled in this class are also presently taking a 'Business Database Management' course. So they will be using the same project for both classes. In terms of grading the emphasis will be slightly different.

Nothing can be more realistic than allowing students to work on 'real-world' projects. It gives them the opportunity to use what they are learning in the classroom in a real-world setting.

PROBLEMS

Regardless of where the course has been taught, one problem seems to continue to exist. Most students have trouble understanding the use of diagrams for systems development. Specifically they have difficulty in developing Data Flow Diagrams, and have problems with functional decomposition. It is the hope of the professor, that they will eventually get it and a light will go on in their heads. But until then patience and repetition of underlying theories with lots of examples seems to be the only plausible solution.

Another problem is that of coming up with projects for those students who have difficulty in selecting one. A solution is to ask for suggestions from Advisory councils, industry contacts, or local business organizations [2]. Certainly another choice is to have students work on university-related projects.

A third problem is how to receive feedback or input from people for whom the systems were developed. Possible solutions include inviting the end-users to attend the presentations, giving them copies of the written proposals, and having the evaluators complete a one-page questionnaire. A sample questionnaire (which has been used in the past at the community college) is presented at the end of the paper.

A fourth problem is that of a heavy workload for students in a one semester course. The Information Systems curriculum requires teaching Systems Analysis and Design. However many institutions and programs cannot offer multiple sequence courses (one semester of theory and a second semester of projects). If this were possible, then much of the workload could be left for the second semester course. The second semester could lend itself to students just concentrating on projects. CASE tools could be introduced, and by then students would have also completed a course in database management. Students would continue to make use of core values and skills already discussed and would be graded on CASE tutorials, final projects, presentations, and teamwork. Until then we as educators must continue to challenge students to their highest potential, despite the amount of work involved in a one-semester course.

CONCLUSION

The author hopes that this paper's key contributions are sufficient enough to provide other faculty in the field with ways to improve the systems analysis and design course they currently teach and with ideas that they can incorporate as well.

Two aspects of this paper, the author wishes to look into in the near future are: a longitudinal study of the job outlook; and the best way to teach students the core values discussed in this paper and appropriate ways to measure these.

Any suggestions from colleagues are welcome.

ACKNOWLEDGMENTS

Special thanks are in order to Dr. Trevor Jones and Dr. A. Graham Peace of Duquesne University. Many of the ideas incorporated into the course syllabus come from their own individual course syllabi. This would not have been possible without their permission. Other ideas have come about from having attended different workshops over the years and from authors of various Systems Analysis and design textbooks such as Sandra Dewitz and Whitten, Bentley, and Barlow, among others.

REFERENCES

1. Edison Community College. 1997-1998 Academic Catalog, p. 4-5.
2. Harris, Albert L. (No Date). Developing the Systems Project Course. Journal of Information Systems Education [online], 6(4), 5 pages. Available: http://www.gise.org/JISE/vol6/64/v64_3.htm [1998, March 3]
3. National Association of Colleges and Employers. Spotlight Special Report: Job Outlook 95, November 15, 1994, p.7.
4. U.S Department of Labor. Occupational Outlook Quarterly. Winter 1997-1998, p. 17.

EDISON COMMUNITY COLLEGE
Microcomputer Applications Technology Program
Spring Semester 1996

EVALUATION FORM

Please answer questions 1 through 3 by rating them on a scale of 1 to 5, with 1 indicating poor and 5 indicating excellent.

	Poor				**Excellent**
1. Did the students demonstrate the ability to communicate effectively?					
a) oral communication skills	1	2	3	4	5
b) written communication skills	1	2	3	4	5
2. Did the students demonstrate high ethical standards?	1	2	3	4	5
3. Did the students demonstrate:					
c) strong teamwork skills	1	2	3	4	5
d) flexibility	1	2	3	4	5
e) strong analytical and problem solving skills	1	2	3	4	5
f) leadership skills	1	2	3	4	5
g) interpersonal skills	1	2	3	4	5
h) knowledge and proficiency in the computer field	1	2	3	4	5

4. Were the recommendations made for implementation reasonable enough for you to consider recommending to your company or organization?

   ______ Yes   No ______

5. Would you hire the student(s) for an entry-level position in your company or organization? Do they meet the skills you would look for in a new hire?

   ______ Yes   No ______

6. Are there any other recommendations you would like to make?

Figure 1 - Sample Evaluation form

Engineering a Better Software Organization

Dan Shoemaker
Gregory Ulferts
University of Detroit Mercy

Abstract

The case will be made in this paper that all of the diverse forms of development activity can be rationally and systematically managed from a single framework. That framework is the ISO 12207 Standard. ISO 12207 covers the life cycle of software from conceptualization through retirement and consists of all of the processes necessary for acquiring and supplying software products and services. It is now possible, no matter what size or type of organization, to inter-relate all of the large components of software management into a single practical understanding. Each lifecycle process is further subdivided into a set of activities and each activity is subdivided into tasks. The paper also explains how this Standard can be used to develop an efficient and productive software organization.

Why We Need a Managed Process

Most people understand that software is the end product of a complex human interaction and communication process. What might be less well understood is that fact that, because of all this "human-centeredness" the software industry has never had a single commonly accepted model for its lifecycle processes. However, since software creation is a personal activity such a model is absolutely essential in order to *guide software professionals through disorder in an orderly way* (Humphrey, 1994). The case will be made that all of the diverse forms of development activity can be rationally and systematically managed from a single framework. That framework is the ISO 12207 Standard. Given this supposition, the remainder of the paper explains how this Standard can be used to develop an efficient and productive software organization.

A fully defined process is the quintessential first step in instituting rational management of an IT organization. It is particularly difficult to establish and maintain organizational control over the software process because it is essentially conceptual and abstract by nature. In the past managerial effectiveness, particularly strategic management relied solely on experience. Without that necessary background, "*Inexperienced, or inadequately trained managers are noted with distressing frequency on canceled projects and projects that experience cost overruns and missed schedules. Inadequate management training is also commonly associated with the problems of low productivity, low quality, and of course, management malpractice* (Jones, 1994)." That is because, though: *It has become fashionable to talk of competitive advantage and information technology in the same breath. Yet it is clear that the number of professionally educated (to maximize competitive advantage using technology), fully trained and experienced information technologists is small* (O'Brien, 1992)."

A badly managed IT operation can exact a harsh price on overall organizational productivity. And since, *Productivity is the fundamental economic measure of a technology's contribution. With this in mind, CEOs and line managers have increasingly begun to question their huge investments in computers and related technologies* (Brynjolfsson, 1992). Obviously the Public Sector isn't immune from this either. Over the last decade, the GAO estimates that the federal Government's bill for worthless systems topped $150 billion (1). Industry is not exempt from that either. The Harvard Business Review (Roach, 1991) presents a very telling statistic. During the 1980s, the sector that invested the least in information technology (manufacturing) achieved the greatest total increase in productivity. The business sector with the highest investment (services) realized no gain at all. Roach calls this a "productivity paradox". In essence, more money spent on information technology realizes less productivity. An important second assumption of this paper is that this well-documented "Productivity Paradox" is the end-result of piecemeal approaches to the management of IT operations. That implies the need for a fully integrated management framework and process.

Considering the fact that, over the past twenty years computer hardware has become exponentially more reliable and less expensive, the finger of blame for productivity problems points toward software. Which is understandable since anybody with a passing knowledge of computing knows that software development has always been more Dickens than Demming. That's because hardware design is grounded in the nice, clean world of science and mathematics, while software is rooted in human behavior. In essence, software programs must capture and represent functions in a way that is both recognizable and acceptable to the end-user. In the past, software people have tended to discount the parts of the problem connected with behavior, because the actions of each individual user of the system are impossible to predict, or describe in linear terms. Instead the software business has spent its time searching for a definitive technology that will lead it out of this wilderness of conflicting user requirements and intuition. In fact, that ultimate technology even has a name. It is known as a "silver bullet". Unfortunately the historic performance of silver bullets has tended to consistently upheld Brook's axiom, "there are no silver bullets." *In most software organizations the same problems continue to occur, ad-hoc plans, arbitrary schedules, nonexistent design control, and inadequate resources. Twenty years ago the prime cost in information systems organizations was hardware. Software was comparatively inexpensive. Today the reverse is true* (Humphrey, 1994).

One option to the silver bullet model is a fully defined and engineered software process. A defined software process embraces any set of activities, methods, and practices used in the production and evolution of software. These can exist at any one of several layers of actual realization. A defined process can be as large as the entire lifecycle phase, or as small and focused as inspection and testing protocols. Process standardization has many advantages. An organization that does not use standards typically has processes that are chaotic and unpredictable. *Such an organization cannot adequately gauge the outcome of its efforts and therefore cannot estimate the time or cost of its products. Because these processes are repeatable, the organization can plan efforts and monitor projects. Standardizing an undefined and ad-hoc process leads to decreased cost of production. More importantly: Quality cost, and schedule are predictable* (Paulk, 1994). What's required, is an ideal model, specified at a level sufficient to allow the organization to tailor their processes to fit within its guidelines.

Up to this point there has not been a single comprehensive framework that itemizes and correlates all potential forms of activity within the software process. The early Information System (IS) strategies were strictly and narrowly focused on development. This eventually led to the use of explicit development models such as the Waterfall and Boehm's Spiral. These are not sufficiently defined to cover anything but the processes of software creation, which have been estimated at anywhere between 20 and 30 percent of the total investment of IT resources. Processes such as operations, maintenance and acquisition/supply simply do not rest within the confines of a development model. Yet these constitute by far the majority investment of IT time and resources. That, in a nutshell, is the simple purpose of **ISO/IEC International Standard for Software Lifecycle Processes (1995)**. ISO 12207 establishes the common elements in the Software Lifecycle Process. It is now possible, no matter what size or type of organization, to inter-relate all of the large components of software management into a single practical understanding. The ensuing model allows for rational control of all aspects of software activity. ISO 12207 covers the life cycle of software from conceptualization through retirement and consists of **processes for acquiring and supplying software products and services**. The processes itemized in ISO 12207 are considered to form a comprehensive set. The Standard was intended to fit an individual organization, project, or application. *This includes all facets of system definition necessary to establish the full context for the development, maintenance and use of software products and services* (ISO, 1995). The specific processes itemized in the Standard are designed to describe all software projects. The activities that may be performed during the lifecycle are grouped into *five primary processes, eight supporting processes and four organizational processes*. Each lifecycle **process** is further subdivided into a set of **activities** and each activity is subdivided into **tasks**.

Primary Life Cycle Processes
The primary life cycle processes constitute five activity areas that serve primary parties during the life cycle.

Acquisition - defines the activities of the acquirer; that is, the organization that acquires a system, software product or software services.

Supply - Defines the activities of the supplier; that is, the organization that provides the system, software product or software service.

