

## **Business and Education Cooperation through Classroom Projects**

**Troy Harding, Les Kinsler, Pedro Leite, and Thomas Mertz**

**Engineering Technology Department  
Computer Systems Technology  
Kansas State University – Salina**

### **Abstract**

This paper describes the incorporation of projects supplied by local businesses/industries into computer software courses in an attempt to provide students with an opportunity to develop collaborative problem solving skills, teamwork, professional responsibility, and most importantly an exposure to design and development situations very difficult to reproduce from textbook projects. Our paper describes the projects, discusses implementation problems, assessment procedures, students' attitude toward the experience, and instructors' reflections on the process.

### **Introduction**

Advisory board members, prospective employers, and industrial partners have been expressing the desire to hire computer systems technology graduates that are well rounded in all aspects of our profession. Graduates should possess strong conceptual and practical knowledge as well as be able to work collaboratively at all levels of software development: from problem solving to design, from development to implementation and maintenance. Such an obvious request is not easily implemented.

In an attempt to implement this request, the authors have experimented with giving *real-world projects* in two capstone courses. A problem of nomenclature arises as there is no standard term for these types of projects. We use the term *real-world project* to mean one that is inspired and sponsored by an actual business or industry client. The capstone courses in which the projects were completed are for advanced students and they focus solely on students designing and implementing a large project using development teams.

Several studies have been conducted on the benefits, difficulties, and challenges of implementing real-world projects<sup>1,2,3</sup>. There are also issues related to managing projects in which clients have direct input in the process<sup>4,5</sup> and its assessment<sup>6</sup>.

Bruner's writings on constructivism<sup>7,8</sup> provide the practical framework for using real-world projects to improve learning and develop useful professional skills: (a) students have a predisposition toward learning; (b) instruction should be designed to fill in the gaps; and (c) instruction should take advantage of students' experiences and previous knowledge.

*Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition  
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Jonassen, Peck, and Wilson<sup>9</sup>, described five attributes necessary to create the meaningful learning environment proposed by the Constructivist Theory: Active, Constructive, Intentional, Authentic, and Cooperative Learning. Real-world projects fit the constructivist paradigm of meaningful learning.

## **The Projects**

One project was sponsored by a non-profit association that promotes downtown retail, service and professional businesses. The association also manages the city's Business Improvement District. Overseen by a 13-member Board of Directors, its daily operations are carried out by two permanent, full-time employees, the director and a clerical worker. Records were kept in a variety of places; specifically, in computer databases kept by the city and county and in a combination of paper files and Microsoft Excel files kept in the association office.

The project was to create a database containing details on all property in the BID. In particular the client wanted to be able to access descriptions of each property (its physical and legal description), its business occupants, its owner, whether it is vacant and the owner's leasing terms. The project was to be done using Microsoft Access since the association owned that product. It had to have an appropriate user interface since none of the office staff knew how to use Microsoft Access. Finally current data had to be converted from its current form and entered into the new database.

The second project was provided by a carwash company that wanted a website that was “fun, professional, and customer service oriented.” They emphasized that students should be creative and make suggestions of what should be included on a carwash website. At a minimum the website was to include the ability for customers to obtain pre-paid washes and coupons, complete a customer survey, and find out about product offerings and promotions. In addition, the website was to be used for recruiting employees and to provide information to organizations wanting to sell carwashes for fundraisers.

The students were divided into teams of four. Each team was responsible for its own design but all teams essentially completed the same project. However, for efficiency reasons the teams collaborated on such things as conducting user surveys and client interviews. The client was very pleased with this arrangement because it produced several different designs and ideas from which to choose from.

A local medium size law firm sponsored the third project (done as an independent study, not in a capstone course). The client wanted to create a web presence mainly for public relations. The current web site was developed in-house by one of the firm partners. The design was very simple with several broken links, out-of-date pages, and incorrect information. Similar to the carwash project, the client described their web presence as “boring” and wanted a more “lively” presence.

## Students Perspective

At the end of the Spring 2003 semester, 52 students that had participated in a capstone project sponsored by local clients responded to a survey about their experiences. From this total, 39 students (75%) were male and 13 students (25%) were female. The total average age was 23.9 (male 23.4 and female 25.0).

The survey used a Likert type scale where students would Strongly Agree (4), Agree (3), Disagree (2), Strongly Disagree (1) with the statements. Students also have the option of marking that a statement was Not Applicable (0) to the course. Following are the average responses:

Statement	Average
The ability to work in groups was definitely beneficial.	3.2
Learning by working with peer group was much better than trying to struggle through the material alone.	3.2
The project made great use of what I have learned in this course.	3.2
The project made great use of what I have learned in other courses.	3.4
The project allowed me to apply knowledge that I have acquired through non-formal education (personal experiences, on-the-job-training, etc.)	3.2
Cooperative learning and learning through collaboration was a positive experience for me in this course.	3.1
I enjoyed the opportunity of being exposed to a diversity of views and different ways of dealing with the project's problem.	3.2
I enjoyed this course's focus on learning rather than on a grade.	3.5
I enjoyed the course's flexibility and open-minded teaching.	3.6
My team worked well together.	3.3
Given the time constraints, our group produced the best product we were capable of delivering.	3.2
The formal and informal presentations helped me develop communication skills and professional demeanor required in the workplace.	3.0
This course has stimulated me to high intellectual effort.	3.0
The real-world project(s) exposed me to stimulating ideas about this course's and other courses' subject.	3.2
I usually confined myself to the course textbook, materials or online postings when searching for solutions to problems found in the project.	2.0
I seldom reviewed literature beyond the sources that are included in the course syllabus or online postings.	2.1
Working with business client was a positive experience.	3.1

