Abstract - Learning management systems are becoming ubiquitous technology adopted at institutions of higher learning. Before these systems can be considered effective the user experience must be studied and analyzed to provide the optimum solution to meet pedagogical needs of both faculty and students. This study compared the user experience between the leading proprietary solution, Blackboard, and the leading open source solution, Moodle. We established a control group that only used the proprietary solution and two study groups, a faculty group and a student group that used the open source solution, but had previous experience with the proprietary solution. We used online surveys to compare the user experience of the basic functionality of each system such as communication tools, student-student interaction tools, student-instructor interaction tools. The study was conducted during the Fall 2006 semester at California State University Monterey Bay and included five upper division courses with the learning management systems used as an adjunct to a traditional face-to-face delivery modality.

Index Terms - Distributed Learning, e-Learning, Human Computer Interface, Learning Management System

INTRODUCTION

The use of technology in the classroom to assist instructors in meeting their pedagogical goals has become ubiquitous since 1990s. The days of mimeograph machines and chalkboards has long past. The flood of technological innovations can be overwhelming and necessitates the careful consideration of which technologies are the most effective and provide the highest cost/benefit ratio to the organizations using them.

One of the technologies that have been adopted for both corporate training and use in institutions of higher education are learning management systems. An organization now has the choice between many competing learning management systems, both from proprietary software manufacturers and open source projects.

A learning management system is a software application designed with the specific intent of assisting instructors in meeting their pedagogical goals of delivering learning content to students. The types of learning management systems that this project considered were all web-based and accessible through an internet connection and a web browser. This aspect of the learning management systems allows for round the clock access to the learning content provided for students and facilitates the ability of an educational institution to provide distance learning opportunities. All learning management systems under consideration meet the following criteria [1]: high availability, usability, scalability, interoperability, stability and security.

In the current market space there are many commercially available learning management systems from which to choose. The primary contender in this market space is Blackboard, especially when its acquisition of its main competitor WebCT is taken into consideration.

The combined market share of Blackboard and WebCT is estimated at 80-90% of the secondary schools and universities that use learning management systems. It is estimated that 20% of institutions of higher learning in the United States uses Blackboard software. The market for learning management software has great potential as it is estimated that approximately 59% of institutions of higher learning in the United States do not currently use any learning management system [2-3].

The open source community has also been active in creating alternative learning management system choices that are free of licensing costs. The main advantages to an open source learning management system are the ability to modify these products and redistribute them back into the community. In the more popular open source projects, as new features become available they can be integrated into the users’ existing system as needed at minimal cost.

The disadvantages to open source software are a lack of dedicated support unlike proprietary systems from software manufacturers and if an organization modifies the common code base too dramatically the ability to upgrade to future releases of the software is impaired. Open source software also requires personnel with the requisite knowledge base to implement the software which may require the addition of new personnel or additional training for current personnel.

Currently the most popular open source learning management system is Moodle. According to the Moodle website there are currently 19,234 registered sites with 35 sites supporting more than 20,000 users. California State University, Humboldt and San Francisco State University have both initiated pilot projects based on the Moodle learning management system. In December 2006, UCLA announced that “in November, 2006, the UCLA Faculty Committee on Educational Technology decided that UCLA should converge...
on Moodle as the single open source platform for its common collaboration and learning environment.”[4]

The primary goal of this project was to compare the usability of two competing learning management systems from the viewpoint of the most critical stakeholders; faculty and students.

Prior Works
There are two prior works that help to provide a foundation and additional insight into this project. The first is unpublished raw data collected in 2005 by Kathy Munoz and Joao Van Dozer from California State University Humboldt [5].

They conducted a study similar to this study, but using a single course of 35 students and the instructional format was a fully online course. The study came to similar conclusions as this study that on any one feature compared between the two learning management systems under investigation there was not always a clear winner, but in the aggregate students were more satisfied with their experience with Moodle and would prefer its use over Blackboard.

The second work considered was a conference paper by David Bremer and Rueben Bryant [6] on a study they conducted in 2004. Their study was similar to this study in that the systems were used as an adjunct to traditional classroom instruction. Also participants were chosen with the assumption that they had prior experience with Blackboard. The differences were that only one course was used with a total of twenty students.

This work came to conclusions similar to this study that given any given feature of the learning management systems under review that that either there was no clear winner or Moodle was slightly favored. Although in the aggregate choice 80% of the students preferred Moodle as a learning tool when compared to Blackboard.

