Deriving Learnability Heuristics for Online Educational Courseware Systems - The First Stage

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ABSTRACT

Over recent years, more and more online coursewares have been released to facilitate people's online learning experience. Although these courseware systems have undergone intensive development over the years, course sites developed from these courseware systems are not user-friendly to students. In addition, the designs of those online educational courseware systems often do not embody particular pedagogical principles. Therefore, I propose to develop learnability heuristics for courseware evaluation. This paper reports the findings from the first stage of deriving learnability heuristics for online educational courseware systems.

KEYWORDS
Learnability heuristics, learnability problems, usability problems.

INTRODUCTION

As technologies improve, people increasingly incorporate them into their everyday lives. Learning is one good example. Throughout these years, software designers and developers have designed courseware systems, such as Blackboard Learning and webCT, to facilitate students' online learning experience. In fact, these systems have undergone intensive development and have good usability for students. However, their development often do not embody particular pedagogical principles.

As the Internet is widely used now, we know that the design of web sites would greatly affect users' ability to search and use information. Over the years, usability heuristics [2] have been derived to facilitate non-specialists in designing web sites. These heuristics represent the most common problems encountered in web site design. By looking at the heuristics explicitly, even non-expert designers can greatly improve the design of their web sites.

According to current practices of online education courses, course contents are designed by instructors who are content experts. However, they are not trained as good web or information designers. As instructors could not simply lay out course materials linearly on the course site, they often encounter difficulties in organizing course contents onto the courseware system. The goal of this project is to extend the usability heuristics to cover the learnability aspect of online educational coursewares. Even

though the design of an online educational courseware system would overlap with the design of a normal web site in certain aspects, I believe that there are usage problems that are unique to educational courseware. Therefore, learnability heuristics need to be derived so that we could evaluate the design of different courseware systems.

With the set of learnability heuristics, courseware system designers could develop and design systems so that pedagogical methods required by instructors would be supported. Instructors could then develop and design course sites that are user-friendly to students. Students would therefore find studying more fun and interesting as their learning environment is improved. At last, the relationships between students and professors would be enhanced as the functionalities provided by the courseware could facilitate communications.

BACKGROUND

In order to derive learnability heuristics, a series of usability testing has been done on one educational courseware system with a selected group of students. The purpose of performing usability testing is to study students' behavior in accessing course materials when using the system. In addition, these usability testing could also reveal some weaknesses in the courseware design. As the educational courseware that I have chosen to use, Blackboard Learning, does not have a perfect user interface design, during usability testing, students encountered numerous problems with its user interface. This in fact complicates my project because students' behavior and learnability problems cannot be studied and revealed if students are unfamiliar with the user interface of the course sites.

The tasks given to students during usability testing are designed to resemble to real assignments. However, as participating students who volunteer for usability testing would be rewarded for one extra credit toward their class grade, some participating students did not take the usability testing seriously. As a result, this might affects the findings from the testing.

As I have briefly stated earlier, the methodology in deriving learnability heuristics for the courseware follows the methods used to develop usability heuristics: a series of usability testing is done with actual students from a real class. When findings are collected from usability testing, the failures of the courseware system will be classified in order to identify different critical instances. In fact, as some failures might classified as traditional usability problems, I will filter out those usability problems by matching them with Jakob Neilson's usability heuristics. Remaining problems and students' access procedures during usability testing will be further analyzed in order to derive the learnability heuristics.

RELATED WORK

Since online education has became widely adopted, no one has done extensive research on the usability of educational courseware systems. Indeed, nobody has studied the learnability aspect of those systems. As a result, the project presented in this paper is a novel project designed to derive some

heuristics in order to evaluate different educational courseware systems.

DESIGN OF PROJECT

In order to derive learnability heuristics for educational courseware systems, three rounds of usability testing were done: the first and third rounds were individual usability testing, and the second round was group usability testing. These usability testing were done on a set of selected, volunteer students. After usability testing, the findings were further analyzed so as to find the weaknesses of the courseware system from the learnability point of view. The details of each phase in this project are described as follows:

Usability testing

Before performing usability testing, I had to choose a realistic environment for the testing. Indeed, I had contacted several professors at University of California, Berkeley (UCB) who were using online educational courseware during 2002-summer session. With the help from Professor Arun Nevader, I decided to choose Engineering 190 (E190), also known as technical communication, to be the usability testing class. E190 is one of the few classes at UCB that uses an educational courseware to its full extent.

