

Using the Internet to Build Realism in Teaching Requirements Analysis

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Abstract

Educators realize that the Internet has the potential to dramatically change education. There is also a widespread recognition that student learning is enhanced when students are actively engaged in the process of their education. This paper describes a project in which the Internet was used to support active learning in an introductory Information Systems class. A Web forum was used to simulate the interaction of systems analysts (students) and a client in determining the requirements for a system. Students were actively involved in the construction of the system requirements through communications with the client. The exercise was successful in enhancing the realism of requirements analysis activities in a course project, as revealed by the nature of the online discussions with the client, as well as students' evaluation of the project. We describe how the project was designed and implemented, evaluate its successes and limitations from both student and instructor perspectives, and offer advice for instructors interested in carrying out similar projects.

Keywords: systems development, active learning, introductory IS, web forum.

1. INTRODUCTION

The Internet has been widely hailed as a technology with the potential to transform education. Scenarios range from augmenting existing teaching methods in a traditional classroom environment to replacing the classroom as we know it with a virtual classroom in which students interact with other students and instructors only via electronic means. One way in which Internet technology can support educational transformation is by supporting *active learning*, whereby students gain higher levels of understanding of a subject area by becoming much more involved contributors to their own education. Internet technologies can support

active learning by giving students the freedom to choose and determine the order of coverage of material, participate in the creation of material, collaborate with their peers and others, and interact meaningfully with a range of available resources.

This paper describes an Internet-based approach to helping students understand the challenges involved in eliciting information systems requirements. The project used a Web forum to simulate the interaction between systems analysts and a client. Students, acting in the role of systems analysts, exchanged messages with the client throughout a semester-long course in order to identify requirements for a transaction processing system and implement a working prototype of the system.

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2. ACTIVE LEARNING

Many educators believe that in order to acquire knowledge and skills, students must be personally and actively involved in the process of learning. Active learning requires that students acquire and interpret information relevant to the task rather than being passive recipients of material given to them (Bonwell 1991). Moreover, active learning is enhanced if the student is required to apply the information that is gathered to an *authentic* activity (Kolb 1984).

In the past decade or so, advances in computer technology have led to a heightened interest in active learning (McDonald 1997). Educators recognize that computer and communication technology provide a mechanism to involve students: students can use computers to participate in group decision making, collect relevant information, contact subject matter experts, and use computer simulated exercises (Nunamaker 1991; Tompson 1995). Active learning has been applied to information systems education in areas such as group support systems (Jessup 1995).

Our experience suggests that educators have used the computer and the Internet primarily for three purposes: to provide students with simulated activities, to allow for student collaboration, and to provide students with access to information. In many cases, the technology has been used to support student involvement in only one of these activities at a time. We aimed to enhance the active learning experience by incorporating all three activities in a course project. Moreover, we attempted to integrate the critical components of active learning – actively acquiring and processing information, interpreting that information as it relates to a task, and applying the information to an authentic activity – in the activities.

3. COURSE PROJECTS IN INFORMATION SYSTEMS DEVELOPMENT

A common approach to teaching information systems analysis, design, and/or implementation is to require students to complete a project involving the creation of systems development artifacts, ranging from analysis models (e.g., data models, data flow diagrams) to working systems. By participating in these systems development activities, students adopt a much more active role in learning about systems development than if they simply read about systems development activities and write traditional exams on that material.

One challenge in executing a systems development project in a classroom setting is creating a high degree of realism in a project task while maintaining a reasonable and controlled project scope. Realism can be achieved by requiring students to work with real people in real organizations on a real systems development activity.

Such a project is likely to be highly inappropriate in a required introductory IS course, where there is the challenge of managing a large number of students, many of whom will never take additional courses in IS. These students may have neither the education nor the motivation to effectively participate in a “real” project. Nevertheless, some coverage of systems development is an important part of an introduction to IS, as witnessed by coverage of this topic in a range of introductory IS textbooks (Alter 1999; Laudon 1999; McLeod 1998). How, then, can this be done in a manner that encourages active learning?