Statement	Average
The project was beneficial in helping me develop practical knowledge.	3.3
Working on the project helped me develop problem-solving skills.	3.1
Working on the project helped me develop teamwork skills.	3.2
Working on the project helped me develop professional responsibilities.	3.2
Working on the project helped me develop software development skills.	3.0

### Faculty Perspective

The faculty teaching the courses that used capstone projects experienced challenges and rewards. The biggest problems were (1) keeping the project on track so that it could be completed during a single college semester and (2) managing group dynamics.

Regarding keeping the project on track, it was a challenge to make sure that the project did not continue to grow during the semester. Feature expansion is common in Information Technology projects, so the instructor had to be diligent to make sure students limited project features to what could be done during a sixteen-week semester. One of the classes had a particular challenge in getting cooperation from the client, who frequently cancelled meeting appointments and delayed days before responding to requests for information. In this situation, the instructor had to take on the client's role so that the students were not dangerously delayed in their work. The result was that the final product was not entirely what the client wanted but it was finished at the end of the semester.

The instructors tried very hard to anticipate and plan for problems in-group dynamics. The groups were chosen by the instructors, who tried to match good students with bad ones by selecting for each group a good leader, a good programmer and a student with good verbal and organization skills. After selecting groups in this manner, students known to be poor were distributed among them. Grading criteria included a certain percentage devoted to individual work and peer evaluations so that unproductive students did not automatically receive the same grade as others in the group.

Several procedures were employed to manage and handle the groups. First, the groups were required to submit regular progress reports to the instructor. After reading the reports, the instructor would meet with each group, discuss how the project was progressing and give the group suggestions on how to deal with issues of group dynamics. Second, the groups made regular presentations to the client. Finally, each member of a group underwent a peer review in which his or her performance was rated by fellow group members. This peer review was factored into the student's grades.

In spite of these arrangements, almost all groups suffered the typical problem of unproductive group members. That is, students who chronically missed meetings, never completed their assignments, or never contributed ideas.

Interestingly there were several uniquely dysfunctional groups. In one group, a strong student took charge of the group and didn't accept input well from other group members. Consequently, the enthusiasm of the other group members waned and the overall quality of the group's project suffered. In another group, two strong students could not compromise and so worked independently on separate parts of the project. Needless to say their project was a mess of incompatible components.

The benefits of using a real project over a made-up project for this class include (1) student enthusiasm for the project, (2) students' exposure to working with non-technical people, (3) real-world experience for the students and (4) greater exposure for the college. Students were very excited about working with a real client in a professional setting and therefore took the project very seriously. Although working with non-technical clients was challenging, it was an experience the students could only have gotten through using a real project. For example, not knowing the what and why of normalizing a relational database, the database client was frustrated by the students' repeatedly asking for more precise descriptions of entities such as *parcel*, *property*, and *business*.

Each course used one project because at the time only one real project was available. This, however, had some advantages, the biggest being that the client had a choice of final projects from which to choose and had the benefit of seeing various fresh ideas and different approaches to the problems. The competition between groups was healthy and caused some groups to excel, although sometimes the competition distracted from the goals of the project.

## Conclusions

For further study, we would like to experiment with each student group within the class having its own project. Each team would present on a regular basis what they are working on and get feedback from the other groups.

Other aspects that need work are managing group dynamics and grading models. We want to work on an improved grading model that factors in the effort put in by each student. The peer evaluation is the right approach but it needs refinement. Management of group dynamics needs to be improved to prevent dysfunctional groups. In addition to the group meetings and reports mentioned above, we plan in future projects to have each student submit regular progress reports explaining what his or her individual responsibilities have been and to what extent they have been accomplished. We also plan to meet with individual students twice during the semester to get their candid perspective on what is happening in the group.

Perhaps the final word on benefits of using real projects is that it will be a challenge for the instructor to keep the project on track, keep the client happy, keep wholesome student group dynamics, and fairly evaluate the students' effort. The other side of the coin is that it gives students experience in how to apply academic subject matter to real projects, it helps them be more prepared for the workforce and it is one of the few ways we in the academy can provide such experience to our students.

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## Biographical Information

TROY HARDING

Assistant Professor, Computer Systems Technology, Kansas State University – Salina ([tdh@ksu.edu](mailto:tdh@ksu.edu))

LES KINSLER

Professor and Section Head, Computer Systems Technology, Kansas State University – Salina ([kinsmo@ksu.edu](mailto:kinsmo@ksu.edu))

PEDRO LEITE

Assistant Professor, Computer Systems Technology, Kansas State University – Salina ([pleite@ksu.edu](mailto:pleite@ksu.edu))

THOMAS MERTZ

Assistant Professor, Computer Systems Technology, Kansas State University – Salina ([tmertz@ksu.edu](mailto:tmertz@ksu.edu))