Improving Usability of Educational Resources by Annotation Mechanism

Jae-Kyung Kim\textsuperscript{1}, Won-Sung Sohn\textsuperscript{2\ast} Kyung Hur\textsuperscript{2} and YangSun Lee\textsuperscript{3}

\textsuperscript{1}Smart Education Research Center, Gyeongin National University of Education, Anyang, Korea
\textsuperscript{2}Dept. of Computer Education, Gyeongin National University of Education, Incheon, Korea
\textsuperscript{3}Dept. of Computer Engineering, Seokyung University, Seoul, Korea

kimjk@ginue.ac.kr\textsuperscript{1}, {sohnws, khur}@ginue.ac.kr\textsuperscript{2}, yslee@skuniv.ac.kr\textsuperscript{3}

Abstract. Mobile device environment has increased demand for educational resources that can be accessed on and off-campus. The resources such as digital textbooks provide various features including multimedia, web-based application and annotation functionality, yet a number of usability issues remains for digital textbook to be a useful educational element. Especially, a digital textbook allows a learner to interact with both its contents and even other class members. Therefore, both self-directed and collaborative learning are the most important usability issues, and they have to be considered in use of digital resources. In this paper, we developed annotation interface which is one of most powerful feature in digital textbooks, and we conducted an evaluation for annotation user interface usability and whether its functionalities are effective and efficient for educational use. To do this, we applied combined and comparative metrics approaches to measure task performance of our system.

Keywords: Usability, education resource, annotation, interface.

1 Introduction

International Organization for Standardization defines usability as "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use."[1] Especially, usability of digital textbooks in education context is very important since it is directly related to gaining learner’s knowledge. Many techniques and features such as animation, interactive media, 3D widget and annotation have been developed to increase usability for digital textbooks.[2,3]
Although the fundamental functionality might be powerful in a general use application, its usability has not been evaluated in the view of pedagogical approach [4,5]. In the previous study, we proposed and implemented recommendation and similarity algorithm to enhance the usability of digital textbook. In this paper, we evaluated its usability and effectiveness in classroom study to prove our hypothesis.

2 Annotation-content Model and Similarity Algorithm

In our previous study, annotation-content model was defined for self-directed and collaborative learning. Due to the limited space of a short paper, detail mechanism and system description is described in [6]

3 Evaluation

In this paper we evaluated the usability of the proposed system based on tasks, amount of time to complete the tasks and grades. Different versions of our system were used in the test. System S₁ is fully functional and S₂ supports note-taking functions without similarity algorithm. We focused on measuring how effective our proposed algorithm was on solving tasks.

40 elementary students (22 male and 18 female, the 6th grade students) were participated as evaluators. Students were organized into a control group (G₁) and an experimental group (G₂) which consisted of 10 students each. Two versions of systems were explained for 30 minutes to each group, and then we gave them enough time to be familiar with the interface before the test.

We chose a math digital textbook as a test subject, because it basically requires a problem solving approach rather than just ‘memorize-use-forget’ approach. Many students seem to discuss about equations and principles to solve a problem in a classroom observation.

After the period of pre-task, the same 10 questions were given to each group as the tasks. We measured average number of task completion by each group, time consumption to complete each task and grade ratings.

In this usability tests, we have collected more than one metric, such as task completion rate, task time, and a self-reported metric such as a System Usability Scale (SUS) score.

We applied a technique for transforming scores on different scales so that they can be combined is using z-scores. These are based on the normal distribution and indicate how many units any given value is above or below the mean of the distribution.

The reason we use the z-scores is that a total picture of the usability of the proposed system as reflected by all of them is more meaningful than individual results for each of these metrics[7].

When a set of scores is transformed to their corresponding z-scores, the resulting distribution by definition has a mean of 0 and standard deviation of 1. This is the for-
mula for transforming a raw score into its corresponding z-score. The calculated difference range of z-score was -0.01 to 0.97 with average of 0.39.

Each value of task time, completed task and rating was calculated to a z-score. As a result, the average of z-scores over 10 tasks, $G_2$ achieved the overall higher z-score than $G_1$. Thus, the proposed algorithm enhanced the usability of the note-featured interface in digital textbooks.

4 Conclusion

In this paper, we measured usability and effectiveness of note-taking interface enhanced by the proposed similarity and recommendation algorithm in digital textbooks. Task completion time, achieved task ratio and satisfaction rating were transformed into z-score to evaluate the total result of the usability of the proposed system as reflected by all of them. As a result, our approach showed better the usability result in annotation functionality. Therefore, students gained their knowledge more effectively with our annotation features than the classic annotation functionality.

Acknowledgements

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education, Science and Technology(2011-0027193)

References