One approach to practicing systems development in a project setting is to do analysis, design, and/or implementation from a written narrative or case. In the case of implementation, this is a sensible and manageable strategy. Given a defined set of project specifications, students can develop skills in transforming a design to a working system using appropriate development environments. However, written cases are of limited value for effectively teaching systems analysis and design principles since they are inherently flat and linear and are highly structured. In contrast, in real life, project requirements are frequently determined through iterative communications between analysts and clients, and vagueness, conflict, and contradiction are common. Successful communication between the end user and the IS professional is an important determinant of system quality and success. It is therefore critical that students are exposed to these issues. One approach to simulating such issues is to use a role-playing technique (Cope 1996).

To address the limitations associated with using cases or written narratives for practicing systems analysis and design, we developed and implemented an alternative mechanism for role playing in a systems development project, as described next.

4. THE PROJECT

The project was designed and implemented in an undergraduate “Introduction to MIS” course at a medium-sized Canadian university. The course is required for all undergraduate business students, and is the only required IS course in the program. The project was developed as an integral part of a major redesign of the course. One of the primary objectives in redesigning the required IS course was to expose all students in the business program to transaction processing and management reporting systems as major types of IS, and to important issues in IS development focusing on requirements analysis. Many students graduating from the program become involved in systems development projects as users, and some as systems analysts. Therefore, an important objective of the project was to give students a better appreciation of the relationship between users and systems developers.

Each author of this paper taught two sections of the course. Approximately 50 groups of four students in the course were

each required to develop a database and transaction processing system for a hypothetical video store. The major deliverables for the project consisted of: a set of data flow diagrams to model the business processes; a 3NF relational database structure; and a set of forms to process transactions and produce reports. Students were required to submit a working prototype built using Microsoft Access.

To simulate a real development project as best we could within the constraints of the course, we initially provided students only with a short narrative describing the system requirements for a fictitious video store, posted to the course Web page. The narrative was deliberately incomplete and intended only to orient students to the nature of the business and the scope of the project. The complete system requirements were to be determined by interacting with the owner of the business, played by the course instructors.

A variety of options are available to support interaction with a mock client (Cope 1996). One option is to schedule meetings between the students and the client. However, given the breadth of material covered in the course, it was impractical to use class time for these meetings. Another option is to schedule meetings outside class time. From the instructors' point of view, it was both impossible and inappropriate to schedule individual meetings with groups. Scheduling meetings with approximately twenty-five groups per instructor would be very time consuming, but more importantly, it would be very unlikely that all groups would emerge from the meetings with the same set of requirements. Different questions would be asked and very likely different information given to groups, thereby creating information asymmetry among groups and making it more difficult to ensure equitable evaluation of the deliverables. Also, if and as information was passed from one group to another, there would likely be information degradation. This may occur naturally, or as a result of unproductive competition between groups.

To address these limitations, we created a Web forum to handle interactions between the student teams and the client. In addition to avoiding scheduling difficulties, this approach offered other advantages. First, it built realism by spreading the requirements analysis phase over several weeks, and included very many separate interactions between students and the client. This allowed the requirements to be established cumulatively in a way not possible if groups had only one or at most a small number of meetings with the client. Second, by broadcasting all questions and responses to the forum, we ensured that everyone in the class was working from a common base of information, as they would if we had been using a traditional case. Third, it allowed students to arrange their own schedules in deciding when to "meet" with the client - they were not at the mercy of preparing for a prescheduled meeting. Finally, the forum offered a long-term repository or set of archived notes about meetings with the client, freeing teams from having to take notes during face-to-face meetings.

One difficulty in using a client whom the students never meet is a sense of artificiality that may result. To add realism, we gave the client (video store owner) an identity, Pat (played by the course instructors), and attempted through responses to questions to infuse the client with a personality. The client was "designed" to have a high level of subject matter expertise, but to be very naive from an information systems perspective. The following examples illustrate dialog between the students and the client. The first constitutes a request for clarification, and the second a technical question that should have been directed to the instructors.

Student: What do you do if you have more than one copy of a movie?

Pat: I hadn't thought of that. I guess we really have no way of knowing. Why does it matter which copy someone has? They're identical movies. When a tape is returned, the employee on duty is expected to mark off the line corresponding to the rental so I guess we should know who has the late movie because that person's name has not been checked off.

Student: When employees offer information to customers about the selection of movies can they be regarded as a Data-store?

