Hands-On Experience for Students in Information Systems Design

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Abstract

This article describes a project in which college students in an advanced systems analysis and design class in the school of business developed an information system for another school. The students were able to obtain hands-on experience in an environment that could be controlled to ensure that educational objectives were met. The client was able to conserve development funds to enhance the project in another area.

Introduction

According to a recent article in the Denver Post, Department of Education statistics show that the number of undergraduate degrees awarded in Computer Science and Information Systems has declined for the third year in a row, as of 1989 (2). At the same time, the number of degrees awarded in business and social sciences have increased. This decline in the number of computer-related degrees awarded cannot be explained by the number of job opportunities in the discipline, which are increasing.

The major reason cited for the decline is the difficult and tedious nature of the curriculum. Chepaitis (1) states that introductory CIS (Computer Information Systems) courses are frequently rated by students as:

- unexciting
- irrelevant
- too technical
- require too much memorization
- dated
- devoid of interesting applications
- unrelated to areas of interest

In addition to concern about enrollment, the faculty of the School of Business, Department of Computer Information Systems and Management Science (CMS), at Metropolitan State College of Denver (MSCD) is generally concerned that their graduates are prepared to compete and be productive in the business place. By giving students relevant hands-on experience, both of these concerns are addressed. This usually means using a case study in the classroom, or sometimes an actual project with a local organization. This article describes a "real-world" project undertaken for another department that met the course learning objectives, saved money for the college, and provided some other benefits as well.

Background

One source of real-world business problems that students can use to apply course concepts is the real world, for example, local businesses that have a backlog of system design needs which could be farmed out to student analysts. But there are limitations to this approach. Business managers have legitimate concerns about the confidentiality and security of their data resources, control over the project, accountability, and the students' reliability, and competence. Course instructors have concerns about the match between the course requirements and the project, the course and project time frames, liability for the students' performance, and possible conflict between the college and professional consultants.

Case studies in the classroom have been frequently used to address the need for practical experience for students. In the introductory systems analysis and design course at MSCD, for example, students are organized into project teams of three to five people. Each team conducts a preliminary study, a requirements definition study, and a systems design using a case.

There has been some success with the case studies. Students become very involved in the case project. They began to pull together--often for the first time--what they have learned in other business school courses as they attempt to design a system to solve a given business problem. In addition, they have an opportunity to apply the concepts they are learning in the text and in the classroom.

The limitation of case studies is that they lack the variety, the rich learning environment, and the unexpected twists that occur in real-world design projects. The information available to the student analysts is limited to what is printed in the case, plus anything the instructors may add as the project proceeds. Case study projects do not provide students with the opportunity to interact with real managers and face real manager limitations and concerns. Nor do case study projects have as much riding on the outcome as real-world projects. Students may be less motivated because they are "pretending."

The one thing that is not an artificial experience in the case study approach is the interaction between members of the project team as they organize and work toward a common goal. In course evaluations, the students frequently mention the experience of working in a group as the most important--and most challenging--aspect of the course.

Although the case study approach gives students experience that goes beyond abstract discussions, the concern is that it still does not prepare them well enough to be quickly productive in the work place. They may lack confidence in their own ability to apply in a business what they have learned in a classroom. Students who takes courses in systems analysis and design should learn at least as much, and learn it at least as fast, as someone who learns systems analysis and design on the job.

The Opportunity

While the School of Business computer information systems faculty at MSCD was pondering these concerns, and trying to come up with ways to improve the course experience for students, they learned of a real-world project just getting under way in the School of Professional Studies at MSCD. The Department of Aerospace Science had just received funding to develop a comprehensive flight simulation laboratory that would incorporate all aspects of flight in the U.S. airspace system, plus some aspects of international and space flight. Part of the project included developing the information systems necessary for administration and control of the flight simulation laboratory. Funds had already been appropriated for this purpose. This was the opportunity for actual systems design experience, but with an in-house project.

