Ogata, H. et al. (Eds.) (2015). Proceedings of the 23rd International Conference on Computers in Education. China: Asia-Pacific Society for Computers in Education

Development of an Interactive E-Book for Improving Students' Learning Performance in Law Courses based on a Fill-in-Blank Concept Mapping Approach

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Abstract: An interactive e-book not only combine words, images, pictures and videos, but also provides interactive learning facilitates, such as the question & answer function, pop-up information function, conditional operations, jump-to-page operations, and event-triggering function. In this study, a concept mapping-based interactive e-books learning mode was proposed for helping students organize what they have learned from e-books. In order to know the learning effects, a quasi-experimental design was adopted in the study to investigate the learning achievement of the students learning with concept mapping-based interactive e-books learning strategy (experimental group) and those learning with interactive e-books learning strategy (control group) in a junior high school law course.

Keywords: mobile learning, tablet computers, concept map, e-book, learning style, law courses

1. Introduction

Researcher pointed out that students are less involved in traditional teaching approach, which leads to less learning interests (Lai & Hwang, 2014, 2015; Pivec, 2007). In recent years, due to the increasing popularity of tablet computers, e-book has become a trend for reading (Wu, Hwang, & Chai, 2013).

In previous studies, it was found that the students using e-books with specially designed teaching content did not perform better in learning achievement than those students using traditional textbooks. However, these studies also discovered that e-book can provide those features that traditional textbooks do not have, including recording, taking photos, and other interactive functions, which are helpful to increase students' attention and motivation during the learning process (Reiber, 1991; Shade, 1994; Shih, Chen, Cheng, Chen, & Chen, 2013). Besides, the way of presenting multimedia-teaching materials in e-books, including pictures and video, can significantly improve students' reading comprehension (Ertem, 2010; Chang & Lee, 2000).

Concept mapping is considered a learning strategy that can assist construction and memorization (Hwang, Wang, & Lai, 2015; Novak & Gowin, 1984; Pankratius, 1990; Yang, Hung, Hwang, & Tseng, 2013). Besides, it is also an effective tool for metacognition (Hwang, Wu, & Kuo, 2013); Novak, Gowin & Johansen, 1983). In the research conducted by Hwang, Yang, and Wang (2013), concept maps were embedded in a digital game in natural science courses. They found that, with the approach, not only students' learning achievement was

increased but also the cognitive load was lowered, which proved that it is beneficial for students to connect what is learned to their prior knowledge and gain new knowledge.

Among many subjects, social science is deemed a boring course with complex structure. While dealing with such a learning content, traditional teaching can only offer limited help. Take Social Studies course as an example. According to the error rate analysis of the Basic Competence Test for Junior High School Students, students' error rate in the law chapter is comparatively high. The learning content in this chapter is relevant to junior high school students' daily lives but they cannot build thorough knowledge structure in the course and apply it in real-world context. The structure of the course content is complex. It is expected that through the implementation of interactive e-book, students can be provided the concept-mapping to help organize concepts and increase the learning results.

In this study, the researchers took the law chapter in Social Studies course as an example to investigate whether students' learning results could be elevated through the implementation of concept mapping-based interactive e-book. Besides, while students used e-books on the devices they were familiar with, they could be more focused on the learning content. On the other hand, researchers have indicated that learning style might play an important role in the learning process (Keefe, 1979). Korat and Shamir (2012) has further pointed out the importance of considering students' learning styles when developing e-book content. Therefore, in this study, the effect of the students' learning styles on their learning performance is investigated. Based on the need of the course, the researchers chose two learning styles, the activists and the reflectors. The activist learners tend to operate and experience by themselves in learning, while the reflective learners tend to think thoroughly and explore repeatedly. Therefore, it is expected that through the experiments, more information about the learning results of leading in two different learning strategies would be explored.