Development - Defines the activities of the developer; that is, the organization that defines and develops the software product.

Operation - Defines the activities of the operator; that is, the organization that provides the service of operating a computer for its users

Maintenance - Defines the activities of the maintainer; that is, the organization that provides the service of maintaining the software product managing modifications to the software product to keep it current and in operational fitness. This process includes the migration and retirement of the software product. (ISO 12207/1995)

Supporting Life Cycle Processes
There are eight supporting life cycle processes. These

support the primary processes as required during the life cycle of the software.

Documentation - records information produced by a life cycle process or activity. The process contains the set of activities, which plan, design, develop, produce, edit, distribute, and maintain those documents needed by all concerned such as managers, engineers and users of the system or software product.

Configuration Management - applies administrative and technical procedures throughout the software life cycle to identify, define and baseline software items in a system; control modifications and releases of the items; record and report the status of the items and modification requests; ensure the completeness, consistency, and correctness of the items; and control storage, handling, and delivery of the items.

Quality assurance - provides adequate assurance that the software products and processes in the project life cycle conform to their specified requirements and adhere to their established plans. To be unbiased, quality assurance needs to have organizational freedom and authority from persons directly responsible for developing the software product or executing the process in the project.

Verification- determines whether the software products of an activity fulfill the requirements or conditions imposed on them in the previous activities. For cost and performance effectiveness, verification should be integrated, as early as possible, with the process (such as supply, development, operation, or maintenance) that employs it. This process may include analysis, review and test. This process may be executed with varying degrees of independence. The degree of independence may range from the same person or different person in the same organization to a person in a different organization with varying degrees of separation. In the case where the process is executed by an organization independent of the supplier, developer, operator, or maintainer, it is called Independent Verification Process.

Validation - determines whether the requirements and the final, as-built system or software product fulfills its specific intended use. Validation may be conducted in earlier stages. It may be executed with varying degrees of independence. The degree of independence may range from the same person or different person in the same organization to a person in a different organization with varying degrees of separation. In the case where the process is executed by an organization independent of the supplier, developer, operator, or maintainer, it is called Independent Validation Process.

Joint review - evaluates the status and products of an activity of a project as appropriate. Joint reviews are at both project management and technical levels and are held throughout the life of the contract. Any two parties may employ this process, where one party (reviewing party) reviews another party (reviewed party).

Audit - determines compliance with the requirements, plans, and contract as appropriate. This process may be employed by any two parties, where one party (auditing party) audits the software products or activities of another party (audited party).

Problem resolution - is a process for analyzing and resolving the problems (including non-conformances), whatever their nature or source, that are discovered during the execution of development, operation, maintenance, or other processes. (ISO 12207/1995)

Organizational Lifecycle Processes
The organizational life cycle processes *establish and implement an underlying structure made up of associated life cycle processes and continuously improve that structure and process* (ISO 12207/1995). These are:

Management - process defines the basic activities of the management function (including project management) during a life cycle process.

Infrastructure - process defines activities for establishing the underlying organizational structure of a life cycle process.

Improvement - process defines the basic activities that an organization carries out to establish, measure, control, and improve its life cycle process.

Training process defines the activities for insuring that adequately trained personnel are available. (ISO 12207/1995)

Fitting ISO 12207 to Organizational Specific Applications
In essence, ISO 12207 provides a viable generic framework that can underwrite all forms of development, maintenance and operation. However, in software development the following axiom also holds true: **since every software project is different, a successful software engineering process must be tailored to reflect and accommodate this range of difference**. Therefore, organizations have to customize their standard processes to

meet each project's unique needs. ISO 12207 assumes that specific situations will be tailored to the general structure and that the processes, activities and tasks itemized in the Standard must be tailored to individual software projects. ISO 12207 does not prescribe a particular life-cycle model or software development method. There are many models and Standards that fit the framework it establishes . . . *"parties of ISO 12207 are responsible for selecting a lifecycle model for the software project and mapping the processes activities and tasks contained in this Standard onto that model.* They are also responsible for selecting and applying the software development methods and activities suitable for managing the software project.

As a simple rule of thumb the mechanism for establishing this is based on defining and maintaining organization-wide process architecture. This mechanism consists of a framework and a standard set of activities. Using these activities and a set of rules for relating them, a dynamic **software process model**, can be created. That is, an optimum approach can be engineered for each individual software project using a standard framework that embraces all of the possible forms of activity. Consequently, that overall framework can function as the single architecture, or baseline, for tailoring each project's essential functions to meet specific needs. This, in a nutshell, is the purpose, role and function of the ISO 12207 Standard. Combined with any one of the popular process improvement frameworks these two major Standard approaches (e.g.,ISO 12207 and the process improvement model that has been adopted) can turn any software organization into a continuously developing and self-refining operation.

Process Engineering

Given all that has been said earlier, practitioners still require a utilitarian road map to engineer a persistent and robust software processes for their organization. The strategy for implementing any such general process is always top-down. That is, a comprehensive framework must always be identified and adopted to serve as the general classification structure within which all project specific software processes are defined. Inside this reference framework, a process model for any given project may always be constructed, at any level of definition. *However, the architecture of the classification structure itself must always be consistent.* That is, the overall architecture of the general framework must provide the constant elements and structural relationships to allow a specific process model to be refined to any desired level of detail for every project.

As we have seen however, in actuality a comprehensive framework such as the ISO 12207 needs to be tailored in detail in order to be useful. The outcome of this tailoring process is a set of pragmatic models (*sometimes known as industry best practice*) which codify the actual process. In general, these pragmatic models are the ones that are of the most practical use for the Software Manager because they represent SOP. However, to make them understandable to the troops in the trenches they need to be tailored to another (more refined) level of presentation. This final application level is meant to convey the exact substance (e.g., activities and tasks) of each individual process.

Applied tasks are the explicitly designated set of individual steps involved in fulfilling the requirements of a given process (specified as required by the pragmatic, SOP model) within a specific project environment. Conceptually, applied tasks are at the other end of the management spectrum from Comprehensive Frameworks. Their functioning can be easily understood by viewing them in the light of current methods and/or tools as embodied in the individual tricks of the technical staff, or institutional proprietary methods and tools. These practices are always project specific and generally can not be characterized in a standard fashion. They represent the current best approach to the work being done. However, without standardization these approaches are usually very particular and unique in their focus (meaning they can be tremendously effective on a specific project but simply not apply to the next) their variability is one of the chief contributors to the Productivity Paradox outlined in the first part of this.

Establishing and using a Process Model

In the applied universe, ISO 12207 integrates software engineering (the five primary processes), with software management (the eight supporting process areas), and strategic management (the four organizational processes). Reconciliation of the software engineering and management areas is accomplished by cross-referencing primary process elements (activities and tasks) to the relevant supporting process elements. This is normally presented in tabular form. Obviously all of the elements of the primary process do not require all of the supporting processes in order to function. Some primary process elements may not even require supporting tasks. Table One provides an example of this. It displays a way of looking at the potential relationships between a primary process and the relevant supporting lifecycle processes (for ISO 12207, Section 5.1, Acquisition Process)

TABLE ONE: SAMPLE CROSS-REFERENCE FOR ISO 12207 Section 5.1

	Documentation	Config. Mgmt	SQA	Validation	Verification	Audit	Joint Review	Problem Resolution
Activity 1: Initiation								
Task: concept	x	x	x	x	x			
Task: prepare requirements	x	x			x	x	x	x
Task: cost-benefit analysis	x					x	x	
Task: acceptance criteria	x	x	x	x	x	x	x	x
Task: acquisition plan.	x	x						
Activity 2: Request for Proposals								
Task: acquisition requirements	x	x						
Task: tailor processes	x	x	x					
Task: define milestones	x							
Task: delegate implementation	x		x				x	x
Activity 3: Contract Preparation								
Task: institute supplier selection	x							
Task: carry out negotiations	x							
Task: institute change control	x	x	x					
Activity Four: Supplier Monitoring								
Task: plan for supplier review	x		x	x	x		x	x
Task: review supplier	x		x	x	x	x	x	x
Activity Five: Acceptance								
Task: acceptance reviews and testing	x	x	x	x	x	x	x	x
Task: configuration management	x	x						

Remember, at the comprehensive framework level all projects look alike. That is, it is as valid to use the comprehensive framework you have adopted to develop a space shuttle system as it is to develop software for your home computer. It is only when this framework is translated into processes and pragmatic tasks that the differences appear. In terms of any differences that might appear at the project level however, it can be assumed that most of the fundamental processes in a software organization can be standardized across projects. This common set of processes can then be interconnected in different ways to meet a project's unique needs. A defined architecture, such as ISO 12207, offers guidance as well as identifying the basic, organization-wide framework required to achieve policy leadership and control of the software process. *Once a Standard Framework has been defined a process model for each project can be built using common standards.* The idea is to actively construct an approach for each project that will address the expected issues and problems while still referencing organizational best-practice issues dictated by the Standard Framework. This requires *defining and documenting a complete set of processes* with the attendant *roles and responsibilities*, along with all of the *measurement and reporting requirements*. Tailoring of the basic model can then be accomplished by identifying the unique project issues problems and criteria and documenting the adjustments necessary to fit the overall Framework. Subsequent tailoring is done by decomposing each of the standard architectural components (Standard Processes) to its logical level and repeating this for each Process.

The Process Engineering Plan (PEP)

We began this by defining the organizational framework required to make and manage an organization wide software process. This is based on a top-down architecture that interconnects and tailors standard sub-processes specified within the process model. What we have not discussed is the practical mechanism for making something like this actually happen. Accomplishing that requires something called a Process Engineering Plan, or PEP.

The PEP is a formal document, It defines the processes and how they will be arrayed. It provides: a definition of each major process, an estimate of the resources that must be allocated for carrying it out, and a framework for overall management review and control. This plan is developed at the beginning of the engineering process and is successively refined as the work progresses. Initially, it is a starting point that relates the major components to the resources required.

Besides providing the basis for definition and understanding of correct organizational practice, a PEP is also essential for quantitative and qualitative assessment and optimization of the process. It is built around the specification of an ideal architecture that effectively consolidates all of the relevant process requirements into a single unified array. The fact that this takes place under an internationally recognized umbrella only enhances its validity. Taken as an integrated whole, the attributes that foster efficient and productive processes can be factored into this unifying approach. The framework presented also represents the international software community's current understanding of an effective software organization, and can be understood as such.

What Does the IS Educator Get Out of This?

Clearly the influence of standards will persist and grow stronger. This paper aims to impart a practical understanding of how the ISO 12207 Standard can impact the information system organization. We have concentrated on this aspect because we believe that business in the next century will be shaped by coordinated standards for selected but meaningful areas of leading edge technology. However, in order to perpetuate that understanding Information Systems curricula need to incorporate this view into their program structure. We believe that a study based on the implementation of formal strategic management principles and structures has the potential to pilot Information Systems curricula through the endless change that is a fact of modern computer education.

