In this issue:

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Abstract

This paper summarizes an extremely successful problem-based service learning project for a sophomore level systems analysis and design class. Students were divided into three teams of 3-4 students. Each team designed and implemented WebQuests for the client, a second grade teacher at a local elementary school.   WebQuests are web-based guided inquiry activities and in our case involved science and social studies curriculum at the second grade level. Students, the client and the instructor reported a highly successful experience.   Guidelines for creating a successful problem-based service learning experience are provided and discussed.

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1. INTRODUCTION

It is extremely important that Information Technology (IT) students have experiences that supplement textbook and theoretical learning. It is essential that these students experience working on a project team to accomplish a client driven goal. While this is important for all students, it is especially important for IT students where the predominant mode of working is on client defined problems in project teams.   Students should experience not only the text book theory but the practical issues of working on a team for a real project.

Over a period of 16 weeks, students in a sophomore level systems analysis and design class worked with a second grade teacher in a local school district.   Throughout the semester, college students were working with both a second grade teacher and her students to deliver systems which met her and her students' needs.   Students split into groups to analyze, design, and create three "webquests," online web-based systems that guide second grade students to specific informational sites to help them learn about a subject.   The webquests were designed according to the client's request. They covered Ohio animals, Ohio plants and

citizenship. The Ohio animals webquest, for example, featured Zack the Zookeeper who introduced the second grade students to Ohio mammals, birds and fish, complete with facts, photos and sound effects.   The sites included many activities for the youngsters, including mazes, fill in the blanks, pages to color and a hang-man game.

A WebQuest is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests are designed to make good use of a learners time, to focus on using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis and evaluation. The WebQuest model was created by Dodge (1995) and his colleague March (1998). MacGregor and Kim (2004) report that the WebQuest model has been embraced by many educators at all grade levels. While the empirical studies on WebQuests is sparse, Lipscomb (2003) found that students in the classroom found WebQuests interesting and fun.

The project described in this paper has elements of problem-based learning and service learning. Problem-based learning is a learner-centered approach in which learning is motivated by either real world problems or

problems that are similar to real world problems (Greening, Kay, Kingston, and Crawford, 1997). While problem-based learning is a paradigm that permeates much learning in information technology there is a literature base which specifically studies problem-based learning in computer science (Greening, Kay, Kingston, and Crawford, 1997; Kay, Kummerfield, 1998; Ellis et. al. 1998)

Perhaps the paper most related to this project is Laware and Walters (2004) review of approximately 20 lessons learned from five different successful and unsuccessful experiences implementing problem-based learning in the undergraduate computer programs at Purdue University. One of the projects they describe was also a project completed by a systems analysis and design course. The project we describe in this paper has a clear relationship with problem based learning. Students were solving a real world problem throughout the course and that problem partially drove the curriculum of the course.

Problem-based learning may or may not include an element of service. Service learning is form of experiential learning that integrates classroom learning with community service (Hatcher, Bringle, 1997; Eyler and Giles; 1999). Although problem solving may be a part of the process of service learning, the focus is more on the service than in problem-based learning. Sanderson (2003, pg 85) reports that "computer science is not very visible in the service-learning community." He reports that the National Serice_Learning Clearinghouse web resource for computer science and syllabi had only three entries. He similarly reports that an ACM Protol search on "service learning" found 15 results from 472, 596 documents. A Google search, however, on "service learning" and "computer science" yields many hits. He concludes that there is in fact a lot of service-learning going on in computer science, but it is not visible.

Whether the angle taken is problem-based learning or service learning, they both share common attributes which foster similar learning outcomes. Students in this course solved a real world problem (problem-based learning), and integrated classroom concepts with related community service (service-learning).

In short, students in a systems analysis and design class were divided into three different teams of 3-4 students. Each gathered the information requirements, analyzed, designed, and implemented a computer system. The students' client was a second grade teacher at a local elementary school. Each team designed a different WebQuest for second grade students that were consistent with state standards.

This paper discussed the context in which the project was developed by describing the course, the project itself, and the assessment of the project. The paper concludes by highlighting the components which made this project a success.

2. THE COURSE

2.1 Demographics

The course was offered at a regional campus of a medium-sized University. There are approximately 3000 students at the campus and all are commuter students. Almost all of the students work and have outside responsibilities. All of the students had had Java programming (CS1) and the majority of students were proficient in some aspect of Web development. The class met once a week for almost three hours. Twelve students began the class and ten completed the course.

2.2 Course Description

The course, CIT 276 (Systems Analysis and Design), was a required course for an Associate Degree in Computer and Information Technology. The text used was Kendall and Kendall's Systems Analysis and Design (2005). Course grade was determined by the following:

1) *Quizzes*. Quizzes were used to test book content. Students began each class by both turning in the take-home quiz and by completing an in-class quiz. The in-class quiz was given during the first 10 minutes of class. It was a multiple choice quiz to assure students had read the chapter. The take home portion of the quiz was more in-depth and required the students carefully study and solve various problems in the text. 30% of the student's grade was based on the quizzes.