2. Research Design

2.1 Participants

A total of 71 eighth grade junior high school students in northern Taiwan participated in this study; their average age was 14 years old. They studied Social Studies for three hours a week. One class was assigned to be the experimental group (17 males and 18 females), and the other one was the control group (19 males and 17 females). These two classes were taught by the same instructor in their regular Social Studies course; the instructor was a female teacher with more than fifteen years of teaching experience of Social Studies course in a junior high school. The experimental group used the concept mapping-based interactive e-book and the control group used the interactive e-book in this learning activity.

2.2 Concept Mapping-based Interactive E-Books learning environment

In this study, a concept mapping-based interactive e-book has been developed for promoting experimental group students' learning performance in the law courses. Figure 1 shows an illustrative example depicting how a student completes a concept map in the interactive e-book. Figure 2 shows one of the practicing functions which asks students to connect the relevant items. If the students failed to correctly identify the relationships between the candidate items, some hints or feedback will be given on a pop-up menu.

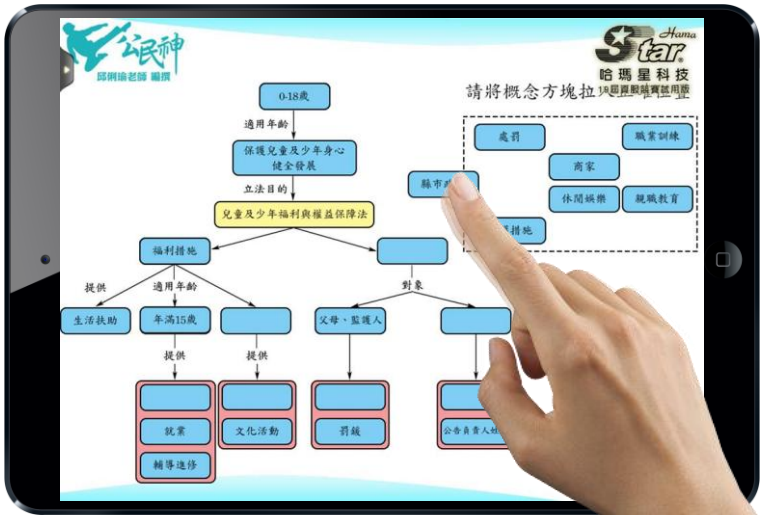

Figure 1. Experimental group students try to complete a concept map on the e-book

Figure 2. Practicing function that requires learners to connect the relevant items

2.3 Measuring tools

Before the experiment was conducted, the students completed the achievement pre-test and learning style pre-questionnaire. After the experiment, an achievement post-test was completed by the students.

The content of the pre-test consisted of 20 multiple choices questions, 10 fill in the blank questions, and 4 short answer questions, with a perfect score 100. The post-test included 10 true or false questions, 20 multiple choices questions, 5 fill in the blank questions, and 3 short answer questions, with a perfect score 100.

3. Experimental Results and Analysis

A quasi-experiment and two-way covariance analysis was conducted in the present study. Table 1 and 2 shows the simple main effect analysis and the descriptive statistics of the students' learning achievements. It was found that the post-test score of reflective students was significantly higher than that of the active students ($F=10.11$, $p<.01$). Moreover, in terms of the

learning styles of the two groups, the post-test score of the experimental group was significantly higher than that in the control group (F=21.06, p<.001).

Table 1. The abstract of pure main effect analysis of learning achievement

Simple Main Effect	*SS*	*df*	*MS*	*F*	*p*
Learning Strategy					
Experimental Group	300.13	1	300.13	1.25	.271
Control Group	3083.44	1	3083.44	10.11**	.003
Learning Style					
Reflective	725.21	1	725.21	2.2	.148
Active	4746.05	1	4746.05	21.06***	.000
Error	9385.84	66	142.21		

**p<.01; ***p<.001

Table 2. The descriptive statistics of the post-test scores

Dependent variable	Independent variables		mean	S.D.	N
	Learning strategy	Learning Style			
Post-test	Concept mapping-based e-book	Reflective	72.26	3.50	20
		Active	70.14	2.44	15
	Conventional e-book	Reflective	68.22	2.67	12
		Active	53.35	3.14	24

Conclusions and future works

From the research results, it is inferred that for those subjects with more complicated knowledge, students' understanding of the overall structure and the learning achievement would be effectively improved if concept mapping can be provided. For those research with similar learning content, it is suggested to provide corresponding situation to assist students' learning. Besides, from the aspects of learning styles, it can be concluded that in the learning environment with concept mapping, the active style leaners gain more benefits than the reflective style ones. Therefore, besides the learning strategies, students' learning styles should be considered in the future. The combination of both ways can increase the learning results.