<u>References</u>

1. "Federal Government Mismanages Computer Costs", Detroit Free Press, March 17, 1993, p. 1B
2. Erik Brynjolfsson, "The Productivity Paradox of Information Technology", Communications of the ACM, Vol. 36, No. 12, pp. 67-77, December 1992
3. Norman Fenton, Shari Lawrence Pfleeger, and Robert Glass, "Science and Substance, a Challenge to Software Engineers", IEEE Software, pp. 86-94, July, 1994
4. Watts S. Humphrey, Managing the Software Process, Addison-Wesley: Reading, MA, 1994
5. Capers Jones, Assessment and Control of Software Risks, Prentice-Hall: Englewood Cliffs, 1994, NJ, pp. 217-218
6. International Organization For Standards, ISO/IEC 12207, Geneva Switzerland, 1995
7. M. O'Brien, Software Production Management, NCC Blackwell Ltd.: Oxford, U.K., 1992
8. M. Paulk, B. Curtis, M. Chrissis, C.Weber, "Capability Maturity Model, Version 1.1," Technical Report, Software Engineering Institute, Carnegie-Mellon University, 1993
9. Stephen S. Roach, "Services Under Siege-The Restructuring Imperative." Harvard Business Review, pp. 82-92, Sept.-Oct., 1991.

Case Study of a Collaborative IT Project: Siemens' Production Computer Information System (ProCIS)

Kathryn O. McCubbin & Steve Allen, Christopher Newport University, Newport News, Virginia

ABSTRACT

One of the major problems facing businesses today and the foreseeable future is the deficit of qualified information technology professionals. Institutions of higher education are not producing sufficient graduates and many academic programs are not keeping up with the rapid changes in information technology. Even if qualified professionals were available businesses are hesitant to commit this expensive resource to in-house training and retraining. One approach to addressing the problem is collaboration between business and the educational institution. This paper describes the result of collaboration between Siemens Automotive Fuel Component Division, USA and a mid-Atlantic university. The joint project was the development of an interactive, windows based training system for use by operational personnel using robotic equipment in the production of fuel injector parts. Both management and technical features of the project are described.

Introduction

A survey of U.S. companies recently concluded that there are approximately 190,000 jobs that remain unfilled due to the lack of qualified personnel.[1] In the next 7 years the need for workers with information system development skills will far exceed their availability both in the United States and worldwide. The largest job growth during this period will be systems analysts, those that marry end-user needs to the available technology. The need for these workers will grow from 483,000 in 1994 to 928,000 in 2005, a 92% increase. "According to the Bureau of Labor Statistics, for jobs in the business environment, employers usually want systems analysts with backgrounds in business management or closely related fields. Many information service and consulting firms are looking for educated, computer savvy, individuals with a variety of college and graduate degrees to fill systems analyst positions. A number of consulting firms, which are rapidly expanding their information services, prefer hires with degrees in management, business, public policy, over those with more narrow computer specialization. General business skills and experience related to the operations of the firm are preferred by employers as well."[2]

Businesses have traditionally relied on community colleges and universities to provide a pool of qualified information technology workers; however, the rapid advances in this field quickly outreach the ability of such institutions to satisfy the demand. Where then are these critical workers to be found? More and more the answer to this question appears to lie in "retraining" of current employees. A business must either commit substantial resources to in-house training and retention of highly skilled (and highly paid) internal technological expertise or find ways to motivate employees to seek outside training. In addition, the business must find a way to ensure that such training is directly applicable to its technological needs. This suggests that business and educational institutions work closely to design curricula for personnel and provide meaningful on the job experience for prospective employees currently in the formal education stream.

One of the major impediments to realizing an effective cooperative program between business and educational institutions is the ubiquitous "resistance to change" syndrome. The educational institution operates on at least a two-year cycle for the implementation of curricular change. In the case of politically sensitive changes, those that cross academic departments, the cycle can extend indefinitely. To satisfy the business need for systems analysts the institution must provide an interdisciplinary program that includes programs from the School of Business and the Computer Science Department. Many institutions have resolved the organizational and political problems this may pose but many have not.

Businesses also can experience resistance to change. This appears most often in their management style. The hierarchical model of the organization is common and inhibits tactical response to changes in the environment. When the environment includes dependency on computer applications delays in response can be catastrophic and at the least, threatening. "Restructuring," "Re-engineering"[3] and "Empowerment" are current cliches that have as their common denominator the sharing of decision making by those who are most affected by the decision.[4] In many cases this is the line employee. Applying this concept to the training function it means allowing the production line employee to define the content and delivery of training.

Both the educational institution and the business can adapt to the changing technological environment and collaborate on seeking a possible solution to the critical need for information technology workers.[5] A strong motivation for adapting to the environment might be a demonstration of a successful collaboration between the education institution and the business. This paper describes such collaboration.

The Company: Siemens Automotive, USA

In the mid 1980's Siemens Automotive, manufacturer of fuel injectors for automobiles, purchased Bendix Automotive in Newport News, Virginia. Its main customers are foreign and domestic automobile manufacturers. By 1988 Siemens was experiencing serious financial difficulty and the president, George Perry, knew there had to be a change in management philosophy if Siemens were to survive. The philosophy he chose was one of employee empowerment.[6] It worked because George Perry "decided to turn the world upside down." He committed himself and the organization to three fundamental tenets:

People are not expendable;
We will pay for knowledge;
We will develop and retain a culture of trust in the organization.[1]

John Olson instituted the practice of Company Wide Quality (CWQ). This is a six-step program involving the following:

Training and education;
Communication;
Improvement planning;
Employee involvement;
Productivity;
Reward and recognition.

It is implemented in three distinct ways. Through its *REFLEXTIONS* program Siemens deposits $50 for every implemented employee's suggestion into a central fund that is distributed equally to all employees at year-end. Through its Small Group Improvement Activity (SGIA) a cross-section of hourly and salaried employees, customers and suppliers brainstorm solutions to problems and develop implementation plans.[7] Through its Process Optimization with Early Results (POWER) program it dedicates teams full-time for 3 to 5 days to analyze and resolve specific problems.

Incidental practices that amaze more conventional outsiders include the fact that: all salaried employees have company credit cards; no administrative authorization is required for domestic business travel; travel advances require no authorization and are obtained at ATM machines using the credit cards; decisions involving employees are made by the affected employees. Since the implementation of this management philosophy and practice in 1989:

Productivity as a measure of sales per employee is up 89%;
Customer reject rate on finished products has decreased by 43%;
Output is expected to increase by 33% in each of the next 2 years without increasing employment;
30% of total plant budget is invested annually in information systems and technology;
Manufacturing cost per unit was trimmed by 41%
Warranty costs were down 64%
Order-to-shipment lead times were slashed 75%;
There was 99.5% on-time delivery of all products.

As John Olson delights in pointing out "this turn around was accomplished with the same employees, the same work force." He credits employee training done in cooperation with the local community college for this fact.

The impact of international standards for businesses involved in global commerce was an important motivator for the change in management style. These standards, typically called the ISO 900x series of standards, impose severe quality requirements on businesses. Auto manufacturers have adopted an even more stringent set of standards.[2 8 9] The auto manufacturers require that all of their suppliers are QS 900x certified. To become certified under these standards a company must have written procedures for all processes, these procedures must be followed by all relevant employees, an independent auditing team must certify that the employees' performances are consistent with the documentation, and the audit process must be continual. John Olson believed that the way to reach that level of quality was to empower each employee, to have her/him understand the importance of individual performance and continually try to improve upon it.

University/Siemens Collaboration

Background

The University is located in a predominantly manufacturing area. The student body consists of adult learners, average age 27, who believe that a college degree will advance their career. In 1993 the School of Business revised its curriculum in

[1] As a testimonial to its 1988 commitment to keep its word to avoid layoffs, Siemens did not lay off any employee during the long recent Chrysler strike.

[2] Foreign auto manufacturers also emphasize the importance of knowledge and training in manufacturing excellence.

management to include an emphasis in management information systems (MIS). An introductory course in this program was one that investigated computer business applications developed for common business functions. Part of this course focused on software development tools. The final project required the student to identify a major business function, describe a specific process in this function and suggest a computer application system, together with a relevant software development tool, that would enhance the effectiveness of the process.

In 1995 an employee of Siemens, an operator of advanced robotics machines, decided to take advantage of the company's Pay for Knowledge program and enroll in the University Business Program. In the MIS course he chose as his business application the training of robotic operations personnel. The training manual (required by QS 9000 certification) was to be digitized using OCR scanning, indexed, and stored in an ACCESS database. The computer application system was an interactive PC system that provided operators on the production floor to randomly access parts of the manual for trouble shooting as well as instructional purposes. This final project did not require the student to implement it, only to describe its functions. The student was so enthusiastic about the possibilities of such a system he pursued its implementation outside of the class through the "empowerment/improvement" programs at Siemens and his academic advisor. The result was a grant from Siemens to develop the system.

The Interactive Training and Maintenance Support System

System Description

The objectives of the system were: To improve delivery of training for operational personnel since the proper set-up and operation of the robotics equipment is vital to the mission of Siemens; To facilitate the use of uniform guidelines in the operation of this equipment since this is essential for continued QS 9000 certification; and, To provide quickly accessible and readily understood instructions for correcting machine faults. An activity log of the number and types of faults may indicate training and/or maintenance needs. The emphases of the system design were on the ease of use of the user (operator) interface, the use of commercial hardware and software for minimum cost, and the use of multi-media[10] [11] wherever possible. The major advantages of the final system were to be continuous reinforced training, an increase in operator effectiveness, support of QS certifications, a control for standard procedure updates, and expansion to a variety of machines over local and wide area networks.[3]

System Implementation

Undergraduate and graduate students implemented the system. The pilot system used VISUAL BASIC 5.0 and the Windows Explorer user interface format (using a mouse to explode and condense menus). It stored the operations manual in an ACCESS database that contained both text and photographs. Video was excluded because of storage limitations. The text could be edited by invoking rather complicated VISUAL BASIC features. Either the text or the photograph was displayed. They could not be displayed simultaneously.

The next version, version 2, of the system redesigned the user interface so that a minimum of text was displayed at all times. Text and photographs were displayed together with the option of scrolling the photographs with the text or keeping the text fixed while scrolling the photographs. Forward and backward buttons were provided as well as "on the fly editing". A zoom effect for enhancing the text description of a process was accomplished by relating several, increasingly magnified photographs, with a single portion of text. This version is currently being field tested by a team of operational personnel on the production floor. Feedback from the field test will be used for the design and implementation of version 3. Software tools are evolving from the programmer's desk to the end-user[12] [13]and the system provides the production operator with the software tools to add and delete machines. An information specialist, however, must enter photographs. System specifications for version 3 of the system are follow.

