

The Effects of Online Activities on Student Learning Outcomes in Blended Learning Environment

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ABSTRACT

This quasi-experimental study aims to find out how online activities influence the learning outcomes of Yogyakarta State University students on e-learning courses. This 4-week study consisted of two experimental groups and one control group. The experimental groups received face-to-face instruction plus e-learning or blended learning (BL) with online discussions and quizzes. The control group used Blended Learning without any online activities. Quantitative analytical results include 1) student's learning outcomes in BL with online discussions and quizzes are better than those without any online activities. 2) The student's learning outcomes in BL with online discussions and quizzes are also better than those with online quizzes. Furthermore, this study also found that 3) student's learning outcomes in BL with online quizzes are better than those without any online activities and 4) there is a positive correlation between student's learning outcomes and their level of activities in the BL environment.

CCS Concepts

• Applied computing → Education → E-learning

Keywords

E-Learning; Online activities; Blended learning.

1. INTRODUCTION

Along with the development of internet technology, the adoption of online learning in higher education is increasing as an alternative to face-to-face learning in the classroom. The online learning provides flexible, personalized, authentic ways for teachers and students to interact with others [1, 2]. It also provides convenience for students in learning activities such as increasing productivity, flexible, and interactive [3].

Activities in e-learning that encourage students to be active, interactive, and collaborative with their friends can improve the quality of the online learning environment. Through these activities, students can develop critical thinking skills, deepening material, reflection, high-level thinking skills, and transformative

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learning [4]. In line with adaptive e-learning, this activity can also accommodate a variety of learning styles and cultures because collaboration values diversity. In reality, collaboration activities in e-learning are often disliked and tend to be avoided by students [5]. Therefore, online activities need to be implemented in e-learning by utilizing innovative information technology, both synchronous and asynchronous.

In the e-learning environment, to make students active, interactive, and collaborative so that they remain motivated throughout the semester is not easy because students are accustomed to face-to-face learning. Therefore, lecturers need to design scenarios that contain online activities in stages [6]. Stage 1, which is conducted at the first and second week, contains a lightweight interactive activity with the aim that students recognize the online learning environment and get to know other students. This activity can be an icebreaker, an activity that aims to establish the existence of individuals and open communication channels for learning communities in a fun way. Through this activity, students will feel a pleasant learning atmosphere.

Stage 2, which is conducted at the third and fourth week, contains activities that require critical thinking, reflection, and exchange of ideas. This activity aims to develop academic ideas and share with others whose forms can be peer-reviewed in pairs. Stage 3 is carried out at week five and six, which is useful in developing collaboration skills to solve problems and share experiences in small groups. The form of activity can be in the form of discussion, role-playing, games, simulations, etc. Stage 4, which is carried out at week seven until the end of the semester, contains student-led activities. Students in larger groups create and lead activities for deepening specific material.

Research on 21 students taking online courses in New Zealand shows that there is a correlation between the level of online participation and motivation with learning outcomes. Online participation is seen from the number of activities in posting in discussion forums [7]. LMS can improve student motivation and confidence in online learning [8]. There is a positive correlation between student online activities and their learning outcomes [9].

Research by Kupczynski et al. [10] of 1631 students at universities in Southern Texas who took full online courses during a school year showed that the more active students were in online learning, the higher the final grades obtained. Activities in this study were measured from the frequency of students in logging into the online course portal.

Cheng and Chui [11] studied 78 students who took the "Digital Citizenship" online course in higher education in Hong Kong. Online courses are in LMS Moodle with various activities, namely information access (online reading), interactive learning

(simulation), online learning (discussion forum), writing material (reflection). Online participation is measured by the number of activities completed. The results showed that the level of participation correlated positively with learning outcomes.

In a blended learning environment, there are many factors affecting students learning outcomes, among others, include reading and posting in the discussion forum, creating content, answering quiz, and viewing materials [12]. Because in the blended learning environment students used most of the time to interact with e-learning systems, interactive activities are believed to be one of the factors that most influence student learning outcomes [13, 14, 15]. Online interaction that provides the most significant impact on student learning outcomes within blended learning is between student and student type interaction [16].