Acknowledgements

The authors would like to thank Ms. Siang-Yi Wang for her assistance in writing and proofreading this paper. This study is supported in part by the Ministry of Science and Technology of the Republic of China under contract number MOST 104-2511-S-011-001-MY2.

References

Chang, Y. W., Lee, S. C. (2000). Design of Web-based Multimedia Courseware for Children's English Learning. Audio-Visual Education Bimonthly, 1, 1-14.

Hwang, G. J., Wang, S. Y., & Lai, C. L. (2015). Seamless flipped learning- a mobile technology-enhanced flipped classroom with effective learning strategies. Journal of Computers in Education. DOI: 10.1007/s40692-015-0043-0

Hwang, G. J., Wu, C. H., & Kuo, F. R. (2013). Effects of touch technology-based concept mapping on students' learning attitudes and perceptions. Educational Technology & Society, 16 (3), 274-285.

Hwang, G. J., Yang, L. H., & Wang, S. Y. (2013). A concept map-embedded educational computer game for improving students' learning performance in natural science courses. Computers & Education, 69, 121-130.

Keefe, J. W. (1979). Learning Style: An overview. NASSP's student learning styles: Diagnosis and Proscribing Programs (pp. 1-17). Reston, VA. National Association of Secondary School Principles.

Korat, O., & Shamir, A. (2012). Direct and indirect teaching: Using e-books for supporting vocabulary, word reading, and story comprehension for young children. Journal of Educational Computing Research, 46(2), 135-152.

17. Lai, C. L., & Hwang, G. J. (2014). Effects of mobile learning time on students' conception of collaboration, communication, complex problem-solving, meta-cognitive awareness and creativity. International Journal of Mobile Learning and Organisation, 8(3), 276-291.

Lai, C. L., & Hwang, G. J. (2015). High School Teachers' Perspectives on Applying Different Mobile Learning Strategies to Science Courses: the National Mobile Learning Program in Taiwan. International Journal of Mobile Learning and Organisation, 9(2), 124-145.

Novak, J. D., & Gowin, D. B. (1984). Learning how to learn. New York: Cambridge University Press.

Novak, J. D., Gowin, D. B., & Johansen, G. T. (1983). The use of concept mapping and knowledge vee mapping with junior high school science students. Science education, 67(5), 625-645.

Pankratius, W. J. (1990). Building an organized knowledge base: Concept mapping and achievement in secondary school physics. Journal of Research in Science Teaching, 27(4), 315-333.

Reiber, L. P. (1991). Animation, incidental learning, and continuing motivation. Journal of Educational Psychology, 83(3), 318-328.

Shade, D. D. (1994). Computer and young children: software types, social contexts, gender, age, and emotional responses. Journal of Computing in Childhood Education, 5(2), 177-209.

Shih, B. Y., Chen, T. H., Cheng, M. H., Chen, C. Y., & Chen, B. W. (2013). How to manipulate interactive E-book on learning natural catastrophe - An example of structural mechanics using power machine. Natural hazards, 65(3), 1637-1652.

Wu, P. H., Hwang, G. J., & Chai, W. H. (2013). An expert system-based context-aware ubiquitous learning approach for conducting science learning activities. Educational Technology & Society, 16(4), 217-230.

Yang, C. C., Hung, C. M., Hwang, G. J., & Tseng, S. S. (2013). An evaluation of the learning effectiveness of concept map-based science book reading via mobile devices. Educational Technology & Society, 16(3), 167-178.