After a realistic class was chosen, six students were recruited from a group of volunteer students for usability testing. In each round of usability testing, these students were given with a sheet of tasks. Figure 1 lists the tasks in each round of usability testing. As explained earlier, the tasks were designed in the way such that they resembled to real assignments given by the instructor. In fact, the tasks for the next round were modified based on the results of the previous round such that I could further explore a certain aspect of the courseware system. So, with the given sheet, students had to finish all the given tasks independently. No help could be provided to students during usability testing. In addition, students had to "think aloud." "Think aloud" means that students have to say out loud whatever goes through their minds. Additionally, during usability testing, with the permission from volunteer students, their actions were tape-recorded for future references.

Round	Tasks
1	1. Fill out the survey 2. Find and read the handout on how to use "colon" 3. Complete "colon" exercise and submit it digitally
2	1. Prepare a group oral presentation phrase outline on the ethics articles that named "Tobacco and Death: When Is a Cause Not a Cause?"
3	1. Check your class grade 2. Pick a position from the job description handout 3. Based on your chosen position, draft a phrase outline for your resume and cover letter. Sample resumes and cover letters have already been posted on the course site.

Figure 1. Tasks given to students during usability testing

Data Analysis

After each usability testing, the findings were analyzed. As explained earlier, modifications on tasks assignments would be made according to the analyzed results from the previous round. The results of each round's analysis are detailed in the following results section.

RESULTS

During each round of usability testing, I monitored each student's sequence of actions to accomplish the tasks. And usually, at the end of usability testing, I would asked students for the underlying reasons of some unclear actions. The findings from each round of usability testing are listed as follows:

First round individual usability testing

The first round individual usability testing aims to observe each student's approach in searching and using certain features or functionalities provided by the educational courseware system to accomplish the given tasks. According to the surveys that were filled out by all participating students prior to usability testing, all of them are senior students at UCB. All of them are from the department of Engineering. And most importantly, 83.33% of them have experience in using educational courseware system for at least one semester.

Surprisingly, although more than 80% students have experience in using other courseware systems, during usability testing, almost all participating students encountered usability problems. In order to measure and compare the severity level of the problems, each problem is rated from 1 (least severe) to 5 (most severe). The problems are rated according to the number of students who had encountered that particular problem together with the amount of time that the student was stuck. Figure 2 shows a list of all the encountered problems.

Problems	Severity
1. Cannot find certain functions provided by the courseware system	2
2. Cannot save a modified document	5
3. Document name inconsistency	4
4. Find the correct course site	1
5. Lose certain document after refreshing the screen	2
6. Search for a particular document	5
7. Submit a file to the professor	2
8. Switch over two documents	4

Figure 2. Problems encountered by students in usability testing 1.

As shown in figure 2, almost all listed problems are usability problems. These problems are resulted from the imperfect user interface design of the chosen educational courseware system, Black-board Learning. Even though I could not find problems that are more related to the learnability aspect of the courseware during this round, this round helps participating students to become more familiar with Blackboard Learning's user interface. Indeed, I believed that after this round, students in later rounds would be less interfered by the user interface design of the system. In other words, students would waste less time when encountered similar usability problems. As a result, students might be able to reveal more learnability problems of the courseware in future rounds.

Second round group usability testing

The second round group usability testing aims to observe how a group of students would use the functionalities provided by the educational courseware to

communicate and accomplish a group task. Besides observing their discussions through a real time chat room called virtual classroom, I also monitored a pre-selected student on his reading behavior and his approach in solving a group problem.

In fact, during the second round usability testing, some learnability problems of Blackboard Learning began to reveal. Throughout the testing period, all students agreed that the most severe learnability problem was that the chat area inside virtual classroom did not support cut, copy, and paste functions. Students therefore wasted much time in searching for another way to "work around" this problem.

Besides the most severe learnability problem described above, their approach in accomplishing the group task was also observed. Figure 3 shows how a group uses their time in managing and accomplishing a group project.

As shown in figure 3, surprisingly, I found that instead of discussing the course materials and given tasks thoroughly, most of the time spent in a group project is organization.

