

Learning Performance Evaluation in eLearning with The Web-based Assessment

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Abstract: With the prevalence of Internet, eLearning provides a platform for education that enables students to take classes online. While eLearning provides a flexible learning environment, it also has drawbacks. This research investigated the potential benefit of the proposed method in an informal formative web-based assessment. The data were collected from college students in three separated groups. The statistical analyses showed mixed results. Some possible reasons were discussed along with other methods that could be further explored in the future.

1. Introduction

Nowadays, many people have experiences with Internet. In Taiwan, the estimated Internet users are 18.83 million out of the total population, 23 million. There are more than 83.7% of the people who can access broadband network. Most users access Internet at home with a high frequency of 91.2%[1]. These bring about new alternatives in pursuing higher education. ELearning provides opportunities that utilize Internet technologies to access educational curriculum outside of a traditional classroom.

Among Internet applications, eLearning offers a flexible learning environment, an easy access to online learning resources, and a feasible solution to self-learning [2]. Since eLearning provides a flexible learning environment, one could learn without the restriction of time and space [3][4]. However, there are some drawbacks in eLearning, such as, the basic computer manipulation skills are necessary, and it may be inconvenient to the individuals who seldom use a computer. Hence, it minimizes the learning results and learners' satisfaction [5]. In addition, eLearning environment usually lacks interaction [6][7]. The learners may misunderstand the learning materials. The learners in the eLearning platform may perform worse than the students in the traditional classes. As to the drop-out rate, in the traditional course is around 10%-20%. And, it rises to 25%-40% in eLearning [8].

In the traditional face-to-face learning environment, students have to attend the classes and arrive on time. They have to schedule study time regulated by the instructor. In contrast, in the eLearning environment, students could study whenever they have free time without the regulations from their instructor. Although eLearning has the advantage of flexibility, it lacks face-to-face regulations and enforcement. If students are short on motivation, they could become procrastinating or even stop using the eLearning system altogether [9].

Comparing with the traditional classrooms, eLearning may have no real-time interactions, learners could study passively, unable to ask the instructor questions and to discuss study materials with classmates. In the meantime, they could have difficulty navigate the eLearning system, resulting in low satisfaction, thus discourage students in the eLearning environment. Positive correlations were found between user satisfaction and system interactivity investigated by a previous research [10]. In addition, the formative assessment is often used as a separated part embedded in the eLearning system. Although the feedbacks from students who have taken the formative assessment are mostly positive [11], this assessment needs to be taken by students voluntarily in the eLearning environment. If the students do not self-regulate to use it, the effect of the formative assessment may be lower than that it should be. Thus, it brings about embedding an assessment in the eLearning system. This setting forces students to study the learning material and to take the assessment in the same eLearning session. It could be helpful in increasing the successful rate of the eLearning system. Hence, this paper proposes a scheme to prompt students' interest in using eLearning and to increase students' usage of

the system. The scheme contains a formative assessment that embedded in a lecture video. It is designed to use the informal formative assessment to prompt the student's interest in the eLearning.

The following section introduces the formative assessment in the eLearning, and the evidence that the assessment supports students' learning by keeping their interest in the eLearning. The third section describes this research's research method. The fourth section gives the discussions about research hypothesis and the statistical analysis of the experiment results. Finally, the conclusion and research challenges are addressed in the last section.

2. The Formative Assessment

There are two kinds of assessment in general: the summative assessment and the formative assessment. The summative assessment is used for the purpose of grading. It is used to judge the degree of understanding. An exam is a good example of summative assessment. On the other hand, the formative assessment is used to help students' learning. It provides the instructor insight in terms of what students have understood and confused. Similar to the summative assessment, it could be an exam and its result could be considered part of grading. However, the grade for formative assessment is not as important as that for summative assessment. The initiation–response–evaluation or initiation–response–feedback sequence is the best to describe formative assessment [12]. The instructor initiates the process and asks a question. S/he retrieves responses from the students and provides a feedback to the students. This way, instructors can gather all information from the students and know what the students don't understand. Then, they adjust teaching style if it is necessary. With a different teaching style, students could get a deeper understanding from the feedback. Hence, the formative assessment is helpful to improve learning.