Project Goals
The goal of this project was to compare the usability of two competing information systems. To accomplish these goals a pilot test was established utilizing an alternative learning management system to one already in use by the hosting organization, California State University, Monterey Bay. Users of the Blackboard learning management system used by the university were identified who were willing to participate in the pilot test. Surveys of the participants were conducted after a reasonable period of time to have sufficient data to analyze to attempt to answer the following questions:

- Which information system is more efficacious?
- Which system has the superior user interface?
- Which system provides the most desired functionality?
- Which system has the shallowest learning curve?
- Which system do the users prefer?

Methodology
A pilot test of the Moodle learning management system was conducted using five course sections that were taught in the School of Information Technology and Communication Design for credit during the Fall 2006 semester. These course sections all used the test system as the learning management system for the duration of the Fall 2006 semester as a replacement for the currently deployed learning management system, Blackboard. All course sections were taught previously using Blackboard. All instructors participating in the pilot test had previous experience using Blackboard as a learning management system.

The course sections chosen were all upper division courses in a technology focused major and the assumption was made that the majority of the students enrolled had experience using Blackboard as a learning management system previously at CSU Monterey Bay. At the start of the pilot test there were 101 students enrolled in these five courses.

Three groups were identified to receive the surveys for the pilot test. The first group identified was a control group to establish a baseline to compare against the pilot test student participant’s survey responses. The candidates selected for the control group survey had taken the courses included in the pilot test the last semester they had been offered, either Spring 2006 or Fall 2005. Their survey consisted of a subset of the...
questions asked the pilot test student participants with all mention of the alternative learning management system removed.

Seventy-seven students were identified that fit into control group category, and they were sent links to the control group survey through their campus email address. Twenty of the emails were returned as undeliverable. The reasons for this could include students transferring, graduating, or otherwise leaving the university. This left a total pool of 57 participants for the control group survey.

The second group identified was the student participants of the pilot test. At the beginning of the pilot test there were a total of 101 candidates for this group, but due to attrition the final number of candidates surveyed in this group was 94.

The pilot test survey for student participants was designed to provide the comparative data for the two learning management systems under consideration. The assumption was made that all or almost all participants would have had previous exposure to the Blackboard learning management system. This survey consisted of a series of the identically phrased questions about the user’s experience with the two learning management systems under consideration utilizing the identical Likert scale.

The third group identified was the instructor participants of the pilot test. The pilot test instructor survey was designed to provide the comparative data for the two learning management systems under consideration from the perspective of an instructor. The assumption was made that all or almost all participants would have had previous teaching experience utilizing the Blackboard learning management system. The survey consisted of a series of the questions directly comparing the user’s experiences with the two learning management systems utilizing a Likert scale.

The limitations with this part of the project were that there were only a total of four instructors involved in the pilot test, one of whom had no prior experience teaching with the Blackboard learning management system. Even though all instructor participants responded to the survey, the small sample size does not allow for any reasonable quantitative analysis.

**SURVEY DESIGN**

The surveys for the pilot test consisted of four sections. Section 1 focused on demographic information; age, gender and educational status. Section 2 focused on the user’s prior experience with learning management systems and comfort level with information technology in general. Section 3 focused on questions that compared the user’s experience with the learning management system. Section 4 was the narrative response section. This section allowed users to provide additional comments or suggestions on any issues that were not addressed in the previous three sections of the survey.

All three surveys consisted of identical question sets that were modified for the target audience. For example, the control group survey was a subset of the pilot test student participant survey with all questions related to the Moodle learning management system removed. Questions that did not require a yes or no answer or were located in the narrative response section used Likert scales.

**DATA COLLECTION**

Surveys were sent to the student participants of the pilot test at the beginning of November 2006. The assumption was made that nine weeks exposure to the new learning management system would allow sufficient time for the students to have formed a concrete opinion about the usability of the system. No incentives were offered for them to respond to the survey. The survey for this group included a total of 31 questions. The surveys website was open at all hours from November 15, 2006 through December 6, 2006.

A survey for the instructor participants was conducted mid November 2006 to assess their opinions and comments on the new learning management system. The assumptions were the same as above, that sufficient time will have elapsed for them to have formed concrete opinions. There were only four instructor participants to survey so while their feedback is valuable to the pilot test, the group size is too small to make definitive statements concerning the usability of the system from an instructor perspective. In addition, one of the instructors had no previous teaching experience using the Blackboard learning management system. The survey for this group included a total of 19 questions.