2) *Site Visits.* On three separate occasions the class went off site and spent the entire class time visiting at a local organization. During these sessions we met at that

organization and talked with them about their particular systems approach to Systems Analysis and Design. One of the sites embraced a more traditional SDLC, another embraced Agile methodologies, and the third used a combination with little structure at all. Students were required to write a summary of each site visit. These summaries were 15% of the student's final grade.

3) *Participation*. Participation was essential to making this an effective class. Students were asked to document their participation for each and every class session. Students were given a participation rubric in which they were asked to rank and justify their participation on a 0-3 point scale. The document was checked once about half way through the term. It was turned in at the end of the term and students were asked to give themselves a final grade. In 90% of the cases, the instructor agreed with the self assessment. Participation was 10% of the students grade.

4) *Final Exam*. The only exam in the class was a final which consisted of two components: a take home and an in-class. The take home asked the students to explain how each chapter in the textbook applied (or should have applied) to the project they had just completed. They were also asked to write an essay that required them to personally reflect on their contribution to the project and the ways they could improve in a future project. The in-class component was a multiple choice exam on the textbook. The final was only 10% of the final grade.

5) *Project*. Last and most importantly the students actually completed a real project for a real client. Twelve students were divided into three teams. They met with the client four separate times in our classroom. Each team visited the site (an elementary school) at least 2 times, and a segment of each class session was reserved for the group. The project was the single most time consuming and the most educational component of the course. The project and its associated deliverables accounted for 30% of the class grade.

3. THE PROJECT

The project was the main focus of the course. It was introduced in the first class session and teams were created by the in-structor by the second class session. The client (a second grade school teacher) also met with the students during the second class session to begin to describe her needs. The client met face-to-face with the students during their class time three different times. Two students visited the 2nd grade classroom and reported their observations to the rest of the class. One student acted as the technical contact to the district IT offices.

3.1 Organization of Teams

The instructor of the course created three teams of four students each. Prior to creating teams she asked students to complete a survey which asked the student whether there were people they would like to work with or prefer not to work with. For the most part, the instructor met those requests.

The teams then met to decide on a team leader. The team leader played an important role. The leader was responsible for posting minutes of all group meetings, being the primary contact for the client and making sure the team met all of its deliverables.

As expected, two teams had members drop the class which brought them down to a three-member team. Only one team had a member that simply did not do his share of the work.

3.2 Project Deliverables

Students were required to turn in 4 deliverables which were written in concert with the text. The first deliverable corresponded with the initial analysis of the system. It required students to write a report discussing organizational culture, the impact of their proposed system, the feasibility of their project, and a project schedule. Students were asked to directly site the textbook and any other material that informed their report. In this phase students were just beginning to understand the second grade environment, their client's requests, state standards, and curriculum material.

The second deliverable required the students to turn in a report detailing how they would gather the information they needed to complete the system. For this deliverable, they needed to read background material, establish interviewing objectives, determine who to interview, decide on question types and identify the unobtrusive methods for their

data collections. In short, they needed to identify how they would get the information necessary to complete the project.

The third deliverable was the most substantial and was submitted about half way through the semester. For this deliverable, the students submitted a complete system proposal to both the second grade teacher and the instructor. The proposal included a cover letter, title page, table of contents, an executive summary, an outline of the systems study, the proposed system, and the schedule the team would be following to complete the system. Student turned in prototype screens and their proposed system was described in detail.

The fourth and final deliverable was turned in the last day of class. It included a short procedure manual as well as a technical reference section.

3.3 Presentations

The culminating experience of the project was a presentation to elementary school students, faculty, administrators and parents. Student dressed professionally, presented the systems they developed and then helped parents, teachers, and most importantly second grade students use their system.

3.4 Final Exam

The take home portion of the final exam proved to be an important part of the project. Each student was asked to relate the things they learned in the textbook to their project. One student reported that until this activity, she felt the textbook was a waste of time. Throughout the course, she felt like she did not understand what the text was saying. Only after having a concrete project experience did the textbook material make sense to her.

4. ASSESSMENT

There were three major groups of people involved: the students, the client, and the instructor. A brief assessment of each is described below.

4.1 Student Assessment

Students reported overwhelmingly that they liked the project. Table 1 shows a survey given in class on the last class session. Students responded Strongly Agree, Agree,

Neutral, Disagree or Strongly disagree. The table below shows student responses.

Table 1. Student Assessment

Project Question	% SA or Agree
I learned a lot through the team project experience.	100 %
I enjoyed the team project	90%
Working with a real client was a worthwhile experience.	100%
When this course is offered again, you should continue using a real client with the tem project	100%
Actually doing the project helped me learn about the systems analysis and design process	80%
The project experience helped me understand and apply the concepts from the text.	80%

It is important to note that no student Disagreed or Strongly Disagreed with any question. All of the remaining responses (not shown in the table) are neutral.

In this last day survey, students were also asked to comment specifically on the most important things they learned from the project. Table 2 shows sample comments.