As for the selected, monitored student, I found that while he was reading relevant course materials, his reading approach was non-linear. This means that during usability testing, the student did not read a document from top to down. Instead, he often jumped back and forth. After a discussion with him, I found that his reading approach was firstly skimming through the whole document and spotting all the related topic words. And whenever he encountered a topic word, he would read the few sentences surrounding that topic word more carefully. Sometimes, he would go back a little bit further in order to pull out facts and supporting data.

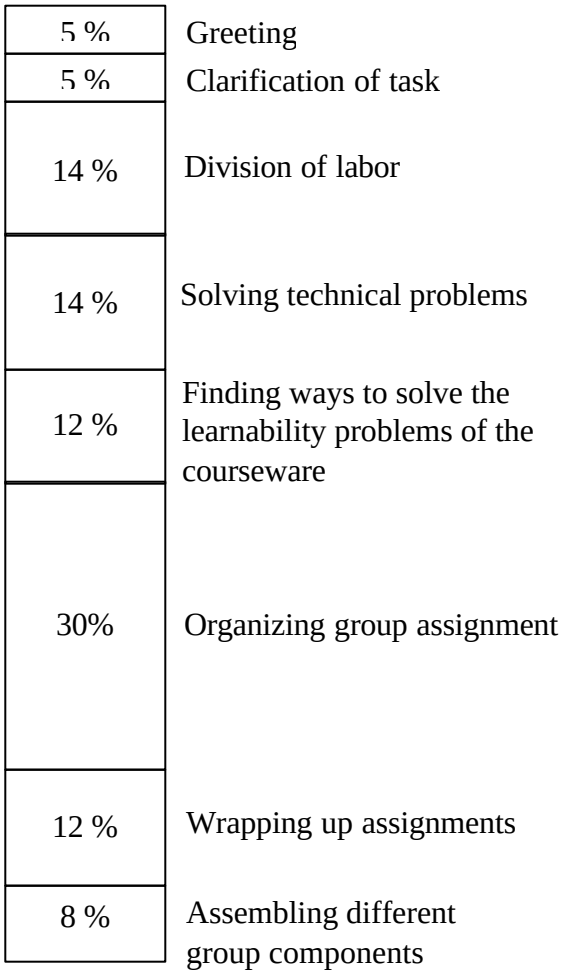

Figure 3. Estimated time bar chart for the group project in usability testing 2.

Third round individual usability testing

Based on the results of the first and second round usability testing, the third round individual usability testing aims to further study students' reading approach. In addition, this round also aims to investigate the procedure that a student would take in tackling an assignment.

During this round, students wasted less time when encountered the usability problems described in the first round. In addition, as shown in figure 4, it is found that if the students felt that they understood the given assignment, about 36% of students would not look at the given sample documents. For students who would look through all the given documents, I found that their reading approach were very similar to the student that I had described in the second round usability testing.

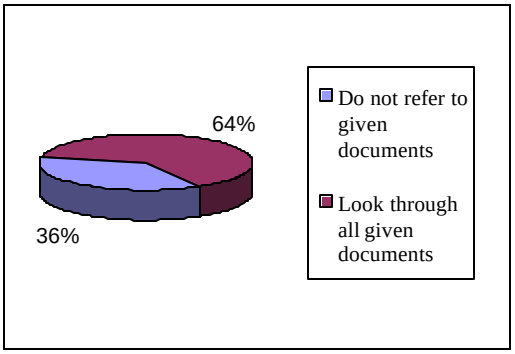

Figure 4. A chart showing the percentage of students who access previously posted course materials during usability testing 3.

CONCLUSION

After conducting a series of usability testing as depicted above, some learning patterns of students were observed. However, the collected results are not sufficient to generate the set of learnability heuristics. Therefore, I concluded that future works on deriving the learnability heuristics are necessary.

FUTURE WORK

As this project is only the beginning step in deriving learnability heuristics for educational courseware, the findings in this project are insufficient to derive any learnability heuristics. Therefore, in the future, more extensive usability studies should be done. In fact, the studies should cover other different educational courseware systems as well. It is hoped that in the future, based on the derived learnability heuristics, I could develop a system that could be incorporated into any educational courseware system in order to provide advices and supports to courseware designers and instructors.

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