The Campus as Learning Laboratory for Systems Analysis and Design

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Abstract

This essay makes the case for using the campus as a teaching/learning laboratory for the Systems Analysis & Design course. The nature of the field of *Computer Information Systems* is discussed, and the role of the *Systems Analysis and Design* course is introduced. Resources to support the teaching of the course are noted and the limitations of existing resources are discussed. It is suggested that moving beyond the typical resources to provide for an effective student learning experience should be done in a manner consistent with what we know about good practice in undergraduate education vis-à-vis student learning. The *Seven Principles for Good Practice in Undergraduate Education* are introduced as guidelines for developing an effective learning environment. Techniques for using the campus as a teaching laboratory are discussed, and it is demonstrated that the use of such a method is consistent with research on effective student learning. In conclusion, this paper suggests that by using such an approach students are provided the opportunity to *do* analysis and design and effective student learning occurs.

Keywords: Systems Analysis & Design, Pedagogical Limitations, Effective Learning, Learning Laboratory

1. ON THE NATURE OF COMPUTER INFORMATION SYSTEMS

Computer Information Systems is undeniably a technical field, but simultaneously it is a field in which the use of the technology must be tempered by an understanding of the how humans interact with and are affected by the technology. Too often both teachers and learners get lost in the technology, forgetting the reason for it's deployment.

In explaining our field to the uninitiated it useful to begin with a definition of the term *Computer Information System*. In defining any new term it is most productive to evolve the definition from an understanding of what the student already knows. As such, we might start with "unfolding" the term; i.e., start with the noun *system*, add the adjective *information* to the noun to form the noun phrase *information system*, and then add the adjective *computer* to the noun phrase to form the term *computer information system.*

We start by appealing to what our students already know about the term *system*, by having them tell us of systems with which they are already familiar. Students frequently mention such systems as digestive system, solar system, immune system, and the like. We ask our students what these systems have in common; i.e., what does it mean to be in the class of things we intuitively know as systems? In short order students conclude that minimally all systems are composed of groups of interactive components that are goal directed.

Next, we have our students add the adjective *information* to the term *system*. We note that adding an adjective to a class of nouns limits the definition; i.e., it makes the class smaller. Thus, all information systems are systems, but not all systems are information systems. After much discussion, we guide our students toward the conclusion that information systems are systems in which the goal of the system is to process information. Reflecting on the type of processing that can be done to information, we quickly derive the processes of input, store, output, manipulate/calculate, update, etc. We also note that at this point in our definitional evolution there is nothing in the definition of information system that necessitates the use of a computer.

Finally, we append the adjective *computer* to the noun phrase *information system* and rapidly conclude that a

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computer information system is an information system in which one of the components is a computer. The time is ripe for discussing why we bother to use a computer. Terms such as *speed, accuracy,* and *cost* quickly enter the foray, and the discussion rapidly shifts to doing the processes more *efficiently* and *effectively* with a computer that without a computer.

Lest our students/learners rapidly become too enamored with the technology, Kroenke's (1984) classic Five-Component Model is introduced to reinforce the idea that all Computer Information Systems have both a technical and human side. The model is an extremely useful tool to introduce different classifications of hardware and software, define data as the means of humans interacting with machinery, distinguish between data and information, and classify the human component into the subcategories of clients, users, operations personnel, and developers. This brief introduction to the field is concluded with the introduction of the idea that the purpose of every information system is to provide *value* to the organization/user by enabling the users of the information system to better serve the client population of the system.

2. THE SYSTEMS ANALYSIS AND DESIGN COURSE

Most *Systems Analysis & Design* courses begin with the view of a system as a group of interrelated, goal-directed procedures. Systems are candidates for study and improvement when a *systems problem* arises; that is, when someone who interacts with or uses the system perceives a difference between the way things are (what *is* happening) and the way things ought to be (what *should be* happening). The goal of the analysis and design process is to improve the way things are, to foster continuous quality improvement of organizational processes and consequently of organizational systems.