There are two different types of formative assessment [13]. One is the formal formative assessment. Instructors pre-schedule the assessment and they can manage the content and get feedbacks from the students. The other one is the informal formative assessment. As its name suggests, the assessment can be held during the interactions between teachers and students. Both of these two formative assessments have a similar process including initiation–response–evaluation and collecting student's learning progress. Because the formal formative assessment is planned ahead, the instructors can predict what types of information will be collected and how to evaluate such information. Informal formative assessment is only implemented at times during the course of the term. Both formal and informal formative assessments are helpful to student learning.

Since the purpose of the formative assessment is used to help students to learn, it could be significantly related to the positive learning performance. Most researchers use the formal formative assessment for the experiments [14]. They built the assessment separated from the teaching material. This paper proposes an informal formative assessment method in the eLearning environment, which is similar to the traditional classroom. The purpose is to explore whether the informal formative assessment still has the same effectiveness in the eLearning environment.

3 Research Questions and Research Method

As mentioned in section two, the formative assessment can be used to improve students' learning, and the feedbacks from the students are also positive. In that thought, the proposed eLearning system has an informal formative assessment embedded. This research is designed to investigate whether the proposed embedded assessment could prompt students' interest and increase their eLearning usage.

There are four questions that are related to our experiment:

Question 1: Does the formative assessment prompt students' eLearning usage?

Question 2: Does the informal formative assessment improve students' learning performance?

Question 3: Is there a significant relationship between the usage frequency and the learning performance?

Question 4: Does the roll call increase students' eLearning usage?

Due to the limitation of resources, this research has held an experiment in an undergraduate course, Introduction to Statistic. This course is one-year long spanning in two semesters. There were 55 students registered for this course in the first semester. In the subsequent semester, there were 68 students including the

51 students from the previous semester. Only the 51 original students taking the class from the previous semester were chosen for the experiment for the obvious reason. According to the performance on the mid-term exam before the experiment, students are randomly clustered to 3 groups named with Question-Embedded eLearning System group (QEES), Roll-call-Embedded eLearning System group (REES) and Control group. Each group consists of 17 students. The composition of students is shown in Table 1.

Table 1. Summary of group composition

	QEES	REES	Control
Gender			
Male	6	6	10
Female	11	11	7
Age			
20	9	15	13
21	7	2	4
25	1	0	0

* Every participant is a sophomore majored in MIS

The eLearning system used in this research is implemented with PHP and MySQL. There are two parts in the system. One contains the information related to class and the other contains the teaching material including PowerPoint slides and the teaching videos. Depending on the experimental groups, there are 3 different appearances to play the videos as follows.

1. QEES group: The students will have a screen with two areas. One area is used for playing a teaching video and the other area is used for showing an assessment question. The video playing area attaches with a functional control panel bar including Pause, Play, Forward or Backward and Seek. Beside to the video playing area is the question showing area. When the instruction video reaches a specific time, the video player will pause and display an assessment question in the question showing area.

2. REES group: Without the meaningful assessment questions, the system contains an area to play a teaching video, similar to the one for QEES group. There is no area to show the question. Instead, there is a text entry to record that the students are using the system.

3. Control group: This system only contains an area for playing a teaching video. Without any inspection, it recognizes the students are studying with the eLearning after logging in the system. Comparing to the system for REES group, there is no inspection to assure if the students are using the eLearning. However, the mechanism is still existing for checking the usage frequency.

4 Hypothesis and Experimental Results

In order to answer the research questions, we have derived the hypotheses and variables from the proposed questions.

Hypothesis 1: students in the QEES group will use the eLearning system more frequently than those in the control group.

Hypothesis 2: students in the REES group will use the eLearning systems more frequently than those in the control group do.

Hypothesis 3: students in the QEES group will have a better learning performance than those in the control group.