Requirements:

ProCIS (Production Computer Information System) is a stand-alone PC based production training system. The user interface displays integrated text and pictures in separate windows. Text to photo and photo to text hyperlinks are provided with text highlighted when the photo to text hyperlink is selected. There are forward and back navigation buttons for sequencing text and photos. There is an "on the fly" feature for editing text in real time. It operates in a Windows NT environment.

Activities:

---

[3] Siemens has plants in South America, Europe and Canada that are linked by a wide area network.

The development must include the validation and demonstration of the completed system using actual production machines such as the Swager and associated Kurt Gage. Final system testing is to occur on the production floor during regular shift operations. Users are regular production personnel.

Developer Considerations:

There is a "novice" level user interface, which minimizes user inputs to obtain the desired information as well as minimizing the use of the Windows menu bar. The "mouse" is to be used to orient the interface and provide text to photo orientation. Password security should be used for text editing while limiting the "on the fly" text editing to essential use only. It must accommodate the user work environment, for example: protective eyeglasses are required so text sized should be available for ease of reading (14/16/18 point fonts); gloves are often in use, therefore design should include oversized navigation buttons; production targets are time-dependent, therefore the use of selection windows should be maximized and tasks should be limited by forcing user selection and minimizing the use of open windows. Rapid development of the software should be realized by embedding the machine database in the source code and the response time should be optimized.

Development Tools:

Microsoft Visual Basic 5.0 – source coding and executable compilation.
Microsoft Word 97 8.0 for rich text display.
Microsoft PowerPoint 8.0 for "Splash" screen and tutorial examples.
Microsoft NT 4.0 to provide LAN integration at a future date.
Graphics Editor to crop and edit photos (for example, Corel Photo Pant 5.0) and to size photos for exact picture window fit (580x400 pixels)
Optical Character Recognition to convert documents to computer-editable text (for example, Omni Pro 7.0).

Hardware:

200 MHz Pentium
32 MG RAM (primarily required for efficient operation of Windows NT)
3.2 GB hard drive storage
Video card with 2 MB VRAM/DRAM to support 1024 x 768 resolution with 16 bit color
CD ROM/floppy drives
17" high resolution monitor and 1024 x 768 dpi screen resolution
100 MB ZIP drive for media transfer
Photo Scanner to digitally scan photo prints (for example, HP ScanJet 3c with 600+ dpi capability)

Future Development Objectives:

Design and develop a data file system to accommodate various production machines
Design and develop an easy to use data entry/file maintenance capability
Design and develop LAN – stand alone options
Determine optimum means of media transfer for both initial set-up and periodic updates/revisions
Determine stage device requirements to manage the entire set of production machines
Provide for compatibility of Pro CIS Windows 95 platforms and various monitors.

Conclusion

Forward thinking institutions and businesses can work together to help solve the deficit of intellectual capital facing the U.S. in the next few years. The advantages of collaboration are many. The institution provides its students with practical experience and a real world test of their classroom learning. The business acquires experience in leading edge technology at minimum cost. When this collaboration takes place in an environment of employee empowerment and management commitment to training it provides fertile ground for innovation.

---

[1] "Help Wanted: The IT Workforce Gap at the Dawn of a New Century" The information Technology Association of America.
[2] "America's New Deficit: The Shortage of Information Technology Workers," U. S. Department of Labor, 1996.
[3] Braithwaite, T., Information Service Excellence through Total Quality Management: Building Partnerships for Business Process Reengineering and Continuous Improvement, ASQC Quality Press, Milwaukee, WI, 1994.
[4] Caudron, Shari, "Create an empowering environment," *Personnel Journal.* Sept 1995 v74 n9 p28 (8).
[5] "Manufacturers cultivate 'home-grown' employees," *Tooling and Production,* July 1997 v63 n4 p31 (2).
[6] Belasco, James A. and Stayer, Ralph C., Flight of the Buffalo, Warner Books, Inc. New York, 1993.
[7] Elmuti, Dean, "Sustaining high performance through self-managed work teams," *Industrial Management,* March-April 1996 v38 n2 p4 (5).
[8] Vasilash, Gary S., "Agility and other anguishing exercises in the auto industry," *Production,* Oct 1994 v 106 n10 p50 (10).
[9] Pickard, Jane 'Tour de force, (Philip Ashmore, Nissan UK's personnel director)," *People Management,"* March-April 1996 v 38 n2 p495).

[10] IBM Multimedia Training, 'Power to the people: multimedia drives customer service training," *Training,* July 1994 v31 n7 p59 (4).
[11] Harris, Neil, "Multimedia is the message," *New Scientist,* Dec 21, 1996 v152 n206-2 p83 (1).
[12]U.S. Bureau of Labor Statistics.
[13] Cronin, Mary J., "Intranets Reach the Factory Floor," *Fortune,* Aug 18, 1997 p208.

Constructing Multimedia: Interdisciplinary Collaboration in Cyberspace

Dr. Christiana Birchak and Dr. Herbert Rebhun
University of Houston-Downtown
Birchak@dt.uh.edu and Rebhuh@dt.uh.edu

Abstract

This paper traces the design and implementation of an interdisciplinary, computer-mediated collaboration. As students in two upper-level courses (computer information systems and communications) created a series of interactive multimedia projects, they participated in the instructional process. This initiative fostered a shared learning environment, resulting in the burning of a CD-ROM. We discuss the coordination within groups, assessment measures, and collaboration with enabling technologies of computer networking.

If Isaac Newton were alive today, he'd probably be found navigating the Internet, flaming Hooke and Leibnitz at times, but most often displaying his experiments. Imagine Newton burning his first CD-ROM! We two professors kept that vision in mind as we introduced our students to the interdisciplinary multimedia project entitled *Gulliver in Cyberspace Revisited.* It engages audiences in the cultural context presented in Jonathan Swift's satire *Gulliver's Travels* (1726).

In this paper, we discuss designing, conducting, and assessing an interdisciplinary, computer-mediated collaboration. By engaging students in the instructional process, we established a social context within which they interacted. Introduced to a variety of discourse communities, they analyzed audience needs and participated in practical applications of information design. Thus, they inhabited new social spaces, ultimately reflecting on their own learning techniques. The project fostered the creativity demanded as the academy and the workplace expand into new dimensions.

Authoring multimedia begins with the collaboration of writers, videographers, editors, graphic designers, animators, and narrators. The CD-ROM prototype our students completed in Fall 1997 represents the collaborative efforts of two classes: CIS 3309 Computer Graphics in Business and COMM 3312 Writing for Presentation. Some of the materials developed in a previous semester by English 4306 Science Writing students were incorporated.

Background

Situated in the midst of a large metropolitan area, the University of Houston-Downtown, an undergraduate institution, has achieved recognition for its diversity. The *11th Annual America's Best Colleges Guidebook of U.S. News & World Report 1996-97* judges it "the most diverse regional liberal arts college in the western United States." The average age of the approximately 8000 students is 26.5. All of them commute to our urban setting. The participants in our collaborative reflect the ethnic diversity characteristic of the Houston community: 32% Hispanic, 27% Caucasian, 25.7% Black, 11.4% Asian, and 3.6% International. This multicultural environment enhanced the creative ideas implemented by the teams.

As members of the multimedia production team, students enhanced their skills for creating computer-based instruction and training materials. This approach is consistent with the 1997 National Science Foundation's Workshop on Human-Centered Systems, an initiative focusing on achieving synergism between humans and machines. Inasmuch as the CIS class met in the evening and the COMM class in the day, students interacted mainly in cyberspace. Shared folders on the network facilitated the process. This asynchronous collaboration enhanced the students' credentials when they applied for entry into the corporate environment.

Participatory learning

In her 1994 book *Artful Science: Enlightenment Entertainment and the Eclipse of Visual Education*, Barbara Maria Stafford predicts the 21st century will be an opportunity for re-enlightenment. She traces the teaching of science through entertainment, noting the extent to which it became associated with educating women and children as well as wealthy amateurs. The method used to convey this new knowledge depended upon a visual component. Thus, Stafford rejects the idea of idle spectators. Instead, she suggests that the 18th century emphasis on participatory learning provides a model for modern intellectual exercise. Certainly, the digital world offers innovative opportunities for visual design and pattern recognition. As electronic writing reduces the distance between author and reader, it turns readers into authors.

Our multimedia project restored the participatory aspect of science education in the 17th and 18th centuries. Mainly, we confined ourselves to the Enlightenment (1660-1780). Nevertheless, at the request of students, we expanded into 1783-85 in order to include the first manned balloon flight. Mentoring students as they designed an interactive multimedia project, a CD-ROM specifically, transformed the classroom from teacher-centered to student-centered. Additionally, the computer-mediated collaboration fostered a shared learning environment.

Multimedia software

HyperStudio software enabled the students to author multimedia without extensive training. We professors teamed with Nabil Ajine, an instructional technologist, to develop an instructional flyer entitled *HyperStudio Basics*. Making it available in print and digital formats, we then conducted workshops for the classes and demonstrated the rudiments of this accessible software package. After limited hands-on experience, students began building stacks of cards. The technology remained merely a tool for creativity. Thus, we focused on redefining the way we learn in a multimedia world .

Information overload

In Swift's *Gulliver's Travels*, Lemuel Gulliver, if you recall, suffers from information overload. As he travels from the land of Lilliputians to that of the Houyhnhnms, he carefully enters data points and logs events, overwhelming readers and himself with minutiae. Lacking the skill to filter information or to apply a social context, he remains isolated and unable to effect his environment. Many, in fact, would diagnose him as insane. Thus, he epitomizes the danger of technology without humanity. To avoid graduating clones of the fictional Gulliver, we must encourage students to place information in a context of social relevance.

Technology grant

Phase I of the project arose as the result of an internal technology grant. Applying technology as a tool in Spring 1997, students in English 4306 Science Writing shared in the learning experience of retrieving, archiving, and creating information. Their authoring a CD-ROM with HyperStudio was designed to enhance understanding of Enlightenment science (1600-1780). The 22 students enrolled in this interdisciplinary class were majors in one of two departments: natural science and English. They represented age, gender, and ethnic diversity. Although most were computer literate, none had authored multimedia.

Students selected topics for which they wanted to become subject matter experts. Maintaining a logbook, each student developed an abstract that transformed data into information. Among the topics researched were spontaneous generation, smallpox, automata, cognition, geometry, the microscope, planetary motion, manned balloons, and musical instruments. Ultimately, 5 interdisciplinary teams formed. They established the learning objectives for the HyperStudio stacks that included astronomy, biology, cognitive science, music, and the plague. The balloon served as the metaphor for navigating throughout the project. Positive responses from the students, professorial colleagues, and the Instructional Technology Center led to expanding the project the following semester.

