Introducing Information Technology Students to a New Major: The Role of an Introductory Course Sequence

William Owen
owen@cis.usouthal.edu

Jeffrey P. Landry
landry@cis.usouthal.edu

Dawn McKinney
mckinney@cis.usouthal.edu

University of South Alabama
School of Computer and Information Sciences

ABSTRACT

Information Technology is defined as a philosophy of applying complex tools to complex information management problems using a tool-oriented, problem-solving methodology. The primary themes of one medium-sized, southern, state university's four-year degree program in information technology include the use of high-level computing tools for solving problems, the importance of technology evaluation skills, the goal of increasing productivity, the need for two voices of communication, and an emphasis on rapid, life-long learning. A two-course introductory sequence in information technology offered at the authors' university's computing school utilizes innovative teaching assignments in a two-course introductory sequence to acquaint its students in the fundamentals of this new major.

Keywords: curriculum, information technology, introductory course description

1. INTRODUCTION

This paper describes the critical role of the introductory courses within a new *Information Technology* (IT) major degree program. The IT major is designed around the philosophy of using tool-oriented problem solving to tackle complex information management problems. The role of introductory courses for a major is critical when that major is itself new to a department or school, and even more critical when the major is closely related to existing, well-established majors. The introductory courses should serve to define and differentiate the new major from the existing majors by introducing and reinforcing primary themes that are the foundation of the curriculum. This paper outlines the primary themes presented in a two-course introductory sequence in IT at the authors' university.

The remainder of this paper defines the audience of students to be served by the introductory sequence, provides an overview of the philosophy of IT as a field, defines the primary themes of the IT introductory sequence, and describes how these themes are reinforced through innovative instruction.

2. INTRODUCING IT TO DIFFERENT STUDENT POPULATIONS

The introductory courses serve a role for introducing IT to three different categories of students: transfer students, new students, and interdisciplinary studies majors. This new major was introduced two years ago along side well-established programs in computer science and information science. As such, a large segment of the early majors were transferring from either computer science or information science. For students transferring from computer science or information science, the goal was to distinguish the themes of IT from themes encountered in CS or IS, fields that are closely related to IT. It was thought to be essential that the transfer students begin to understand and adopt the new philosophies of the major from the beginning. Meanwhile, students entering the major for the first time would find that the two introductory courses are an appropriate introduction to the IT major. These courses serve as the only exposure to IT received by adult interdisciplinary studies students.

3. PHILOSOPHY OF INFORMATION TECHNOLOGY

Several philosophical threads that define the IT philosophy of using high-level computing tools in a rapid problem-solving paradigm are introduced in these two introductory courses (see Table 1). These threads serve to distinguish IT from the more traditional disciplines of computer science (CS) and information science (IS). The IT major is one of a growing number of such programs that have begun to emerge (Countermine and Pfeiffer 2000; Rochester 2000; Spooner 2000) as counterparts to traditional CS and IS programs. The primary threads covered in the introductory sequence are listed below in Table 1 and are described in the paragraphs that follow.

Use of High-level Computing Tools: Over the last few years the tools available to solve problems have increased in number, capability, and quality. Increasingly, IT applications require less original code development and can be developed by assembling pre-fabricated components. For example, web development tools have progressed from text-only HTML editors to systems like Macromedia's Dreamweaver and Microsoft's Front Page. These tools have increased the diversity of problems that can be solved with measurably less effort. Additionally, the ability of the tools to communicate and exchange information with each other has increased the scope of the problems that can be solved and has emphasized the importance of integration skills for the IT worker.

Table 1 - Key Themes of an IT Introductory Sequence

IT Theme	Description
Use of high-level computing tools	The adoption, utilization, and integration of a wide range of high-level, information technology tools for rapid problem-solving
Technology evaluation	The ability to evaluate new information technology with respect to its capabilities and limitations within various problem domains
Increasing productivity	In terms of improving effectiveness and efficiency, the fundamental goal to be achieved by the information technologist's solutions, as emphasized in the introductory sequence
Two voices of communication	A communications emphasis on speaking and writing about IT problems and solutions in the dual languages of the peer information technologist and the client
Rapid, life-long learning	A requisite skill for the information technologist, due to the rapid technological change unique to the IT field, which requires the early adoption and infusion of new technology

One of the vital roles of the introductory IT sequence is to introduce its problem-solving methodology. Upon entering the first introductory course, the student has received prior experience using a bottom-up, object-oriented problem-solving and programming methodology (in CS1 and/or CS2 courses). Although object-oriented programming is an important problem-solving approach for the information technologist, the overriding emphasis of IT is the idea of using high-level tools to solve problems rather than creating a totally new application from scratch. The object-oriented emphasis in IT is not so much on building new code objects, but more on using and integrating a variety of pre-built objects.

The integrative aspect of problem solving, which is becoming increasingly important in industry, is a fundamental thread within the IT program. Here, the term *integration* is used in the context of problem solving, and refers to the process of creatively producing an IT solution by connecting together various hardware, software, telecommunications, and database components. This principle is evident today in Web development, as many web-based solutions involve the integration of Web page technology, database technology, various scripting languages, and networking concepts. A recent survey of IT employers (Dash 2000) concluded that Web development and networking skills continued to be the most sought-after technical skills for IT jobs. In the same survey, employers identified integration abilities as one of the most demanded skills.