The analysis process is typically broken down into a series of *phases*, each of which is designed to produce a *deliverable*. In the workplace, phases are conducted by *project teams* and continuation decisions regarding a systems project are typically made at the end of each phase by some form of *steering committee*. Typically the initial phase examines the *feasibility* of doing the project in technical, economic, and organizational terms. The second phase produces a *general design* of the proposed solution focusing on *what* must be accomplished to improve the business system. The third phase produces a *detailed design* of the new system, focusing on *how* the new system is to be built to accomplish the desired changes (the *what* from the second phase). The fourth phase produces a totally functional system.

The solution to any systems problem is usually thought of to take on one of three distinct yet somewhat interrelated forms: (1) *Business Process Automation,* in which we do not substantively change the function of the system processes but seek to automate some or all of the existing processes; (2) *Business Process Improvement,* in which the goal is to improve the business processes by introducing some moderate changes which are generally incremental or evolutionary in nature; or (3) *Business Process Reengineering,* which seeks to radically redesign business processes to achieve dramatic improvements in system performance measures such as cost, quality, speed, and/or service.

The learning objectives of the Systems Analysis and Design course are as much about teaching a process for continuous improvement as they are about obtaining an end result. Though we seek to have the students produce useful deliverables, we are at least as concerned with their ability to work through a procedure involving both technical and human dimensions in a team environment in a realistic time frame. We can no more teach Analysis & Design without having our students do Analysis & Design than we can teach our students swimming without having them get in the water. We want them to actively be able to do Analysis and Design in as real an environment as possible.

3. RESOURCES FOR THE COURSE

Typical resources available to teach the *Systems Analysis & Design* course include a text augmented by a web site and/or a CD-ROM. The web site usually includes both instructor resources and student resources. Instructor resources include such items as PowerPoint slides, examination questions in a variety of formats, links to other web sites, etc. Student resources on the web typically include review questions, hypertext links to various web resources to elaborate on the course topics, and sample deliverables. The text and web site are frequently augmented by a student CD-ROM that includes some form of project management software and sample deliverables. Students have a natural tendency to focus on how to use the project management software rather than engage in the process of analysis and design, and employing such software can put the course at risk of turning into a software course unless the instructor is careful to plan otherwise. Another problem with such a course is that students are not *doing* analysis and design. In particular, viewing PowerPoint slides is a passive rather than an active learning mode, and examinations typically measure what students can memorize rather than what they can do.

Case studies are frequently introduced to augment such a course and move it from the passive to the active learning mode which attempts to have students do analysis and design. Since their introduction at Harvard Law School in the late 19th century, case studies have been used in a number of disciplines across the academic spectrum. They can range from a

highly structured exercise to a very unstructured problem that could raise a variety of complex issues and alternative solutions. Typically, case studies are written objectively and include a brief overview of the situation along with descriptive information that both establishes a context for the problem and identifies the major decisions that must be made.

While a step in the right direction, case studies in themselves are fraught with limitations. In particular, the case study environment is at best incomplete and cannot substitute for (1) the absence of real people with vested interests in the system because of their roles either as users or clients of the system, (2) the time and space continuum that a real system occupies, (3) the presence of office politics and its influence on the range of legitimate solutions, etc. To offset these people issues, instructors and/or students are encouraged to "role play" to vicariously experience situations that may be encountered in the future. But even the most effective role player is no substitute for the presence of a real person. At their very best, case studies only simulate reality.

4. TOWARD A SOUND LEARNING PEDAGOGY

In attempting to move beyond the limitations of the case study approach, it is essential to remember that the focus of education should not be about my teaching, but about my students' learning.

What do we know about how students' learn? How can we create an effective learning environment?

Many research efforts have been undertaken to understand how students learn, and many an alternative pedagogy has been proposed. Currently in vogue are emphases on teaching with technology, but how many of the new technologies have been designed consistent with the principles of effective learning? In our rush to use technology, are we at time guilty of "letting the tail wag the dog?"

One the best summary presentations of the research findings on the principles of effective learning is Chickering and Gamson's (1987) *Seven Principles for Good Practice in Undergraduate Education*, a review of 50 years of research on the way teachers teach and the way students learn. In effect, the *Seven Principles* are a distillation of five decades of knowledge into guidelines for effective practice. Each of the Principles was developed based on two distinct strands of research. One set of studies focused on the development of students, looking at both the broad outcomes of college as well as specific dimensions such as intellectual, personality, psychological, and ethical development. Most of these works were longitudinal studies applied to students across a wide array of disciplines in both professional schools and the arts and sciences. The second strand of research focused on college teaching and its effects on students. In this arena the *Principles* point to the commitment of teachers and students as central to the task of providing effective undergraduate education.