Asynchronous collaboration

Before beginning Phase II, *Gulliver in Cyberspace Revisited*, we professors brainstormed the guidelines for our interdisciplinary collaborative endeavor. Our commitment to the project was accompanied by the realization that technological innovation requires living with a high level of ambiguity. Our first challenge was to convince business computer information systems students (33 juniors and seniors) and communication students (12 juniors and seniors) that a collaborative would serve their needs. We became used to answering the question, "Why are we working with them?" Interestingly, some of those who had the most doubts initially about the project and their ability to contribute were the most successful. The more initially confident ones tended to lack the perseverance and imagination to overcome technological or human vicissitudes.

Business computer information science course (CIS 3309)

This course presents the needs and applications for graphics in business. It also covers developments such as the principles of software packages that generate graphics. Course objectives are as follows:

- Recognize and describe the differences between the major categories of graphics.
- Write applications using presentation graphics, text charting, desktop publishing, and WWW graphics.
- Create a presentation of a team-researched topic integrating the use of a multimedia graphic package.

Communication course (COMM 3312)

This interdisciplinary course (3 credit hours) guides students in analyzing strategies for presentation in industry, government, private organizations, and education. The overall goal of the course is to design, create, and deliver professional presentations using available technology and remaining sensitive to human factors. More specific goals include acquiring visual literacy, managing information and projects, applying cognitive theory, understanding aesthetics, and developing multimedia presentations for diverse audiences. Specific learning objectives are as follows:

- Develop nonlinear writing skills.
- Prepare materials suitable for trade shows, product demos, kiosks, and interactive training.
- Consider hypertext linking as an influence on reader's comprehension.
- Explore computer-mediated learning using HyperStudio.

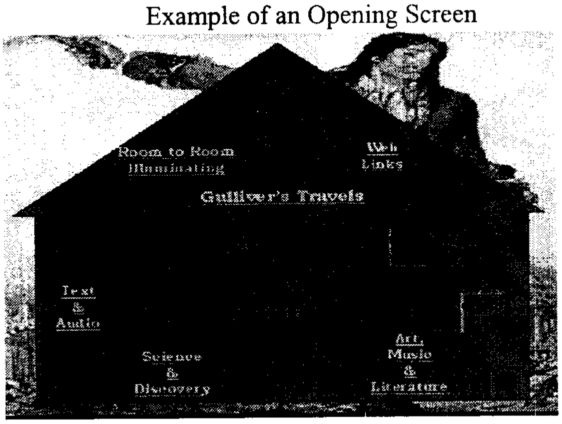
Collaborative strategies

To introduce the project, we demonstrated selected modules from the first student-developed CD-ROM, concentrating on the biological section. It incorporates animation, simulation of an experiment, and self-testing options. Then we provided a brief historical perspective essential to project planning. A timeline and a list of noted figures such as Descartes, Halley, Handel, Leibnitz, Locke, Montagu, and Newton represented the breadth of activities in the Age of Enlightenment. This background ensured thoughtful decision-making.

Coordinating topics for the 10 teams being established demanded flexibility. Each of the teams consisted of 3 to 4 students from CIS 3309 and 1 to 2 students from COMM 3312. Expanding material from the previous semester was the first option. Four teams decided to enhance earlier material: the plague, astronomy, baroque music, and manned balloons. As the selection process continued, other students requested a second option: research a new topic within the same century. Five teams selected this option, introducing Newtonian science, mental illness, Benjamin Franklin, Salem witch trials, and Handel. A tenth team was charged with media management, making decisions about navigational coherence, creating control elements, and integrating images.

All students were required to develop interactive screens, conduct usability testing, assess the multimedia, and reflect on the collaboration as a shared learning experience. In developing the project, students actively engaged in the instructional process, exploring multiple ways of knowing. They conducted research, using the library, the web, and media from the network system. WAV files archived the previous semester were particularly appreciated. Communication students were required to participate in the HyperHelp listserve. Additionally, each student drafted a minimum of three interactive cards and developed a storyboard of the team project.

Example of an Opening Screen



Team responsibilities remained consistent for both classes. Each team was required to create a six-card stack, each card leading to subsequent cards/activities. Elements to be evaluated included the following:

<u>Graphics</u>: Active buttons and graphic objects (internal/external).

<u>Background</u>: Screen layout and design appropriate for topic.

<u>Audio</u> (sound/voice): WAV files of music and narration.

<u>Text</u>: Scrolling material, original content, and links to WWW.

<u>Animation</u>: Moving objects and simulations.

<u>Interactivity</u>: Timelines, maps, and self-testing options.

Project goals

We envisioned engaging the multimedia developers in discovery learning. They applied technology as a tool for creativity and enhanced their scientific literacy. Using available technology, they remained sensitive to human factors. More specific goals include acquiring visual literacy, managing information and projects, and applying cognitive theory.

Once the students began their digital drafts, they conferred with the professors and the instructional technologist, seeking specific advice on the content and the technology. A system of shared folders accessed on the network facilitated the collaboration. Students needed to rethink the approach to writing for a digital audience rather than a textual one. Ensuring the user retained the autonomy to navigate throughout the program presented a challenge.

Problems

Although the students completed the ten projects successfully, problems did occur, both technological and human. The initial instability of HyperStudio 3.0 in the networked environment resulted in frequent crashes. Ultimately, we returned to HyperStudio 1.05; however, technological complications continued, heightening the level of student and faculty frustration. Human error caused additional difficulties. Nevertheless, those who failed to save files and to consult with team members seemed to accept responsibility for their actions.

In the required self-assessment, each student discussed contributions to the final project and the team, reflecting particularly on problem-solving activities. One participant stated, "It was quite an experience working with this type of project because we had to keep in constant communication with each other in order to ensure that we were on the right track." Another student recognized, "The opportunity that technology presented to make this project a success was enormous; however, if members don't make use of this technology, it is wasted." The one individual who participated in Phase I and Phase II of the project wrote, "This class was interesting and intellectually stimulating. We had time to think, discuss, and implement. I learned so much from my group members and other members." Although these students and others noted ways in which the technology hindered completion of the assignment, they appreciated the extent to which this computer-mediated collaboration fostered creativity and enhanced their professional credentials.

Spring 1998 initiative

Observing the pride the students took in authoring the multimedia and impressed with the completed CD-ROM, we professors decided to engage in a subsequent collaboration. Both of us were assigned to teach at The University Center, a multi-institutional center 35 miles north of downtown Houston. The technology facility at this remote site is advanced; however, HyperStudio is not available. Therefore, we designed a project using PowerPoint. A third colleague, Dr. Jean DeWitt, Associate Professor of Speech, joined us, expanding our multidisciplinary approach. The collaborative included Speech 3306 Business and Professional Speech, English 3312 Studies in Fiction, and CIS 3309 Computer Graphics in Business.

Inasmuch as spring 1998 was the first semester for courses to be offered at the site, each class tended to be small, six students or fewer. Three teams developed, each focusing on a separate novel: *Gulliver's Travels* by Jonathan Swift, *Jane Eyre* by Charlotte Bronte, and *To the Lighthouse* by Virginia Woolf. Tracing narrative traditions relating to time and space, the students entitled the multimedia project *Room to Room: Illuminating Reality.* Criteria for evaluating materials remained similar to those of the previous semester, including an expanded option for narrated passages. Continuing to work in an asynchronous environment, students negotiated meaning in digital space as they transformed cultural data into "rooms" of information.

Conclusions

We plan to expand our research by examining assessment measures, communication and coordination within groups, shared information space, and collaboration with enabling technologies of computer networking. Cultivating technology as a tool for serious inquiry ensures instructional design remains key to educational courseware. The students' dedication and enthusiasm for our interdisciplinary collaborative have been rewarding. The final product was visually effective and scrupulously researched, reinforcing the role of multimedia in enhancing cognitive skills. *Gulliver in Cyberspace Revisited* engaged professors and students in unique forms of association for learning.

References

Coburn, Edward. (1991). *Business Graphics: Concepts and Applications*. Boston, Massachusetts: Boyd & Fraser.

Korolenko, Michael D. (1997). *Writing for Multimedia: A Guide and Sourcebook for the Digital Writer.* Belmont, CA: Wadsworth Publishing.

Laurel, Brenda. *Computers as Theatre*. (1993). Reading, MAA: Addison-Wesley.

Rich, Grace. (1995). *Special Edition Using PowerPoint for Windows 95*. Indianapolis, IN: Que Publications.

Stafford, Barbara Maria. (1994) *Artful Science: Enlightenment Entertainment and the Eclipse of Visual Education*. Cambridge, Massachusetts: MIT Press.

Factors Associated with Adoption and Use of Technology in Instruction

Mary Sumner
Department of Management Information Systems
Southern Illinois University at Edwardsville
Edwardsville, IL 62026
Msumner@siue.edu

and

Dennis Hostetler
Department of Public Administration
Southern Illinois University at Edwardsville
Edwardsville, IL 62026
Dhostet@siue.edu

Abstract:

With the current availability of instructional technology, faculty are beginning to create Web-based instructional materials, to use computer-based presentation systems in the classroom, and to design on-line courses. Many colleges and universities are anxious to provide incentives and opportunities for faculty to use technology in teaching, but strategies for facilitating the learning curve with respect to the use of these technologies are unclear. This paper proposes factors associated with the adoption and use of technology in teaching.

Objectives:

The purpose of this paper is to identify some research questions relevant to the use of technology in teaching and to propose a series of variables which may be associated with influencing the adoption of instructional technology. The paper will summarize the findings of interviews which were conducted with faculty who participated in the Internet Bootcamp, a workshop designed to train faculty how to design and construct their own Web pages for instructional purposes.

Relevant Literature:

There are a number of factors associated with the adoption of innovations. These include application development factors, organizational factors, support factors, and environmental factors. Each of these factors can be applied to the process of introducing innovative uses of technology into instruction.

Application development factors:

Adoption of innovation must be consistent with an organization's capabilities and skills (Burgleman, 1983; Rogers and Shoemaker, 1971). This means that a technological infrastructure must exist (Madique and Zirger, 1984) and that the innovation itself must be compatible with the experiences and values of potential adopters (Rogers, 1983). In the case of instructional technology, the users and developers of Web-based instructional materials would need to have skills and capabilities relevant to designing such materials, as well as access to the appropriate hardware, software, and infrastructure to support its application in the classroom.

Organizational factors:

Organizational design is a factor in facilitating innovation. Organic structures which offer flexible communications, internal interaction, and networking are more likely to foster innovation. Innovation is most likely to occur in functionally differentiated, decentralized organizations (Moch and Morse, 1977), as compared with hierarchical structures with centralized control. In the academic environment, this means that innovation is likely to be effectively diffused at the departmental and academic unit levels, rather than being super-imposed from above.