A simple example of teaching integration, used in the first introductory course, involves producing individualized letters by combining information in a database and word processor (see exercise 6). Integration techniques may range from simply using the output from one tool as input into a second tool to the more sophisticated use of object linking and embedding (OLE) technology. In any case, using tools in creative, integrated ways drives the problem solution.

Technology Evaluation: An information technologist must develop the skills and strategies to evaluate new technologies, seeking to understand the inherent capabilities and limitations of the technology and the types of problems the technology can solve. This central theme is first discussed in the entry course sequence. By the end of the curriculum, each student will have developed a strategy for monitoring and evaluating new technologies.

Because they will undoubtedly encounter many new tools throughout their careers, information technologists must develop a strategy of learning and evaluating the capability of new technology. Although there is a temptation to over-teach the specifics of a tool by using a feature-based, tutorial approach, this teaching method is usually not available outside the educational environment. In our introductory sequence, students are shown the basic functionality of the tool and then encouraged to explore new features.

The introductory sequence focuses upon two sets of tools: integrated office productivity tools in the first course and graphics and multimedia tools in the second. Introducing a new tool begins with a statement of basic functionality, such as a description of numeric processing for a spreadsheet or data management for a database tool. A problem is defined and the students

are encouraged to begin exploring the tool by first understanding basic operational features and then directing learning towards solving the given problem. This approach is possible because many applications provide extensive help systems, wizards, and tutorials to facilitate user learning. Students are encouraged, from the beginning, to seek tools to solve specific problems. The course instructor serves as a facilitator and mentor for the classroom hands-on exercises.

Increasing Productivity: A primary mission of IT is to increase productivity. The impacts of IT on individuals, organizations, industries and society are far-reaching. This concept is simplified in the introductory courses and is presented on two levels: (1) increasing productivity in organizations by employing IT, and (2) increasing personal productivity by using appropriate IT tools (Davis and Naumann 1997).

Two-Voice Communication: While the importance of oral, written, interpersonal, and team communication has been emphasized in computing fields in general, the IT program emphasizes the concept of two-voice communication. With one voice every student should be able to communicate with IT professionals using precise language and terminology. Perhaps more important is the second voice. The information technologist must be able to communicate effectively with the non-technical audience comprised of key stakeholders, such as clients, users, and managers. An emphasis is placed on demystifying technology and avoiding "geek-speak."

Life-long Learning: The field of IT is characterized by rapid change, particularly with respect to the proliferation of new tools and tool paradigms. The information technologist must be able to rapidly change tool paradigms frequently over the course of his or her career. The philosophy of IT is to produce information technologists who are able to rapidly adopt and infuse new information technology and apply it creatively to problems. Technology evaluation is itself a meta-skill required for life-long learning (Westfall 2000).

4. INNOVATIVE IT TEACHING EXERCISES

In order to reinforce the philosophy and methodology of the information technologist at the authors' school, several teaching exercises were devised for use in the introductory course sequence. The exercises are used in conjunction with traditional instruction, such as lecture and coverage of IT textbook material (Davis and Naumann 1997; Senn 1998). A summary of each of these exercises is given below. Most of these exercises may be implemented variously as individual or group homework assignments, projects, exam or quiz questions, in-class exercises, or teacher-facilitated discussions.

In order to enforce the theme, *use of high-level computing tools*, the students receive an overview of a

broad array of tool paradigms, including the following: object-oriented programming, visual and event-driven programming, graphical user interface design, CASE tools, office suite tools, databases, networking technology, Web-based tools, and multimedia technology. The object linking and embedding concept is taught and emphasized as a means of creating powerful solutions. One of the exercises developed for the introductory sequence challenges the student to discover and apply a seldom-used integration feature to create a more powerful solution while avoiding the temptation to use a more time-consuming manual approach (see exercise 6).

The *technology evaluation* theme is emphasized in nearly all of the exercises. Often, student exercises that emphasize this theme also emphasize the theme, use of high-level tools, because using and exploring high-level tools go hand-in-hand. In the first course, the instructor-led technology evaluations are performed in class using topics selected from sources such as *ACM Tech News*, *USA Today Tech Report*, *Computerworld*, or *InfoWorld*. In the second course, students begin the transition to developing their own searching and evaluation strategies by completing simple evaluation assignments.

The *increasing productivity* theme is emphasized by the conceptual overview of productivity and how IT is used to increase productivity, particularly that of increasing the productivity of individual knowledge workers (Davis and Naumann 1997). Even though IT is known to impact organizations in a variety of ways, a simpler view, focusing mostly on the impact of IT on individual knowledge worker productivity, is presented in the introductory sequence. For example, the students are taught a systems development life cycle for a single-user system (Senn 1997), and asked to compare that to a more traditional systems development life cycle. Class discussion/lecture, reading assignments, and homework are all used to develop the goal of increased productivity. Students are exposed to suites of tools (Microsoft Office) and other IT tools, such as PIMs and e-mail, that are designed to increase productivity.