Hypothesis 4: students' learning performance is positively correlated with the eLearning usage frequency.

After the experiment, we analyzed the collected data and obtained the following results. Because Hypothesis 1 and Hypothesis 2 discuss the eLearning usage frequency, their results are presented together. We investigated the usage frequency for each chapter and determined any difference. The results of the ANOVA analysis with respect to the Average Usage Frequency are shown in Table 2. The significance value is 0.004 which indicates a significant difference among the groups. Then, LSD test is used to compare these groups and the result is shown in Table 3. The control group is significantly different from the other two groups because of the p-values. Furthermore, the mean differences between Control group and the other two groups are positive. It shows the Control group has the highest usage frequency. Hence, the students in Control group use the eLearning system more frequently than those in the other groups do. Since the usage frequency in the eLearning system is related to the students' intention of using a specific technology, this research adopts Technology Acceptance Mode (TAM) [15] for the experiment.

Table 2. ANOVA Analysis to Average Usage Frequency

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	222.275	2	111.137	6.352	.004
Within Groups	839.765	48	17.495		
Total	1062.039	50			

Table 3. Pairwise Comparison of Average Usage Frequency

(I) Group	(J) Group	Mean Difference		Sig.	95% Confidence Interval	
		(I-J)	Std. Error		Lower Bound	Upper Bound
QEES	QEES					
	REES	1.88235	1.43466	.196	-1.0022	4.7669
	Control	-3.17647(*)	1.43466	.032	-6.0610	-.2919
REES	QEES	-1.88235	1.43466	.196	-4.7669	1.0022
	REES					
	Control	-5.05882(*)	1.43466	.001	-7.9434	-2.1742
Control	QEES	3.17647(*)	1.43466	.032	.2919	6.0610
	REES	5.05882(*)	1.43466	.001	2.1742	7.9434
	Control					

* The mean difference is significant at the .05 level

The results of ANOVA analysis with respect to the mean grade are given in Table 4. According to the results, there are no significant differences among these groups because of the p-values. The students in the different group have the identical performance without the influence of the assessments. From the previous related works, the formative assessment is able to increase students' learning performance. However, the analysis result is not able to demonstrate such effect in this research. The reason could be that informal formative assessment does not have a similar effect to that the formal formative assessment does in the eLearning environment.

Table 4. ANOVA Analysis of Mean Grade

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	16.193	2	8.096	.007	.993
Within Groups	55835.216	48	1163.234		
Total	55851.408	50			

With the regression analysis, the usage frequency is the independent variable and the score of the exam is the other dependent variable, the results are given in Table 5. According to the standardize coefficient, Beta, it is significantly positive. It shows the learning performance is positively related to the usage frequency. Comparing with the pure eLearning courses, there still exists some external influential factors. For example, the registered students in this course are familiar with each other. They could get the knowledge of the course by using the eLearning system, or by studying and discussing the material with other students. It is difficult to determine if the eLearning prompt students' learning.

Table 5. Regression Analysis

	Beta	t	Sig.
Frequency of Use	.309	2.276	.027

*Dependent variable: Grade

5 Conclusion

This research attempts to apply an informal formative assessment in the eLearning environment. Due to the research limitation of time and available research subjects, it adopts a hybrid approach from a traditional course in Statistics. TAM model is employed to obtain the results. The students in Control group can use the system easily without any interruption. It is reasonable to explain they have the highest usage frequency in the eLearning.

Referring to the hypothesis of this work, the proposed method should have added the interactivity to the eLearning system to increase learners' interest and willingness to use the system. However, the results have shown otherwise. Other methods, such as applying Web 2.0 technologies, may increase the desired interactivity. Web 2.0 is a Web service in which the users could also be the contributors. Such service often requires the high involvement of users and possesses high interactivity. Hence, Web 2.0 is a good candidate with the potential to solve the concerned problem.

ACKNOWLEDGEMENTS

This work was supported by Ministry of Science and Technology Grant (MOST 105-2410-H-468-009).

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