A survey for students that had taken the courses involved in the pilot test the last semester they were offered for credit prior to the pilot test was also conducted mid November 2006. They were surveyed about their experiences with the learning management system, Blackboard, used during those semesters and how it impacted their learning experience. This allowed for a basis of comparison with the student experience with the new test system. There were 77 students in this pool. No incentives were offered for them to respond to the survey. The survey for this group included a total of 22 questions.

**SURVEY RESULTS**

**Control Group**

The 57 candidates for the control group survey were sent reminder emails four times during this timeframe the survey was available. Thirteen of the candidates responded to the survey, and of those responding there were ten complete responses. One hundred percent of the participants that responded indicated an educational status of junior or senior in a technology focused undergraduate degree program. This gave a total response rate of 22%, but only a 17.5% rate of survey completion.

The answers of significance given by the respondents to the control group survey are listed in the following tables. 90% of the students had no prior experience with learning management systems prior to their enrollment at the University.
of standardization in how instructors used the learning management system.

Pilot Test Student Participant Survey

The 94 candidates for the pilot test student participant survey were sent reminder emails four times during this timeframe the survey was available. Fifty-three of the participants respond to the survey and of those responding there were forty-eight complete responses. Forty-seven of the participants that responded indicated an educational status of junior or senior in a technology focused undergraduate degree program. This gave a total response rate of 56%, but only a 51.1% rate of survey completion.

The answers of significance given by the respondents to the survey were in the following areas: 89% had used a learning management system prior to the pilot project and 95% of them had experience with the Blackboard system.

The divergences in responses were seen in the following areas:

In the narrative response section of the survey the recurring theme was instructor’s lack of expertise and the lack
Figure 7 questions: Did the Moodle learning management system enhance the instruction that you received in your current course or did the Blackboard learning management system enhance the instruction in your previous courses.

Figure 8 questions: You felt the Moodle learning management system enhanced the organization of learning materials and you felt Blackboard learning management system enhanced the organization of learning materials.

Figure 9 questions: You felt that the communication tools available in Moodle enhanced interaction with your instructor(s) and you feel that the communication tools available in Blackboard enhanced interaction with your instructor(s).

Figure 10 questions: You felt that the web-based resources available to you in Moodle were effective learning tools and you felt that the web-based resources available to you in Blackboard were effective learning tools.

The most significant responses were seen in the following areas:
- 71% felt that the Moodle learning management system was easier to use than the Blackboard learning management system.
- 75% of the respondents would prefer to use the Moodle learning management system in future courses as a replacement for Blackboard.

These significant responses are mitigated by the survey participant’s response to the question; if you have previously used a learning management system, you felt that this experience made learning the Moodle user interface easier. These responses are displayed in figure 11.

**Pilot Test Instructor Participant Survey**

The four candidates for the pilot test instructor participant survey were sent reminder emails four times during this timeframe the survey was available. The limitations with this part of the project were that there were only a total of four instructors involved in the pilot project, one of whom had no
prior experience teaching with the Blackboard learning management system.

Even though all instructor participants responded to the survey, the small sample size does not allow for any reasonable quantitative analysis. Anecdotally, of the responses received, three of the four instructor felt that Moodle was easier to administer and would prefer to use it in future courses. All four felt that Moodle allowed for better organization of their course materials.

CONCLUSIONS

The goal of this project was to compare the usability and effectiveness of two competing learning management systems. From the data collected the following conclusions can be drawn with high confidence in their validity.

There were mixed results on functionality. Participants in the pilot project rated Moodle’s course material organization and communication functionality higher, but in other functional areas the data was not definitive enough to reach a solid conclusion. There was no clear winner when the systems were compared on functionality.

The students in the pilot project preferred the Moodle learning management system over the Blackboard learning management system. They rated its ease of use higher and 75% of them would prefer to use it over Blackboard in the future courses that they enroll in at the university.

Even though Moodle was rated as easier to use, this result was mitigated by the fact that 65% of students felt that their previous experience with learning management systems helped them to acclimate to the new system faster.

The results of the research show that in the aggregate, when the systems were compared in their entireties, that the Moodle learning management system was the preferred choice of the users. These results are echoed by the two studies that were looked at in the prior works section of this paper.

We therefore conclude that the Moodle learning management system is the more efficacious and effective learning management system than the Blackboard learning management system.

ACKNOWLEDGMENT

We would like to thank Marc Oehlman, the interim director of the Center for Academic Technology at California State University, Monterey Bay and programmer analyst Andrew Coile. Without the contributions of these two individuals this project would not have been possible.

REFERENCES