Pat: I don't know what you mean by a "data" store. I have a video store.

5. OUTCOMES AND INTERPRETATION

Students' Perspective

We begin with some observations about use of the forum to elicit requirements from the client. Postings were not distributed uniformly through the semester. Instead, there was a marked spike in the week preceding the due date of the requirements analysis phase, and significantly fewer postings during the design and implementation phases. The instructors classified most messages as questions to the client (each leading to a response from the client). In addition, some questions were directed to the instructors (usually dealing with the course content). The postings also were also marked by "threads," in which a posting and response led to further questions to elaborate on, or request clarification of, a client response.

Of the fifty groups participating, there was an uneven distribution of postings. Fewer than five groups dominated the requirements gathering activity. In addition, many groups appear to have designated a single member to interact with the client by posting messages.

These data give a general picture of the pattern of activity. However, they do not reveal how students felt about the project itself, and the use of a Web forum to interact with a client. Student feedback on the project was collected using course evaluation questionnaires and by informal

opportunistic discussions with students after the course was completed.

Student feedback was essentially of two types: reaction to the structure of the project, and reaction to the use of a forum for disseminating project information. In general, students felt that the use of a Web forum to develop an evolving project definition was an approach they had not seen in other courses.

Some students did not like the ambiguity in the project requirements. This appears to have been a reaction to the explicit burden of having to elicit the project requirements by getting clarification and elaboration from the client. There was also some initial difficulty in separating the roles of the storeowner from those of the instructors. Consequently, some early questions ostensibly addressed to the client were really intended for the instructor. This caused some frustration and the feeling that the instructors were "playing games" by refusing to answer technical questions contained in messages directed to Pat. However, a clear separation of the roles quickly emerged as students tagged each post with the intended recipient (instructor or storeowner). This is an indication that students learned there are boundaries to a client's expertise.

In terms of student feedback on the use of Web forum technology to support active learning, several points are worth noting. First, there was considerable variability in familiarity with (prior experience) and ease of access to (computers, modems) the forum. Students who had difficulties for either of these reasons sometimes perceived a lack of timely information.

Second, some groups were reluctant to ask questions publicly, fearing they would give away their ideas to other groups. We did not anticipate this reaction, but in retrospect it appears to be a product of the competitive nature of the undergraduate business program at the school. We believe this kind of behavior detracts from the realism and effectiveness of the simulation.

Finally, a small number of students perceived the forum as an attempt by instructors to substitute face-to-face contact during regular office hours with electronic contact. This occurred despite clear indications from the instructors that the forum was intended to be used primarily for interaction with the client, and not the instructor.

Instructor's Perspective

From our perspective, the approach used was more successful in promoting students' active learning than traditionally delivered cases because it was a better simulation of a real-world, analyst-client relationship. In addition, students were required to participate in the exercise, and the quality of the client's responses was directly related to the quality of the students' involvement. Unlike a traditional case, the description of the system requirements

was open-ended and incomplete, forcing students to determine what additional information was needed and formulate appropriate questions for the client. Most questions posted to the forum reflected thought and preparation by the students.

Growing tension between students and the client as the project progressed also enhanced active learning. Tension is not uncommon in real systems development projects. We believe experiencing tension first-hand more effectively conveys one unpleasant reality of doing systems analysis than merely reading about it in a text or cases. Students learned what it was like to "speak a different language" from the user, and learned strategies to phrase questions in ways that a subject matter expert with no IS background could understand.

Providing students with access to all communications between other groups and Pat further enabled active learning. This required students to filter relevant information from noise. For example, although students knew that the 'video ordering' process was outside the scope of the system, some nevertheless asked such questions as, "How do you place orders for videos?" In such cases, Pat provided answers. As the volume of postings increased, some students highlighted the inappropriateness of some threads with hyperbole ("Do you, Pat, have a pet?"). In our view, this was clear evidence learning was taking place.

Indirect evidence of active learning lay in the overall quality of projects. Information sharing on the forum eliminated ambiguity about project requirements. Without this open communication, there would have been greater variability in the final product. Some groups may have misunderstood what was required, but may not have felt a need to consult the instructor.