The flight simulation laboratory--or "World Indoor Airport" (WIA)--will be the most sophisticated college integrated aviation laboratory program in America. It will involve combining flight simulators, a Flight Service Station (FSS), a Fixed Base Operator (FBO), air traffic control (ATC) simulators, avionics laboratory, interdisciplinary curriculum, a student tutorial computer center and software with teaching simulations. The simulations will challenge students to perform as effective members of a major air carrier air crew, an aerospace design team, a middle management project team, or a small business enterprise. Figure 1 is a schematic that shows how the four major components--flight simulators, FSS, FBO, and ATC--will be linked together via a computer network to provide an integrated airspace system environment for students. These components will exchange data and interact with each other in the simulation laboratory in the same ways that they do in the U.S. airspace system.

The flight simulator laboratory will include 11 personal computers, 10 single-engine flight simulators, three twin-engine flight simulators, and two turboprop/jet flight simulators. All flight simulators are programmable for both flight and performance characteristics, and geographic position for navigation. The twin-engine and turboprop/jet simulators will be installed on three-axis motion platforms. All flight simulators will interface with five ATC radar simulator stations.

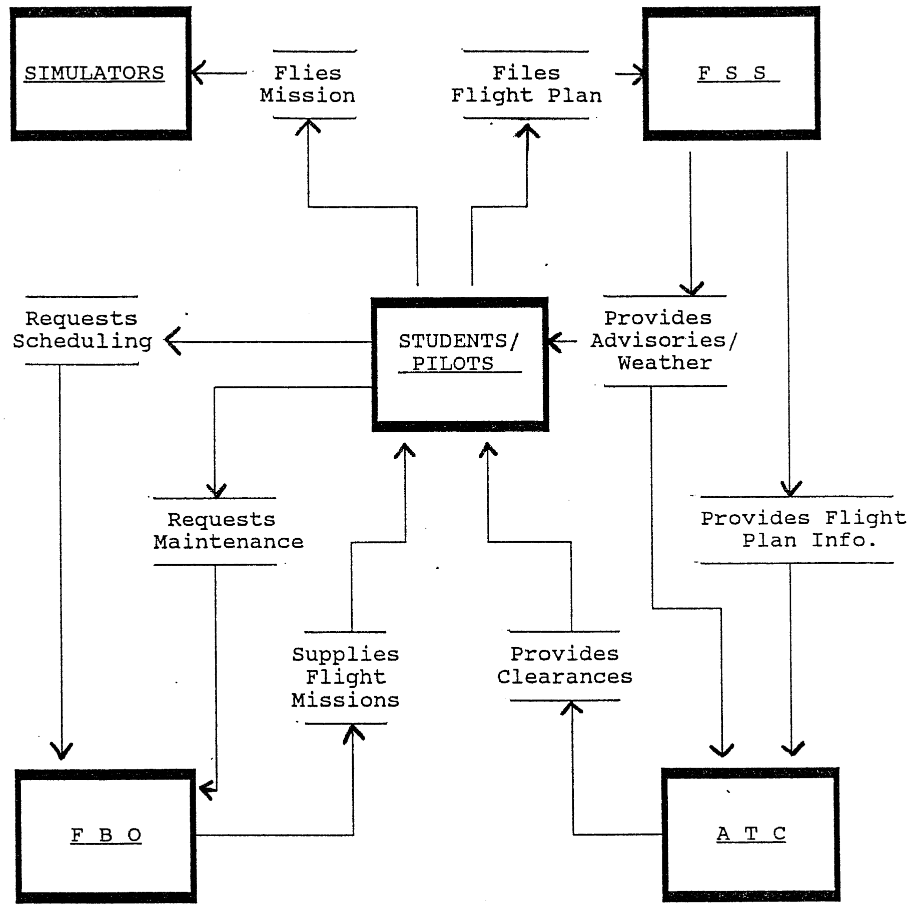
The software interfacing is considered the most complex and challenging component. It will require several iterations to successfully complete the design. Because of the tremendous capital outlay and design integration, the WIA project was designed to be implemented in several phases.