With respect to the *two voices of communication*, students are asked to speak and write to both technical and non-technical audiences. On quizzes and tests, the students are required to describe a problem and a solution differently depending on whether they were talking to a client or a peer. This thread can easily be added to any assignment.

With respect to *life-long learning*, students are taught to explore the features of the tools to solve the problems. Sometimes, they are intentionally not taught the feature they will need. The students are encouraged to develop strategies of searching for and evaluating specific information needed when seeking a solution.

The following lists some of the exercises developed for the introductory IT sequence. Each exercise covers one or more of the threads of IT and is followed by a list

of codes in parentheses representing covered threads. The abbreviated codes are as follows:

HT - Use of high-level computing tools
TE - Technology evaluation
IP - Increasing productivity
VC - Two voices of communication
RL - Rapid, life-long learning

1) For a period of one week, evaluate the efficiency and effectiveness of the information technology you are currently using. Prepare a report outlining (a) the problems (tasks) you solved, (b) the information technology used, (c) the benefits (or not) derived, and (d) personal conclusions about your experience. (HT, TE, IP)

2) Learn and use at least one new feature of a tool, such as a word processor, to complete a given knowledge work task, and report how that feature did or did not increase the efficiency or effectiveness of the task. (IP, TE, RL)

3) (a) Explain a series of technical terms, such as *bandwidth*, *compression*, and *protocol*, in layman's language. You are encouraged to use examples in order to make the concepts easier to understand. (b) Discuss the benefits of having this type of communication skill in later professional life. (VC)

4) Write up a plan for developing a single-user system suited for given scenarios involving graphics applications, such as presentation graphics, desktop publishing, and bitmapped imaging. (HT, TE, IP)

5) Write a macro in your word processor that increases your productivity. Describe the steps that are performed by the macro and how your productivity has increased. (HT, IP)

6) Design and develop an automated customer response system for a retailer/distributor by (a) developing a database containing vendor and product information, (b) using a word processor to design a form letter for responding to customer requests for product information, (c) developing database queries to search for requested products,

7) and (d) discovering how to integrate the separate database and word processing solutions to create a response letter for a product request. (HT, TE)

8) Develop a slide presentation using PowerPoint, reporting on a recent new development in technology. The presentation must include the following elements: text, graphics—both clip art and custom graphics that you created—and an edited sound. Your presentation must be designed to clearly communicate to an audience of business clients. (HT, TE, VC)

9) Based on the following list of problems (i.e. setting up a budget, creating a newsletter, and scheduling appointments), (a) search for classes of tools that would be used to solve each problem, (b) for each tool discovered, list the tool's category, name, vendor, and cost, and your conclusions about the tool's suitability. (TE, IP)

10) Based on the definition of information technology as "a means of transforming inputs (data) into outputs (information)," use the input-process-output model to describe a given tool. Discuss, in laymen's terms and in technical terms, the prior state-of-the art with respect to problem solving, and how this new technology represents an advanced solution, providing some benefit to a user/client. (TE, RL, VC)

11) Search trade magazines, newspapers, and the Internet for published articles (not advertisements) about some new information technology. Turn in a copy of the article, along with a your analysis of the tool's capabilities and limitations, and its impact on productivity. (TE, RL, IP)

6. CONCLUSION

In order to differentiate the IT major from its computer science and information science counterparts, a two-course introductory sequence was carefully designed and implemented at the authors' university. Key threads defining the IT philosophy were emphasized and reinforced through a series of instructional techniques and exercises. As the students move through the curriculum, these threads are treated in greater depth. We believe the introductory sequence serves the purpose of preparing students to become successful information technologists.

7. REFERENCES

Countermine, Terry, and Pfeiffer, Phil, 2000, "Implementing an IT Concentration in a CS Department: Content, Rationale, and Initial Impact," *The Proceedings of the Thirty-first SIGCSE Technical Symposium on Computer Science Education* (March 8-12), pp. 275-279.

Dash, Julekha, 2000, "Web Development Tops Skills in Demand," *ComputerWorld* (34:19), May 8, p. 4.

Davis, Gordon B., and Naumann, J. David, 1997, *Personal Productivity with Information Technology*, McGraw-Hill Companies, Inc., New York.

Rochester Institute of Technology (R.I.T.): Information Technology, URL: http://www.it.rit.edu, Accessed: May 17, 2000.

Senn, James A., 1998, *Information Technology and Business: Principles, Practices, and Opportunities*, Prentice-Hall, Inc., New Jersey.

Spooner, David L., 2000, "A Bachelor of Science in Information Technology: An Interdisciplinary Approach," *The Proceedings of the Thirty-first SIGCSE Technical Symposium on Computer Science Education* (March 8-12), pp. 285-289.

Westfall, Ralph A., 1999, "Meta-Skills in Information Systems Education," *Journal of Computer Information Systems* (40:2), pp. 69-74.