This is not a treatise on the *Seven Principles*; nevertheless, an annotated enumeration is provided as a guideline for assessment of alternative teaching/learning paradigms. *Good Practice*:

(1) Encourages Student-Faculty Contact - Frequent student-faculty contact both in and out of classes is the most important factor in student motivation and involvement;
(2) Encourages Cooperation Among Students - Learning is enhanced when it is more like a team effort than like a solo race. Good learning, like good work, is collaborative and social, not competitive and isolated;
(3) Encourages Active Learning - Learning is not a spectator sport. Students must talk about what they are learning, write about it, relate it to past experiences, and apply it to their daily lives;
(4) Gives Prompt Feedback - Students need appropriate feedback on performance to benefit from courses. In class, students need frequent opportunities to perform and receive suggestions for improvement;
(5) Emphasizes Time on Task - Time plus energy equals learning; there is no substitute for time on task. Students need help in learning effective time management skills;
(6) Communicates High Expectations - Expect more and you will get more. Expecting students to perform well becomes a self-fulfilling prophecy when teachers hold high expectations of themselves and make extra efforts;
(7) Respects Diverse Talents and Ways of Learning - Students bring many diverse talents and styles of learning to college. Students need the opportunity to show their talents and learn in ways that work for them. Then they can be pushed to learning in new ways that do not come so easily.

While each practice can stand on its own, when all are present the effects are synergistic. Together, they employ six powerful forces in education: Activity, Cooperation, Diversity, Expectations, Interaction, and Responsibility. They inherently recognize that content and pedagogy interact in complex ways; nevertheless, they hold as much meaning for professional programs as for those in the liberal arts.

5. THE CAMPUS AS EFFECTIVE LEARNING LABORATORY

Creating an effective active learning environment for Systems Analysis & Design requires that students do analysis and design, not merely participate in a series of case study exercises. If we require that students be able to relate the exercise to what goes on in their daily lives, then the only candidate for an effective

learning experience common to each and every student in the class is our college campus.

Establishing the campus as a learning laboratory requires both a significant time commitment and political acumen on the part of the course instructor. Conversations were held with department heads of various organizational units in which they were told that the course instructor viewed all of our departments and our campus as significantly contributing to our students' education. They too were thought of as educators, for education takes place beyond the boundaries of the classroom. As such, they have much to contribute to our students' education. Much to my surprise, nearly all of the departments initially approached agreed to cooperate, and over time even those reluctant to participate have joined the team.

Each of the departments agreed to appoint an initial liaison for students to approach regarding the students' respective areas of interest, and it became the responsibility of the course instructor to insure that students initially approached the liaison in the appropriate department rather than some other individual. Department representatives were allowed/encouraged to contribute to the student project teams' statement of problem definition and to help structure the scope of the systems projects such that departments might potentially receive real value from the students' systems development efforts.

In the currently classroom environment, students are initially formed into project teams. In forming the project teams attention is given to diversity and gender issues as well as to student schedules and other personal constraints. It is critical that we recognize that our students are people too, and that we honor their respective personal priorities above and beyond the requirements of the classroom. Once teams are established, they are told that their task is to identify an area/system in need of improvement on our campus. This allows the students to identify personal areas of interest in which they can actively become involved, thus leading to higher student engagement in the learning process. Simultaneously, using this approach keeps the course instructor informed of "hot" areas of student interest, promoting a greater student-faculty interaction regarding issues of concern to students. Areas which have been investigated/studied in the past three years include on-campus housing assignment, off-campus housing assistance, admissions, campus food service, bookstore ordering/inventory, advising, registration, the health center, parking for both resident and commuter students, etc.

Class activities include exposure to the phases of analysis and design, paying particular attention to activities, tasks, and deliverables within each of the phases. Significant time is devoted to both project management and group dynamic issues. We work through sample activities in class, and then the project teams apply their newly gained skills/knowledge to their assigned project. Students produce written reports at the end of each phase, and are required to present their finding to the entire class in the form of an oral presentation employing some type of presentation software. Department sponsors are invited to attend the oral presentations to add an additional dose of reality to the course, and many choose to attend.