In addition to the improvement in student learning and performance, the use of the forum provided the instructors with benefits. Foremost, the forum provided an equitable means to disseminate information, allowing all students to benefit from a well thought out response to a question posted by a single group. In addition, this method allowed for far richer project requirements than traditional cases permit. Questions posted to the forum indicated what students were and were not capable of, making it possible to tailor the evolving requirements to what could reasonably be expected.

There were also challenges in using this approach. Although the forum provided a means to rapidly disseminate information, it was time-consuming for the instructors to provide rapid responses to all queries. Also, while the forum was in many ways a good simulation, it could not convey aspects of face-to-face communication such as body language and tone of voice.

6. RECOMMENDATIONS AND CONCLUSION

We believe this attempt to simulate a real-life system development project was successful in promoting active learning. Students gained firsthand and realistic exposure to issues in requirements analysis and had to elicit and interpret requirements through an authentic activity (i.e., by communicating with the client through the forum). This level of involvement would be impossible to duplicate in a traditional case-based approach to analysis and design. Based upon our experience, we offer the following recommendations to optimize the learning and teaching objectives of a project such as this.

- *Apprise students early on of the need for and deliberate use of ambiguity.*

One problem students encountered was managing the ambiguity associated with the initial project description. This is not unexpected given the novelty of our approach. In our view, the ambiguity of the project was an essential pedagogical tool, designed to (1) simulate a real-life environment and (2) encourage use of the forum. In view of this, the issue becomes one of effectively getting this message out to students. In retrospect, we believe we failed to communicate to students the fundamental reality of ambiguity in the early stages of information systems projects. We believe this disclosure will not detract from the benefits of the methodology, but that the openness will go some way to alleviate the students' dissonance. However, the initial ambiguity that contributed to the richness of the exercise will not be lessened.

- *Introduce to the class, at the beginning of the semester, a person that is identified as the client. To increase realism, it may be useful to have the client role played by an experienced actor (Cope 1996).*

During the project, students posted queries to the client that pertained to technical issues, rather than user specifications. One such question went like this: "Will we need to create a table for the suppliers?" The client, Pat, directed the students to ask the supervisor/instructor. Although students expressed some frustration with what they perceived as being given the "run-around," there was a valuable lesson in learning that the client's expertise was not a technical expertise. We believe that students thereby learned well a lesson that would be poorly communicated without active involvement in the process. Evidence of learning is clear, as the archived messages reveal that such posts occurred early in the implementation phase, but quickly disappeared when the client clearly demonstrated a lack of knowledge about, or interest in, technical issues.

However, on reflection, we believe that the "identity" issue also negatively affected the learning process for some students. Students experienced some initial difficulty in separating the role of the storeowner from that of the

instructor, especially since they knew that the instructors were also playing the role of the client. Some students told us that they felt as if they were discouraged from talking over problems with their instructor when in some cases (when the question was best suited to the client) they were told to post queries to the forum. The use of an actor in the role of the client would help differentiate the roles and responsibilities of client and instructor. Instructors considering this approach should evaluate the potential ethical concerns associated with using this kind of deception, and plan a full debriefing at the end of the project.

- *Delegate the responsibilities of the client in responding to student queries to a teaching assistant to alleviate some of the demands on the instructor's time and ensure consistency of responses.*

A practical problem that must be considered in conducting this kind of project is managing the workload associated with providing timely responses to questions. In our case, both instructors monitored the forum, with responses given by the first instructor to read a particular post. This helped lessen the burden on each instructor, and gave the instructors an opportunity to discuss the implications (both in content and anticipated audience perceptions) of a possible response before posting. However, it created an additional problem of ensuring that responses given were consistent with all previous responses of the other instructor. Assigning one person the responsibility of responding to questions addressed to the client will reduce the potential for inconsistent or conflicting responses.

In conclusion, we believe technology such as Web forums in course projects can be very effective in exposing students to some of the challenges in defining requirements for new information systems. They can realistically simulate the ambiguity of project requirements, the iterative nature of requirements elicitation, and the need for effective communications skills to be a productive member of a project team. In addition, an interactive exercise will be more effective than text and exam based coverage of these issues, as its successful completion depends largely on active involvement by student participants. We encourage others to experiment with, and report on, such activities in their teaching.

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