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Promoting Student's Learning Achievement and Efficiency on e-Learning

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Abstract. This research used free software, Moodle, to design an e-learning platform for mathematics in elementary schools. It aimed at the sixth grade students. This platform has proved that the combination of traditional in-class learning and e-learning has improved the performance of the low learning achievement students and reduced the gap between the low and high learning achievement students. The e-learning program designed for this research comprised three chapters from sixth-grade mathematics and was conducted for one and half months. For each chapter, students were first given the traditional in-class learning and a pre-test. They were then given an e-learning that included lessons and quizzes and a follow-up post-test. Analyzing the data from the pre- and post-tests together with the variant of the accessibility to the computers, this study demonstrated that there is a negative relation between the efficiency of e-learning and the accessibility to computers, whereas a positive relation exists between the frequency of taking e-learning quizzes and students' examination grades.

Keywords: e-learning, Moodle, mathematics

1. Introduction

Much recent educational research showed that many elementary school students got learning disabilities in math (Quine, 2009), and learned math with anxiety and fear. It was important to reduce the standard deviations of the math scores and to improve the math scores of the low learning achievement students.

This research tried to find a low cost and high performance e-learning platform (Clark & Mayer, 2003) in math field to attract the students with low learning achievement to use it with interests, and to improve their math scores (Jenni & Beardon, 2001). Students could learn anytime and anywhere (Henderson & Stephen, 2007) by themselves with the e-learning platform (Cole, Jason and Helen, 2008).

In this study the researchers took 23 sixth grade elementary school students for the samples. This school was located at a geoponic village in Nantou County, Taiwan. In this geoponic village, most students did not get help from their parents in math. Therefore this research was expected to help the students review and learn math by students themselves (Bryant, Campbell& Kerr 2003).

This research was expected as follows:

- To build the e-learning resources that could be reused in the e-learning programs.
- To provide the Moodle platform which allowed students to study autonomously and construct the knowledge by themselves.
- To gather and analyze the factors that affected the results of e-learning.
- To analyze the relation between the courses and the factors.

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- Teachers could apply this platform in their courses other than math.

1.1. Moodle

Moodle is a software package for producing Internet-based courses and web sites. It is a global development project designed to support a social constructionist framework of education.

The focus of the Moodle project is always on giving educators the best tools to manage and promote learning, but there are many ways to use Moodle:

- Moodle has features that allow it to scale to very large deployments and hundreds of thousands of students, yet it can also be used for a primary school or an education hobbyist.
- Many institutions use it as their platform to conduct fully online courses, while some use it simply to augment face-to-face courses (known as blended learning).
- Many of our users love to use the many activity modules (such as Forums, Wikis, Databases and so on) to build richly collaborative communities of learning around their subject matter (in the social constructionist tradition), while others prefer to use Moodle as a way to deliver content to students (such as standard SCORM packages) and assess learning using assignments or quizzes.

(http://docs.moodle.org/en/About_Moodle, 2008/8/25)

1.2. SCORM

Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for web-based e-learning. It defines communications between client side content and a host system called the run-time environment (commonly a function of a learning management system). SCORM also defines how content may be packaged into a transferable ZIP file.

SCORM is a specification of the Advanced Distributed Learning (ADL) Initiative, which comes out of the Office of the United States Secretary of Defense.

SCORM 2004 introduces a complex idea called sequencing, which is a set of rules that specifies the order in which a learner may experience content objects. In simple terms, they constrain a learner to a fixed set of paths through the training material, permit the learner to "bookmark" their progress when taking breaks, and assure the acceptability of test scores achieved by the learner. The standard uses XML, and it is based on the results of work done by AICC, IMS Global, IEEE, and Ariadne.

(http://en.wikipedia.org/wiki/Sharable_Content_Object_Reference_Model, 2008/12/4)

2. Methodology

2.1. Samples and hypotheses

Twenty-three sixth grade elementary school students were chosen and divided into three groups: high,medium and low math learning achievement according to their math scores of regular exams before. The process of this research was about one and a half months.

Hypothesis 1:

H_0: IT environment was not related to the effect of the e-learning.

H_1: IT environment was related to the effect of the e-learning.

Hypothesis 2:

H_0: The counts of the e-learning usage were not related to the effect of the e-learning.

H_1: The counts of the e-learning usage were related to the effect of the e-learning.

2.2. Experiment setup

This research was divided into 4 stages:

- Stage 1: Building the LAMP server and Moodle CMS platform.
- Stage 2: Constructing the contents of the e-learning and guiding the students the way to use the Moodle platform. The teaching materials and the teacher of both the e-learning and traditional

learning were exactly the same. The teacher's teaching was recorded on several learning clips which would be imported to the courses on Moodle (Mayer, 2001).

- Stage 3: Implementing traditional learning, pre-test, e-learning then post-test (Bielawski& Metcalf, 2003).
- Stage 4: Analyzing data and research.