This approach to the teaching/learning of analysis and design is consistent with the *Seven Principles* as follows:

(1) Encourages Student-Faculty Contact - Frequent student-faculty contact both in and out of classes is the most important factor in student motivation and involvement;

Students frequent faculty offices on a regular basis to seek guidance in working their way through the activities of the life cycle. Each class session generally starts with a 10-15 minute question and answer session in which students are empowered to help each other answer questions pertaining to both process and product. Students are highly motivated to complete their work because the systems are of direct interest to them.

(2) Encourages Cooperation Among Students - Learning is enhanced when it is more like a team effort than like a solo race. Good learning, like good work, is collaborative and social, not competitive and isolated;

Students work in project teams to provide solutions to real systems problems. The learn from each other and quickly discover that not only are some tasks simply too big for one individual to accomplish in a specified time frame, but that their collective efforts usually yield results far superior to the efforts of any one individual.

(3) Encourages Active Learning - Learning is not a spectator sport. Students must talk about what they are learning, write about it, relate it to past experiences, and apply it to their daily lives;

Students are actively involved in the learning process. They are constantly talking about their project, relating it to their experiences with the system, and assessing how their proposed improvements would effect the lives of students.

(4) Gives Prompt Feedback - Students need appropriate feedback on performance to benefit from courses. In class, students need frequent opportunities to perform and receive suggestions for improvement;

In class, students are given examples of various systems-related documents such as Systems Requirements Documents, Feasibility Reports, Work

Plans, Gantt Charts, Systems Planning Reports, Analysis Plans, etc. After reviewing the contents of a given document, project teams generate a sample document for their area of study. They receive feedback on their rough draft, and are assigned the document to be due in the near future. Documents are collected on the assigned due date, graded, and returned the following class period. Prompt feedback is the norm, not the exception.

(5) Emphasizes Time on Task - Time plus energy equals learning; there is no substitute for time on task. Students need help in learning effective time management skills;

Students work to strict deadlines throughout the course. Emphasis is placed on such time management skills as breaking up work loads into intermediate stage deliverables, division of work into manageable tasks that can be performed by one individual, principles of effective team meetings, etc. The instructor must model such behaviors, for students learn what we do, not necessarily what we profess to be true. It is necessary for the professor to stop making excuses for not meeting his time commitments to students and the course. When students see professors working hard and meeting commitments to both the students and the course, students quickly learn that hard work is both expected and the norm.

(6) Communicates High Expectations - Expect more and you will get more. Expecting students to perform well becomes a self-fulfilling prophecy when teachers hold high expectations of themselves and make extra efforts;

Work of inferior quality is viewed as unacceptable. This point is introduced on the first day, and the instructor, through his/her performance of role as instructor, reinforces the point on a consistent basis. Students must also be told that their hard work is of value, even if it is of somewhat questionable value at first, because they must come to believe that they are capable of producing deliverables of substantive quality. The nature of feedback is of critical importance here.

(7) Respects Diverse Talents and Ways of Learning - Students bring many diverse talents and styles of learning to college. Students need the opportunity to show their talents and learn in ways that work for them. Then they can be pushed to learning in new ways that do not come so easily.

The nature of the course provides for a wide array of assessments. In class cooperative learning opportunities, individual examinations over course material, group project team assignments, group meetings and group dynamic skills, project team peer evaluations, oral presentations, technical talents, etc. Students are given ample opportunities to display their talents in ways that work for them and to learn new ways of learning.

6. CONCLUSION

Using the campus as a learning laboratory for the Systems Analysis and Design course enables students to move beyond the educational limitations of both the traditional text-lecture-test instructional paradigm and the case method instructional paradigm. Employing this approach allows students to *do* analysis and design, experiencing both the process of the discipline while simultaneously producing substantive deliverables. Many of the student deliverables have in fact formed the basis for continuous improvement of many campus systems., thus providing a real service component to the course.

Employing the campus as a learning laboratory also provides for an instructional paradigm that is consistent with what we know to be sound research on the ways students learn most effectively. It requires a heavy planning commitment on the part of the faculty involved, but the payoff in terms of student learning has proved to be substantial.

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