The need for an information system to administer and control the simulator laboratory provided an opportunity for information systems students to gain practical experience while minimizing the limitations associated with going to local businesses. The information system required will include:

- communications between the instructors and students regarding classroom and laboratory assignments,
- scheduling of laboratory sessions and equipment,
- communications between some of the components of the laboratory (e.g., the filing of flight plans between the FBO and ATC components), and
- tracking student attendance and performance during laboratory sessions.

An agreement was reached between the Aerospace Department and the CMS Department regarding the use of student analysts to design the information system. The essence of this agreement was to establish what the student analysts would be expected to accomplish, and what was expected from the CMS instructors and Aerospace Department project managers.

Figure 1
Major Components of the World Indoor Airport



How the Course Was Organized

An existing CMS course, Advanced Systems Analysis and Design, was used as the vehicle for the information system project. Thirty students registered for the course. It was impossible to assign this many student analysts to one project, so the class was divided into five teams of five to seven students. There were three independent design teams that worked in competition with each other. The design teams were responsible for the basic information system design, from the preliminary study through the final design. In addition to the three design teams, there were two special function teams that acted as internal consultants to the design teams. One special function team developed expertise in the use of a CASE tool software package called Excelerator, by Intersolv. The other special function team developed expertise in the use of a prototyping software package. The special function teams were responsible for diffusing their expertise to the design teams and then supporting the design teams in the use of the CASE and prototyping software during the project.

Within the design and special teams, students were free to organize the work any way they wanted to. The only requirement was that all students had to make a significant contribution to their team's effort. To encourage students to do this, each student evaluated the contribution of every person in his or her group at the end of the course using a peer evaluation form. The peer evaluations were a factor in determining final grades.

The course was divided into three phases: a preliminary study, a requirements definition report, and the final design. At the end of each phase, a report was submitted by each design team. This report was evaluated by the course instructors and by the client, the project manager from the Aerospace Department. Any misconceptions or errors were noted and corrected before moving to the next phase. Thus each design team had a starting point for the next phase that was acceptable to both the instructors and the client. The designs were different from team to team. For example, discussions with the three design teams revealed that they had different concepts of what the project was to accomplish after preliminary interviews with the client.

No team was allowed to continue with a flawed concept or an inadequate foundation from a previous phase.

There were no exams in the course. Final grades were based on the instructors' evaluations of the reports submitted at the end of each phase, the client's degree of satisfaction with the final designs, and an adjustment for each individual based on the peer evaluations.

Thus not all students had exactly the same course assignments, as would normally be the case in a course. However, all students were exposed to all phases of the design effort, whether they worked directly on a design team or provided specialized support for a design team. Since this was an advanced information design course, as opposed to an introductory design course, this was acceptable. All students had been exposed to the fundamentals of systems analysis and design in previous courses. This advanced course provided all students with practical experience in the design of an information system, including specialized assignments and the need to organize within and between groups to accomplish goals.

The Results

The three final designs were presented to the client at the end of the semester. One of the designs was judged to be good and two as outstanding by both the instructors and the client. The client found particular features in each of the designs that he wants incorporated into one design that will be implemented in the next phase of the project. (Figure 1, the World Indoor Airport schematic, came from one of the student final design reports.)

The instructors felt that the educational experience provided was far richer than would have been possible with a case study. For one thing, the project was real. Nobody was pretending or simulating. The students knew that at least some portion of their design would be adopted. Also, they were dealing with a real project manager who was learning what his needs were as the project proceeded. In contrast to a case study, students had a client to address any question they had, subject to the client's availability. They were not limited to the information provided at the beginning of the project.

The experiences provided to the students were valuable. For example, one of the design teams complained "The client told us he wanted one thing, but after we completed the requirements report he changed his mind and wanted something different!" The instructors were thrilled. Experienced analysts know that this happens often and accommodate it in their approach to pinning down the client's requirements. This student design team just obtained that experience.

Conclusions and Recommendations

Students, the client, and the course instructors are all pleased with the results of the first semester experience with this project. Students were pleased because they received valuable experience. None of the common complaints mentioned in the introduction to this article were received for this course. Everything students were required to do was required by the nature of the task.