Without question, collaboration between technical support specialists and faculty is needed to facilitate the adoption of technological innovation, and a number of models for this occur in the academic environment. Technological "leaders" among the faculty can spur innovation among their peers by providing models of innovative technology use and by mentoring their colleagues. In addition, user support specialists with discipline-specific knowledge of computing and its applications can help facilitate the efforts of faculty to introduce innovative uses of technology in the classroom.

Support factors:

Support factors include the availability of technical support as well as top management commitment (Burgleman, 1983), user participation (Madique and Zirger, 1984), and effective vendor support (Ettlie, 1986). Effective marketing of a technological innovation is also critical (Robertson and Gatignon, 1986), and champions of an innovation play a vital role in their success.

In the academic environment, all of these support factors play a role in facilitating the transfer of technology into instruction. Clearly, the commitment of the senior administration, deans, and department chairs is needed to facilitate innovation and experimentation as well as to fund technology resources and professional development opportunities. Faculty participation in professional development and training opportunities seems to be critical to their involvement in using technology-based tools in instruction, and the effective marketing of teaching technologies by champions and others seems to be associated with transfer of technology and ongoing commitment to its uses over time.

Environmental factors:

Finally, environmental factors often facilitate technology diffusion and use. Organizations which try to stay technologically ahead of other organizations in a particular market environment or industry are likely to introduce innovation. The rate of adoption of an innovation bears a strong relationship to the number of organizations within the environment or industry which have already adopted the innovation (Utterback, 1974).

Within higher education, these factors undoubtedly apply. The higher education environment is becoming much more competitive, with more and more colleges and universities using technology-based instruction, distance learning, and the offering of on-line, Web-based courses and instructional materials as a mechanism to achieve a competitive edge in the marketplace. Technological innovation in instruction is providing opportunities to address new markets, to attract non-traditional students, and to establish partnerships with business and industry which create new opportunities for students. As more and more universities offer on-line access to academic resources and Web-based courses, those universities without such offerings will actually put themselves at a competitive disadvantage in the marketplace.

Research Questions:

The research questions being addressed in the study and in the preliminary interviews include:

- What are you currently doing with respect to using technology in teaching?
- What factors are facilitating your efforts to achieve these objectives?
- What do you feel are the greatest barriers to your using technology in teaching?
- What types of "motivators" or "incentives" can be provided to faculty to facilitate their efforts to integrate Internet resources into teaching?
- What types of "demotivators" detract from your efforts to use technology in teaching?
- What collaborative mechanisms (e.g. teams, discipline-specific work groups) might facilitate your efforts to use technology in the classroom?
- What is the importance of the "change agent" or "technology advocate" in facilitating innovative uses of technology in instruction?

Case Studies:

In the interviews, the main focus was placed on the question of what are the motivating factors which provide faculty with incentives to allocate time and effort to integrating Internet resources into teaching. In addition, the question of the "demotivators," the factors which detract from using technology in teaching, was raised.

Without question, the traditional motivators of academic effort (credit toward promotion and tenure, weight used in the formal evaluation process, release time from teaching) all apply to the process of facilitating the use of technology in instruction. An interesting and new insight provided by the Associate Provost was that "public acknowledgement" of academic effort on the Web could also serve an an effective motivator. Since courseware available on the Web was technically available and accessible to the entire academic community, individual developers are likely to be more conscious of its quality and more apt to appreciate external acknowledgement of their work.

The faculty viewpoint expressed in the preliminary interviews was somewhat consistent. Clearly, the traditional value system applied, and the respondents believed that credit toward promotion and tenure, as well as weight in the formal evaluation process, were useful incentives when it came to supporting the development of technology-based instructional materials. In addition, one faculty member felt that intrinsic motivators, such as personal satisfaction, were critical in influencing faculty to develop these materials.

On the question of "demotivators" which deter instructional innovation using technology, the consensus was that inadequate hardware, software and networking resources as well as poor technical support were significant deterrents. Since these factors seem to be recurring and ongoing because of tight resources and limited budgets for updating and upgrading hardware and software resources, they are likely to continue to be demotivators.

On the question of organizational mechanisms that are conducive to instructional innovations, the respondents had a variety of ideas. Aside from traditional training classes such as the Internet Bootcamp, which are designed to provide start-up instruction, the respondents felt that "discipline-specific" teams and small groups of interested developers would serve as a catalyst for ongoing change and the sharing of ideas and opportunities. The respondents felt that the role of a departmental or discipline-specific "change agent," a faculty member who was slightly ahead with respect to using technology in teaching, was critical to facilitating the efforts of others.

The Framework

Based upon these preliminary interviews, a framework which includes application development factors, organizational factors, support factors, and environmental factors was developed and includes the following activities.

Application development factors:

- Current level of computing skills
  - Familiar with the basics (command-level user)
  - Knowledgeable of several applications (application-level user)
  - Designer of applications using programming tools
  - Internal consultant (functional support specialist)

- Extent of use of computing skills in teaching
  - Use of word processing and presentation graphics
  - Use of application software (statistical analysis, CAD)
  - Design of an application using a programming language
  - Authoring of a standalone instructional package

- Extent of training in using technology resources in instruction
  - Participation in an Internet Bootcamp
  - Use of on-line tutorials
  - Attendance at a professional development seminar off-campus
  - Use of consulting help

Organizational factors:

- Motivators provided to faculty who integrate technology and teaching:
  - Credit toward promotion and tenure
  - Weight used in the formal evaluation process
  - Criteria used in evaluating sabbatical applications
  - Monetary incentives
  - Release time from teaching
  - Acknowledgements (internal awards)
  - External awards (Educom technology awards)
  - Acknowledgement by top leadership

- Demotivators that detract from using technology in teaching:
  - Lack of adequate hardware
  - Lack of adequate software
  - Lack of adequate technical support
  - Insufficient training
  - Insufficient rewards or incentives
  - Lack of time
  - Lack of support by Chair or other administration
  - Lack of peer group support

- Alignment
  - Importance of technology within your department's curriculum
  - Future importance and impact of technology

Support factors:

- Contact with a "change agent"
- Participation in a technology innovation "team"
- Work with a discipline-specific specialist
- Support of top management
  - Department Chairs
  - Deans
  - Senior administration

Environmental factors:

- Competitive uses of technology in instruction
- Availability of Web-based instructional materials and on-line courses in competitive, regional institutions

Summary:

In summary, these factors are associated with the adoption of technology in instruction and instructional innovation. In a follow-up study, an analysis of which factors are most likely to influence tenured vs. non-tenured faculty, and faculty with different levels of expertise using computing and its applications will be included.

References:

Burgleman, R. A., "Corporate Entrepreneurship and Strategic Management: Insights from a Process Study." Management Science, V. 28, December 1983, pp. 1349-1364.

Ettlie, J.E., "Implementing Manufacturing Technologies: Lessons from Experience," in Managing Technological Innovation, Jossey-Bass Publishers, San Francisco, 1986.

Madique, M. A. and Zirger, B.J., "A Study of Success and Failure in Product Innovation: The Case of the U.S. Electronics Industry," IEEE Transactions on Engineering Management, November 1984, pp. 192-203.

Moch, M.K. and Morse, E.V., "Size, Centralization, and Organizational Adoption of Innovations," American Sociological Review, V. 42, October1977, pp. 716-725.

Robertson, T.S. and Gatignon, H., "Competitive Effects on Technology Diffusion," Journal of Marketing, V. 50, July, 1986, pp. 1-12.

Rogers, E.M. and Shoemaker, E.F., Communication of Innovations, Free Press, new York, 1971.

Rogers, E.M., Diffusion of Innovations, Free Press, New York,1983.

Utterback, J. M., "Innovation in Industry and the Diffusion of Technology," Science, V. 183, February 1974, pp. 620-626.

Emerging IT Issues and Fast-Cycle Curriculum Development

Janis L. Gogan, Assistant Professor
Bentley College
175 Forest Street, Waltham, MA 02154
jgogan@bentley.edu

Abstract

Many faculty find it difficult to keep up with the rapid pace of change in technologies and IT-driven challenges, let alone to introduce new course materials that adequately explore these challenges. This paper discusses a "fast-cycle" process by which field research on two types of IT-driven challenges: a "strategic opportunity" (electronic commerce) and a "necessary evil" (year 2000 compliance projects) led to new courses and course modules. Suggestions are offered for organizational mechanisms that can facilitate a self-reinforcing "virtuous" fast-cycle process of useful and relevant research and curriculum development on emerging IT issues.

Introduction

In the nineties, organizations invested in technologies for improved transaction processing, electronic commerce, process redesign, and other key activities. In order to capitalize on IT-enabled opportunities and control attendant risks, managers and IT professionals have been called upon to take a more holistic view of the organization, its strategy and its environment (Applegate, et al., 1996); engage in effective knowledge management (Davenport et al., 1998; Davis and Botkin, 1997; Hedlund, 1996); and re-examine traditional roles, responsibilities, and reporting relationships (Bradley and Nolan, 1998). These challenges give rise to a pressing need for new content in the management curriculum, and for flexible and responsive curriculum development processes. Firms' increased reliance on complex, interdependent systems and processes have several specific implications for management educators:

- A significant curriculum development effort is required – one which introduces new material at a much faster pace of change than has been the norm (Hall, 1995; Twigg, 1995).
- The long cycle-time of textbook development is inconsistent with a leadership role in teaching about IT-enabled business transformation (Noam, 1998).
- In order to design appropriate new interdisciplinary course materials and curricula, faculty members need to continuously upgrade both their hands-on IT skills and their understanding of IT-driven organizational and industrial transformation.

This paper reports on a "fast-cycle" process in which useful field-based research findings are rapidly incorporated into course materials that address managers' and IT professionals' evolving roles. Use of these materials in traditional and non-traditional classrooms in turn gives rise to new research opportunities, in a self-reinforcing, "virtuous" cycle. Two examples are offered:

- field research which led to a new course, Electronic Commerce on the Web, and new modules in courses on MIS and Accounting Information Systems;
- field research which led to a course on Managing Year 2000 Compliance Projects and modules in courses on MIS, Project Management, and Accounting Information Systems.

Strategic Opportunities and Necessary Evils

The two research/curriculum-development efforts described below were driven by different types of IT initiatives: one "strategic opportunity" (electronic commerce). and one "necessary evil" (Year 2000 compliance). Both courses help students learn to assess business and IT risks and to utilize effective project management and knowledge management tools and processes, in significant cross-functional initiatives.

An AICPA survey placed Electronic Commerce and the Year 2000 among the top five technology issues for 1998, "based on their impact on revenue, organizational and personal productivity and efficiency, and exposure to risk" (AICPA, 1997). Many organizations are attempting to effectively monitor and control initiatives involving these domains. Electronic commerce is a significant strategic opportunity that will cause organizational and geographic boundaries to dissolve (Applegate and Gogan, 1995; Rayport and Sviokla, 1994). Meanwhile, many executives believe that their Year 2000 compliance effort, while necessary, is unlikely to yield strategic advantages; thus it is viewed as a "necessary evil" (Allen, 1998; ISACA, 1997; Jenkins, 1997; MacDonald, 1997; Mills, 1997; Violino, 1997).