2.3. Pre-test and post-test

The questions of pre-test and post-test of each chapter were the same but in random sequences. The students didn't know the correct answers after pre-test. The post-test was hold after each e-learning course was finished. It was about 1 to 2 weeks between pre-test and post-test.

2.4. The flow of e-learning

- Step 1: Previewing the chapter on Moodle.
- Step 2: Watching the learning clips of every section in a chapter and had a test after the section.
- Step 3: After finishing all of the sections, having a test of that chapter.
- Step 4: Having the post-test.

All questions of section test and chapter test could be answered repeatedly till the questions were answered correctly. It was encouraging to try incessantly to find the right answers (Hareton, 2003).

3. Data analysis

3.1. Data sources

- Learning efficiency of three chapters was the scores of post-tests minus the scores of the pre-tests.
- The course logs of every students in Moodle.
- Questionnaires of IT environment at home answered by students.

3.2. Results

TABLE 3-1 CORRELATIONS

		Learning achievement	Computer environment	Network environment	Ch5 efficiency	Ch6 efficiency	Ch7 efficiency
Learning achievement	Pearson Correlation	1					
	Sig. (2-tailed)						
Computer environment	Pearson Correlation	.646(**)	1				
	Sig. (2-tailed)	.001					
Network environment	Pearson Correlation	.646(**)	1.000(**)	1			
	Sig. (2-tailed)	.001	.000				
Ch5 efficiency	Pearson Correlation	-.666(**)	-.565(**)	-.645(**)	1		
	Sig. (2-tailed)	.001	.005	.001			
Ch6 efficiency	Pearson Correlation	-.403	-.424(*)	-.424(*)	.470(*)	1	
	Sig. (2-tailed)	.056	.044	.044	.024		
Ch7 efficiency	Pearson Correlation	-.645(**)	-.376	-.512(*)	.799(**)	.532(**)	1
	Sig. (2-tailed)	.001	.077	.012	.000	.009	

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 3-1 indicated as follows:

- Learning achievement was positively related to computer and network environment, and negatively related to Ch5 and Ch7 e-learning efficiency. Students with computers got better math scores, but students with low learning achievement got better e-learning efficiency.
- Computer environment was positively related to network environment. This showed that in Taiwan the family with computers usually got connection to internet.

In Hypothesis 1 the results rejected H_0 and accepted H_1, IT environment was related to the efficiency of the e-learning.

TABLE 3-2 CORRELATIONS

		Learning achievement	Clips usage	On-line tests usage	Ch5 efficiency	Ch6 efficiency	Ch7 efficiency
Learning achievement	Pearson Correlation	1					
	Sig. (2-tailed)						
Clips usage	Pearson Correlation	-.219	1				
	Sig. (2-tailed)	.315					
On-line tests usage	Pearson Correlation	.357	.100	1			
	Sig. (2-tailed)	.095	.650				
Ch5 efficiency	Pearson Correlation	-.666(**)	.199	-.523(*)	1		
	Sig. (2-tailed)	.001	.362	.010			
Ch6 efficiency	Pearson Correlation	-.403	.109	-.277	.470(*)	1	
	Sig. (2-tailed)	.056	.622	.200	.024		
Ch7 efficiency	Pearson Correlation	-.645(**)	.194	-.546(**)	.799(**)	.532(**)	1
	Sig. (2-tailed)	.001	.374	.007	.000	.009	

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 3-2 indicated as follows:

- Online test usage was positively related to Ch5 and Ch7 learning efficiency.
- Online clips usage seemed not as important as online test.

4. Findings and conclusions

4.1. Conclusions

This research showed the learning achievement is highly positively related to the IT environment and negatively related to the e-learning efficiency of students. But it can't explain why better learning achievement comes with better IT environment. Generally speaking, better IT environment means better economic conditions, and the families with better economic conditions usually pay more attention to the learning of children.

The students with lower learning achievement got better e-learning efficiency. They didn't often spend time in math study after school, and this research forced them to study math online. To reduce the gap of math achievement of students, this research worked greatly than expected.

The online test usage is positively related to the e-learning efficiency, but online clips usage is not. This is an interesting result. It seems that online clips are not as important as online test,but according to the log files in Moodle the researchers can find that the students with better learning achievement watch the online clips more frequently.

4.2. Contributions

- Building the Moodle CMS platform for the elementary school.
- Constructing the useful e-learning contents of math.
- Helping teachers to improve the quality of learning by Moodle.
- Improving students' learning achievement of math.
- Students can get familiar with the teaching material of math by repetitive use of Moodle.
- Lowering the gap of math scores between the students with high and low learning achievement.
- Parents can use the Moodle to get familiar with the teaching material of math, and then they can induct their children to finish homework.

4.3. Limitations

This research aimed at the elementary school students in the geoponic village. The counts of students in the class are not as many as that in the city. So the results may not be implemented to the elementary schools in city.

4.4. Future work

This research showed that e-learning works to improve the scores of math. But students with different learning achievement need different teaching materials. Adaptable e-learning may be a more efficient way to improve both students with high and low learning achievement.

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