The client was pleased to receive three good designs to meet his information needs and no monetary outlay was required. The money that had been allocated for this purpose is now available to enhance some other part of the simulation laboratory project.

The course instructors were pleased that all of the academic objectives of the course were met, that the students were excited and well motivated, and that the students gained confidence in their own ability to complete an actual information system design project. An in-house project such as this offers the additional advantage that the client will be more sensitive to the academic requirements of the course than would usually be the case in a business setting. Also, the instructors have more control over the quality of the product due to having closer ties with the client.

The competition between design teams to have the best design contributed to the students' motivation. Such duplication of effort would not be permitted in most business settings, even if done by students. Having multiple design teams allowed the client to select from several good designs.

This approach--using student analysts--does have some unique costs. Perhaps the most significant is the loss of continuity from one semester to the next. After the first semester (or quarter), the designers are all gone. After the second semester, the developers are all gone. After the third semester the implementors are all gone. There is a completely new project team every semester. If the projects are small enough to be completed within the time frame of one course, this is not a problem. With larger projects, tasks must be defined so as to be completed within the semester, and a procedure devised that will allow work in a subsequent semester to begin where the previous semester left off.

In the WIA project, the initial system design will stand alone. The continuity between the design effort and the development effort will be ensured by the instructors and the client. Since the development effort will extend over several semesters, the system will be developed and implemented in stand-alone phases. This is a common approach used in businesses with large projects. This means that the course is not the same from semester to semester. It remains to be seen how satisfactory this will be for the WIA project. Although continuity from phase to phase will be provided by the instructors and the client, it remains a weakness and a concern of this approach in general.

Another cost, or concern, is the need to establish at the beginning a very clear understanding of what will and what will not be done. Clients have at least a general understanding of what the finished system will be and are very likely to assume that their concept of the finished system is what the students will be doing. That may go well beyond the educational objectives of the course. In the WIA project, considerable emphasis was put on responsibilities and limitations in a formal memorandum of understanding. Such a formal agreement is not just recommended, it is absolutely essential to ensure against later misunderstandings over the scope of each department's participation.

It is also important to recognize that the priorities of the different departments involved will not always be the same, particularly after the initial stages of the project. To the client, completion of his project will always be a high priority. To the instructors of the information system courses, meeting the current curriculum objectives will always be a high priority. To the students, finishing the current semester's work and going on to next semester's courses or to graduation will always be a high priority. If a class is cancelled one semester due to lack of enrollment, or the course objectives change, the client's project--and his budget--could suffer considerably.

The authors believe there are many opportunities to design information systems in colleges and universities. These opportunities are often not recognized because the faculty in one school or department is unaware of the projects being planned in another school or department. Nor are faculty or administrators in other areas aware of specific needs for hands-on projects in information system courses. The favorable notice received by this project has generated interest in additional in-house projects for future classes.

The authors believe that course instructors should scout for information systems needs--or better yet, have students scout--in their own academic backyard. Businesses will appreciate being able to hire recent graduates who have some information systems experience. Students will appreciate being able to add such experience to their resumes along with courses taken. And the college or university will appreciate being able to meet some of its information system needs at a very low cost while enriching the educational experience of its students.

Suggestions for Future Research

Our experience with this project suggests several areas for future research. The first is to determine if hands-on experience improves students' rating of CIS courses over the results found by Chepaitis (1).

A second area for future research is to determine what influence a real-world, hands-on project has on student motivation and performance in subsequent courses. This would be longitudinal research. Student performance would have to be tracked through subsequent courses. This research would require a control section of students who did not do a real-world project. Student ability would be an external factor for which to control.

A third area for future research is to determine whether such hands-on experience contributes to better comprehension and retention of the course content. This would be longitudinal research also. It would require testing students' retention of the material after a period of time. This research would also require a control section of students who did not do a real-world project, and student ability would again be an external factor for which to control.

*****References*****

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