Table 2. Student Comments

Sample Comments
What an excellent real life experience to have while at school. There were things that each team had to overcome to make their system work that would not happen in a classroom.
I learned 3 things: communication is essential, schedules are tentative, goals sometimes are lofty.
I learned a lot about systems by actually doing a system and seeing the steps in action. I don't feel as though it would have been nearly as effective had we not actually done a system.

4.2 Client

The client in this project was given a short survey at the end of the course. Highlights from her responses are shown in Table 3.

Table 3. Client Comments

What were your concerns about the project? At the beginning of the project I was concerned about having the students in your class find the right kind of resources for these web quests….My only concern during the process was getting the web quests set up on our school computers so my second graders this year could benefit from using them.
What were the successes of the project? I found that working with your students, who are extremely computer savvy people, was a very successful part of the process for me. It was amazing to be able to communicate to a group of people what I was looking for and have them take the initiative and create them for me. I have not been involved with collaboration between a university and an elementary school before and I found it to be a positive and rewarding experience.

5. GUIDELINES

In summary, the project was very successful. The second grade teacher ended up with webQuests that her second grade students could use. The university students stated that they learned much from the experience, and reported that they were highly engaged in the process. In retrospect, the following factors helped achieve success.

5.1 Organization of Teams

The instructor of the course had previous experience with all of the students in the class and therefore had a grasp of their strengths and weaknesses. Stronger students were combined with weaker students. A "techie" type was placed on each team. Although the instructor did not explicitly identify a team leader she placed a clear class leader in each team. This helped tremendously and for the most part produced very balanced teams.

5.2 Minutes

Minutes of every team meeting were to be posted on the blackboard web site. These minutes were available for all of the students so that not only the instructor knew what was going on but the class in general knew what each team was doing. The quality of all minutes improved as the class progressed and this partially was due to the ability to review their classmates' minutes.

5.3 Deliverables

The deliverables of the project had due dates that were manageable and evenly spaced throughout the term. For each deliverable, very clear directions with grading rubrics were provided to the students. Students had the opportunity to turn any deliverable in early to the instructor and she would provide suggestions for improvement.

5.4 Choice of Client

Local school districts are an excellent choice for identifying potential clients. Many schools have very motivated teachers who have excellent ideas but very limited resources. Additionally, an elementary school is an interesting choice of a client for University students since it requires they learn about an environment that they are no longer experienced with. In our case, the client was excited and motivated about the project. The university students quickly caught her enthusiasm.

5.5 Choice of Project

The choice of a project was critical. We wanted a project which teams could complete in 16 weeks. The project could not be too large in scope. One advantage of designing WebQuests is that they could be as big or as little as the groups defined. In fact, two of the three groups had to substantially scale their project back as the term progressed because they lost a team member. Identifying projects which have some flexibility in scope (such as the WebQuest) will go a long way as far as success of the projects.

5.6 Testing

One week before the final presentation, we brought five second graders to the class during class time to test the system. This proved to be invaluable and all groups learned that some aspects of the system needed to be changed.

5.7 Stand-up Walk Through

Approximately mid way though the project, one class session was devoted to each team presenting what they were doing to the other teams. The other teams then gave constructive and useful feedback.

5.8 Visit the Client's Environment

Two of the students in the class visited the elementary school classroom and computer lab. The majority of the university students were unfamiliar with an elementary school environment.   By visiting the elementary school they were able to observe the environment for which they were creating a system. Through this visit, they learned a tremendous amount about the culture, environment, and technology they would be using. They shared this information with the class but all agreed that for future projects, each team should be required to visit the environment.

5.9 Communication

Verbal and written communication was an essential component to this class. Many of these students had previously taken a technical writing class and a communication class. Even so, additional training in both how to better communicate and how to better work in groups would be invaluable.

5.10 Final Presentation

The final presentation was held at the elementary school. The client, second grade students, parents, administrators, and the local media's attendance helped the college students feel a real sense of accomplishment in this project. They received positive feedback from teachers and students alike. One student commented that they were on a "complete high" after presenting their projects. They were proud. They did not simply finish a class assignment. They created a product that elementary school students were currently using.

5.11 Final Exam

Having a final exam where students needed to reflect on the process of creating the project proved to be invaluable. Several students commented on the importance of the final exam to connecting the textbook theory with the project.

6. CONCLUSION

It is increasingly important that IT students gain some real-life practical experiences in analyzing and designing systems. Students not only need to learn the text book theory but they also need to experience the practical issues of working on a real project for a real client.   Creating such an experience can be quite difficult, especially for students in a 200 level course on a commuter campus.

In this paper, students, the instructor and the client found that a problem-based service learning experience can be highly successful even at a sophomore level. Elementary schools may be an excellent resource for faculty attempting to build some problem-based service learning into their curriculum.

Certain practices may be put into place which may help achieve a more successful project. These practices include:

1) choosing an appropriate client and project

2) creating balanced teams

3) posting meeting minutes

4) creating clear and manageable deliverables

5) building in a stand up walk through

6) testing with the users of the system

7) visiting the clients environment

8) emphasizing communication

9) celebrating the final presentation

10) giving a final exam which links practice to theory

7. ACKNOWLEDGEMENTS

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