Since electronic commerce and year 2000 initiatives are usually complex, large in scope, and involve numerous interdependent parties (Freeman and Meador, 1997; Ulrich, 1997), each requires holistic understanding, careful risk assessment, and effective project planning and control. Many organizations have limited prior experience with electronic commerce initiatives or with the year 2000 problem on a large scale. Because the associated tools and processes are rapidly evolving, there is a need for new approaches to knowledge management and project management. Thus, interdisciplinary courses which focus on the management of these two types of IT-driven projects offer great potential for addressing pressing management concerns and for helping students acquire analytical and managerial skills that will serve them well in future IT initiatives.

Cycle I: Electronic Commerce

In mid 1994 the World Wide Web was emerging as a powerful new medium for electronic commerce. A small group of entrepreneurial start-ups – such as Netscape, Yahoo, and Open Market – had received their first rounds of venture capital financing. It became quickly apparent that management students would benefit from hands-on exposure to the technologies of the Web and from consideration of the business implications of this medium. At the time, few articles had been written about Web-based commerce, the Web's likely impact, or technical and organizational challenges in capitalizing on its features. Thus, my initial study of Web-based commerce was motivated by two complementary factors:

- recognition of the need for course materials that would engage students' interest while introducing them to new challenges of the Network Era.
- recognition of an unprecedented research opportunity to examine the diffusion and adoption of a potentially disruptive technology -- the Web.

An exploratory study was initiated at Open Market, in collaboration with Lynda Applegate. Utilizing a grounded-theory approach, this first study was an open-ended exploration of a start-up firm in a fast-cycle, technology-intensive young industry. Loosely structured interviews with the company's founders and technical and marketing managers were directed at understanding the interplay of technical, strategic, human resources, structural, and control issues. Several key themes were revealed in these interviews, including:

- *human resources*: as often happens with emerging technologies, this company struggled to locate and retain individuals who were skilled in the use of HTML, other Web tools, and rapid application development techniques.
- *industry turbulence*: in order to respond flexibly to significant, frequent shifts in the competitive environment, this company was taking a highly incremental approach to strategic planning,
- *structure and control*: this company was struggling to achieve an organizational structure and management control practices that could meet the demands of persistent, rapid change in their environment.

A teaching case based on this research (Gogan and Applegate, 1995) was first taught in an MBA elective in February, 1995, followed by several executive programs.

The next step was to examine other Web commerce initiatives, and identify common or contrasting issues and approaches. In-depth, interpretive case study methodology is appropriate for examining organizational assimilation of rapidly-changing technologies, which involve a complex interplay of players, roles, constraints, and drivers (Eisenhardt, 1989; Yin, 1988). The aims at this phase of the study were twofold:

- identify fruitful sites for further research. It was decided that a mix of young start-ups and established major players would help reveal interesting issues of response to technical and competitive turbulence.
- identify other potential teaching case sites that would expose students to a variety of electronic commerce settings, tools, practices, and issues.

Through fall 1995, interviews were conducted with managers and professionals working in 7 companies in the US, Canada, and Europe. Two more teaching cases were prepared (Gogan and Applegate, 1996 and 1997). All interviews were taped and transcribed, and the data were examined using the constant comparative process of qualitative analysis (Strauss and Corbin, 1990). Merely 20% of the interview data were needed for preparation of the teaching cases, but other data informed several papers (Applegate and Gogan, 1995 and 1996; Fedorowicz and Gogan, 1997a; Gogan, 1996; 1996/1997; 1997).

In spring, 1996 I introduced a graduate elective, based on the findings of the above-mentioned study, as well as on materials that were by then available thanks to course development efforts elsewhere[1]. Titled *Electronic Commerce on the World Wide Web*, the syllabus stated:

> "This experimental interdisciplinary course examines significant business activity occurring on the World Wide Web, which is increasing at an unprecedented rate. To understand its potential significance, we will examine the Web's technical, political, and commercial antecedents. This historical view will provide frameworks for understanding the Web's potential significance as a medium for commerce over the next several years. The class will look at Web entrepreneurs and established companies. Students will prepare a significant research paper."

The Course outline was as follows:

I. What is the World Wide Web?

- The Internet's roots in the US Defense Department.
- Internet technologies: UNIX, TCP/IP
- Web Technologies: URLs, HTML, Browsers, Java.
- Web Scavenger Hunt exercise

II. Old-Ways: Lessons From History

- Role of the National Science Foundation.
- A National Information Infrastructure
- Implications of the Personal Computing Revolution. Phases of New-Technology Assimilation
- Electronic Commerce Pioneers: Airline and Hospital supplies industries

III. Web Commerce Unfolds in Three Waves of Change

- Intranet applications and organizational learning
- Business-to-business sales and new relationships
- Consumer sales and new relationships.
- New I-Ways: Entrepreneurs Vs. Established Players

IV. Emerging Concerns on the I-Way

- Transaction Security: new tools, practices, and issues
- Advertising and Audience Measurement
- Ethical Concerns: Information Privacy, Copyright, Freedom of Speech, Trust
- Destructive Price Competition?
- Constructive New Relationships?
- I-Way Driven New Structures and Controls

Web commerce continued to evolve rapidly, as did electronic commerce courses at my institution and elsewhere. While the cases and papers noted above chronicled companies' efforts along multiple dimensions (strategy, technology, H/R, structure), more recent studies (Fedorowicz and Gogan, 1997; Gelinas and Gogan, 1997; Gogan and Guinan, 1997) focused on specific electronic commerce technologies, applications, or issues, reflecting managers' concerns as experience is gained with electronic commerce on the Web.

Cycle II: Year 2000 Compliance Projects

In fall 1996, articles about the Year 2000 Problem began to appear with increasing frequency in the popular press, but at that time it was difficult to locate detailed discussions of how companies were organizing and managing their year 2000 compliance projects. To learn more, Jane Fedorowicz and I conducted a case study at the New York Metropolitan Transportation Authority. We soon came to appreciate the urgent need to make systems year 2000 compliant, and the complex interdependencies that entails. We visited the MTA once in 1996 and three times in 1997 to conduct interviews and observe steering committee meetings. This resulted in a case and teaching note (Gogan and Fedorowicz, 1997). Next, we prepared a conference paper (Fedorowicz and Gogan, 1997), which we will refine and submit to a journal. The MTA case was taught in graduate and undergraduate AIS courses in spring, 1997, and later at several executive programs.

By 1997 I focused my research on year 2000 compliance initiatives. Ashok Rao and I conducted interviews with year 2000 project managers and team members at five companies, resulting in three teaching cases (Gogan and Rao, 1998a, b, and c).

The 1996-1997 research led to a graduate course entitled "Managing Year 2000 Compliance Projects," which was first taught in winter, 1998. Its course description stated:

> "... If not fixed, the year 2000 problem will give rise to a host of inaccuracies and systems failures wherever organizations rely upon automated systems... business interruption costs for those firms failing to comply could be catastrophic ... You may participate as a project manager (oversee all or a portion of a Y2K compliance initiative), systems analyst (identify date-sensitive

[1] By fall 1995, other institutions offering electronic commerce courses included Bowling Green, Columbia, Duke, Harvard,the universities of Illinois (Springfield), Michigan, Pittsburgh, Rochester, and Texas (Austin) and University College, Dublin.

code, plan the compliance work), or user (prepare test scenarios, conduct acceptance tests, develop contingency plans). This interdisciplinary course will examine year 2000 compliance issues from technical, human resources, organizational, and strategic perspectives. Students majoring in CIS, management, and accounting are welcome."

The course outline was as follows:

I. What is the Year 2000 Problem?
- How big is this problem?
- How did we get into this mess?
- Phases of a Year 2000 Compliance Project: Inventory, Analysis, Conversion, Testing, Migration

II. Assessing Y2K Project Risks and Readiness
- McFarlan's Risk Assessment Framework
- How important is a clear IT architecture?
- How can strong change control processes help?
- What's clean data? Why does it matter?

III. Practices and Issues
- Creating and Sustaining Year 2000 Awareness
- Tools for Analysis, Conversion, Testing, Migration
- Inventory and Analysis practices and pitfalls
- Testing Trade-offs

IV. Project Management Tools and Issues
- Hidden assumptions in project planning
- Contingency Planning
- Legal Issues and Due Diligence
- The Year 2000 Audit

V. Capstone: Team Project Presentations

Discussion

The two research and curriculum-development streams were characterized by several common elements:

- identification of a business challenge and attendant strong demand for new skills
- use of a flexible, field-based research strategy predicated on grounded theory
- choice of collaborators with complementary skills
- a certain amount of entrepreneurial initiative!

Faculty sometimes view curriculum-development as an activity which is at odds with their research agenda. Tenure-track faculty often express considerable anxiety -- along the lines of "How will I get any research done if I spend my time on curriculum?" One "solution" excludes tenure-track faculty from course development so they can concentrate on traditional theory-testing research. But this deprives the institution's students of the fresh ideas and current skills that newer faculty members can offer. Yet, an alternative approach could lead to a reduction in the new knowledge generated by an institution's faculty.

The discussion below answers these concerns by proposing a mechanism for leveraging faculty efforts in exploratory field studies, theory-testing research, and curriculum development through Interdisciplinary Research Interest Groups. The guiding philosophy is as follows: just as businesses benefit from adopting a focused product-line strategy, so might schools of management benefit from a more focused research and curriculum development strategy. The first step is to identify a small number of topics (such as year 2000 compliance and electronic commerce) at the intersection of IT and business processes. Other topics might include:

- Transformation of Financial Services
- Changing U.S. Health Care
- IT Assurance Services
- Knowledge Management

For each topical area an interdisciplinary research interest group would form, comprised of up to 10 faculty members, practitioners, and doctoral students[2] and representing a diverse mix of functional areas/academic departments, research perspectives, and seniority. Each group would meet as a seminar (both face-to-face and via collaboration technologies) to develop a shared understanding of managerial, organizational, and research challenges. Participants might receive course relief reflecting their professional development and contributions. Following an initial literature review and discussion sessions, members would develop research proposals on the topic. Members would participate in varied ways. Some would conduct theory-testing studies; others would conduct exploratory field research, including case studies. Some would contribute to multiple studies as specialists in particular research skills (e.g., interviewing or data analysis), others might more broadly participate in a single study. In the ongoing seminar, members would collaborate on relevant literature reviews, share their findings, and critique each others' work. The ongoing research interest groups would give rise to new ideas for further research, and new ways to incorporate the findings into compelling teaching materials.

[2] Interest groups may be especially useful at schools that do *not* have doctoral programs.

A mechanism to support interdisciplinary studies in focused topical areas should yield the following benefits:

- Interest group members will benefit from the collaborative effort to review the relevant practitioner and academic literature related to their topics.
- Members will benefit from a coordinated effort to secure sites, subjects, and resources.
- Having a critical mass of faculty expertise on a compelling business topic increases the likelihood that relevant new course materials are developed and that faculty will be able to put them to use.
- The cross-department relationships that develop as a result of intense intellectual engagement around topics of common interest will provide a foundation for further interdisciplinary curricular innovation.

In the last decade, many firms focused on business processes and reduced the barriers caused by "stove-pipe" organizational structures. To address the changing needs of the organizations that we serve, business schools need to develop similar organizational mechanisms that focus on business processes. Interdisciplinary research interest groups may require new or redirected resources and reconsideration of existing policies and practices. Challenges which need to be addressed include:

- The definition of "scholarship" may need to be revisited. Many faculty believe that research is not "scholarly" unless it is deterministic, quantifiable, and theory-driven. Research that is action-based, interpretive, and inductive is seen as less worthy of respect, despite ample support in the literature (Orlikowski and Baroudi, 1992). A successful interest group will generate a portfolio of studies representing varied approaches to scholarship in a topical area, yielding a more complete and relevant picture of the phenomenon under study and quicker development of course materials. Collaboration may even improve scholars' respect for one another!
- Mechanisms for funding faculty development, research, and curriculum may need to be revised to reinforce interdisciplinary work and reduce artificial barriers between "research" and "curriculum."
- Traditional means of evaluating and approving curricular changes may prove too conservative and time-consuming. In order to rapidly capitalize on insights and materials generated in interdisciplinary research groups, flexible mechanisms are required.

Conclusion

We work in a global business environment that is more turbulent, information-intensive, and complex than ever. Successful firms have found that old organizational structures and business practices cannot keep pace with these changes. Nor can business schools' old structures and practices keep pace. In order to offer content and experiences that will engage students' interest and prepare them for today's turbulent environment, MIS, AIS and management professors are working harder than ever on course development. At the same time, they are trying in vain to keep up with a growing body of research literature and to conduct traditional studies that may have little relevance to what they teach. Many feel caught in a vicious cycle of increased expectations and information overload. A fast, "virtuous cycle" process of coordinated research and curriculum development, combined with the proposed institutional mechanism of interdisciplinary research interest groups, may offer some hope of working smarter, and with results that our students will appreciate.

References[3]

AICPA Press Release, 12/10/97). See also http://www.aicpa.org/news/p121097a.htm

Allen, B. Year 2000: Its impact on the healthcare industry. *IS Audit and Control Journal* I: 11-13, 1998.

Applegate, L & J.L. Gogan, Paving the information superhighway: introduction to the Internet. HBS Publishing 195-202, 1995.

Applegate, L. & J.L. Gogan, Electronic commerce: trends and opportunities. HBS Publishing 196-006, 1995.

Applegate, L.M., F.W. McFarlan, & J.L. McKenney, *Corporate Information Systems Management: Text and Cases*. Irwin, 1996.

Bradley, S.P. and R.L. Nolan, *Sense & Respond: Capturing Value in the Network Era*. HBS Press, 1998.

Davenport, T., D.W. De Long & M. C. Beers. Successful knowledge management projects. *Sloan Management Review* 30(2): 43-58, Winter 1998.

Davis, S. & J. Botkin. The coming of the knowledge-based business. *Harvard Business Review* 72: 165-170, September/October, 1997.

[3] "HBS" = Harvard Business School; abbreviated to fit.

Eisenhardt, K.M. Building theories from case study research. *Academy of Management Review* 14(4): 532-550, 1989.

Fedorowicz, J. & J.L. Gogan. Rise of the Intranet: organizational adaptation to a disruptive emerging technology in public accounting firms. *Review of Accounting Information Systems* 1(2):33-42, 1997 (a).

Fedorowicz, J. & J.L. Gogan. A logical solution to the year 2000 problem? *Proceedings of the Association for Information Systems Americas Conference,* 1997 (b).

Freeman, L.G. & C.L Meador. Year 2000: the domino effect. *Datamation,* January 1997: 41-45.

Gelinas, U.J. & J.L. Gogan. The FSTC electronic check project. Case no. 96-10, *American Institute of Certified Public Accountants Academic and Career Development Division Case Development Program,* January 1997.

Gogan, J.L. The Web's impact on marketing and sales: historical perspective and early observations. *Int'l Journal of Electronic Commerce* 1(2): 89-108, Winter 1996/1997.

Gogan, J.L. Channel turbulence ahead: will the Web cause massive disintermediation? *Proceedings of the Northeast Decision Sciences Institute,* April 1997.

Gogan, J.L. The World Wide Web as a disruptive technology. *Proceedings of the Association for Information Systems Americas Conference,* August, 1996.

Gogan, J.L. & L.M. Applegate. Open Market, Inc. HBS Publishing 195-205, 1995.

Gogan, J.L. & L.M. Applegate. Open Market, Inc.: Managing in a Turbulent Environment HBS Publishing 96-097, 1996.

Gogan, J.L. & L.M. Applegate. Internet Securities, Inc. HBS Publishing 397-052, 1997.

Gogan, J.L. & J. Fedorowicz. Metropolitan Transportation Authority: on track with the year 2000 problem? Forthcoming in Elam, Joyce (ed.), *Management Information Systems Cases.* Prentice-Hall, 1998.

Gogan, J.L. & P.J. Guinan, Fletcher-Allen Health Care: The Telemedicine Initiative. Babson College, 1998.

Gogan, J.L. & A. Rao. Rock Solid Insurance Company of Kansas: Auditing Year 2000 Compliance Projects (A). December, 1997a. Under review.

Gogan, J.L. & A. Rao. Rock Solid Insurance Company (B). December, 1997b. Under review.

Gogan, J.L. & A. Rao. BigCo: Managing a "Program of Programs" December, 1997c. Under review.

Hall, J.W. The revolution in electronic technology and the modern university: the convergence of means. *Educom Review* 30(4), July/August 1995.

Hedlund, G. A model of knowledge management and the N-form corporation. *Strategic Management Journal* 15: 73-90, 1996.

Information Systems Audit and Control Foundation, CobiT. Year 2000 Audit Guideline. Year 2000 Compliance. http://www.isaca.org/yr2000ag.html

Jenkins, H.W. Turns out the year 2000 problem is just beginning. *Wall Street Journal,* May 6, 1997: A23

Noam, E.M. Will books become the dumb medium? *Educom Review* 33(2): March/April, 1998.

Orlikowski, W.J. & J.J. Baroudi. Studying IT in organizations: research approaches and assumptions. *Information Systems Research* 2(1): 1-28, 1991.

Rayport, J.E. & Sviokla, J.J. Managing in the marketspace. *Harvard Business Review* 72, 6 November-December, 1994), 141-150.

Strauss, A. & J. Corbin. *Basics of Qualitative Research.* Sage, 1990.

Twigg, C.A. A chicken-egg dilemma. Educom Review 30(3): May/June 1995.

Ulrich, W.M. Year 2000 third-party packages just as prone to problems. *Application Development Trends,* March 1997: 22-25

Violino, R. Year 2000 getting down to the wire. *Information Week,* February 10, 1997: 14-15

Yin, R.K. *Case Study Research: Design and Methods.* Sage, 1988.

Author, Presenter, and Panelist Index

Joe Adams....56
Steve Allen....282
Chrys de Almeida....4
Beverly E. Amer....109
Glenda Anderson....5
John M. Anderson....225
Kregg Aytes....134
Catherine M. Beise....245
Neelima Bhatnagar....271
Christiana Birchak....287
Gerald F. Braun....240
Nora Braun....8
Nathan A. Buchheit....56
William I. Bullers, Jr.....211
Lisa J. Burnell....213
Netiva Caftori....180
Judy Caouette....128
Don Caputo....75
Carol Young Carver....136
Elia Chepaitis....175
Ronald W. Chorba....252
Carol Chrisman....69, 97
William B. Cone....109
Elaine Crable....240
Roy J. Daigle....148
Gordon Davis....138
Michael V. Doran....148
U. Rex Dumdum....28
Doris G. Duncan....42
Irv Englander....34, 161
Daniel Farkas....3
Tom Farrell....199
John Campbell Finnegan....257
Ann Gates....75
Suzanne E. Gladfelter....75
Janis L. Gogan....295
Chad Grabow....79
Jeffrey A. Griffin....257
Jian Guan....103
Dale D. Gust....142
Jimmie Haines....15, 141
Forest Harlow....9
Albert L. Harris....10, 267
Carolyn R. Harris....48
Jacqueline M. Harris....267
Martha M. Harvey....48
Susan Helms....61
Dennis Hostetler....291
Magid Igbaria....75
Thomas Janicki....1, 250
Brian D. Janz....183
Dennis Jones....5
Janet Kemp....75
Merle King....245
Marcy Kittner....234
Ronald J. Kizior....51
Gwynne Larsen....61
Paul M. Leidig....112
Doris K. Lidtke....141, 232
Susan Lisack....219
Alden C. Lorents....91
Cynthia Martyn....230
Kathryn O. McCubbin....282
Richard W. McCullum....153
Denise R. McGinnis....79
B. Dawn Medlin....10
Mayur Mehta....6, 261
Jeanine Meyer....75, 182
Mike Michalski....139
George Morgan....6, 261
James N. Morgan....91
Michael G. Morris....85
Michael C. Mulder....141
Narayan Murthy....13
Martha E. Myers....245
Gregory Neal....91
James E. Novitzki....116
Patrick A. Okonkwo....142
Jo Ann Oravec....16
Sanjeev Phukan....169
Kris D. Powers....140
Herbert Rebhun....287
John H. Reynolds....153, 230
Thomas P. Schamback....69
William T. Schiano....34, 161
Donald A. Schmidt....85
Kathy Schwalbe....8
Sally K. Scott....97
Peter Shackleton....22
Dan Shoemaker....276
Todd L. Smith....56
Pam Specht....75
S. Srinivasan....103
Geoffrey Steinberg....1, 250
Blair Stephenson....78
Wayne C. Summers....12, 208
Mary Sumner....40, 291
William J. Tastle....28
Linda Taylor....233
Ward Testerman....201
Nancy S. Thomson....122
Kenneth Trimmer....234
Gregory Ulferts....276
Craig A. Van Lengen....109
Craig Van Slyke....234
Stuart A. Varden....13, 75, 182
Sharon Vest....75
Gerald E. Wagner....42
Steven Walczak....155
E. Ray Walden, Jr.....153
Liang Chee Wee....204
Garry White....167
Diane L. Willey....245
Marcia Williams....63
Charles R. Woratschek....193
Andrew L. Wright....103
Steven M. Zeltman....188