In this study, online activities implemented in Besmart (YSU e-learning portal) are online discussions and online quizzes. Besmart is an LMS-Moodle based e-learning system used within the Yogyakarta State University. In online discussions, the lecturer asks students to give responses related to learning material in a particular week. Lecturers can also provide problems to lure students into providing solutions related to learning materials. Furthermore, other students can respond to the opinions of other students. Through this activity, it is expected that students will better understand the learning material in that week.

Besides, the activity in the form of an online quiz was also applied in this study. The online quiz contains ten pieces of multiple-choice questions related to the material in a particular week. Students work on the questions online, and after they finish, they immediately know the results obtained. This online quiz is intended to measure the level of understanding of the material in a particular week.

2. METHOD

2.1 Design of Study

In this study, two experiment groups and a control group of the quasi-experimental design was used. Students in all groups learned an e-learning course in a blended mode, which is a combination of face-to-face instruction and online learning. The first experimental group received face-to-face instruction plus e-learning (blended learning), which was equipped with online activities in the form of online quizzes (BL-Q). The second experimental group received the same blended learning instruction with online discussions and quizzes (BL-DQ). While the control group received the same blended learning without being equipped with any online activities (BL-NA).

A dependent variable observed in this study was students' learning outcomes obtained through post-tests at the end of experimentation. The treatments for providing learning materials through face-to-face and online instructions were conducted in four meetings for four different topics. Four topics covered in the study include Concepts and Utilization of E-learning, E-learning Design, and Development, E-learning Tools and Technologies, Learning Management Systems (LMS). Those would be independent variables. A pre-test was not used because of an assumption that at the beginning of the study, they have the same pre-requisite knowledge.

There were some treatments had been done to overcome threats to internal validity, such as (1) experimental mortality. This threat was overcome by making classroom conditions like normal lectures, where students were required to stay in class from beginning to end. The next treatment was (2) testing effects. This

threat was overcome by giving the only posttest, without pretest so that students when working on posttest were not affected by previous tests; (3) History effects: This threat was overcome by making the same research settings for all research groups, namely: teacher, material, time, place.

2.2 Participants

Participants were 120 junior undergraduate students registered in an "e-learning" course from the Information Technology Education Department at the College of Engineering, Yogyakarta State University – Indonesia (age 19-21; 83 males and 37 women). They willingly participated in the research. They were split into three groups, each of which included 40 learners. The groups were randomly allocated to first and second experimental groups and a control group. Participants were notified of the purpose of the research, the experimental groups, the teaching materials, the lecture, and their research conditions before group tasks and experimentations.

2.3 Data Collection and Analysis

A post-test was provided for the control and the experimental groups to evaluate the learning outcomes of the learner at the end of the experiment. Students in all groups took exams in the midst of the experiment to evaluate their level of understanding of each subject. There are four sets of test tools, each consisting of 10 multiple choice questions. Each set of tools was built by referring to each week's material subjects. Expert judgment was used to validate the study instrument's content. The test questions were prepared on the basis of the teaching frameworks created before the material subjects were referred to. It was also created according to the e-learning course's syllabus. In this research, online activities were gathered from student frequency in posting a fresh post and reacting to messages as well as logging into online quizzes.

Either one-way ANOVA or comparable non-parametric Kruskal-Wallis was used in this research to evaluate the three suggested hypotheses based on the data acquired. The data was inspected to see if it met the circumstances needed for statistical testing. The data analysis was replaced by the Kruskal-Wallis test and continued with the Mann-Whitney test if the data did not meet the normality requirements based on the Shapiro-Wilk test. A α -level of .05 was used for statistical testing. Using Spearman rho, the fourth hypothesis was tested.

3. RESULTS AND DISCUSSIONS

3.1 Results

Summary of detailed results (Mean, Standard Deviation, Minimum, and Maximum Scores) from four-week experimentation is reported in Table 1; while its boxplot diagram is illustrated in Figure 1. The mean score was obtained from learning outcomes test scores conducted every week.

Table 1. Descriptive result summary

Group	N	Mean	SD	Min	Max
BL-NA (0)	40	45.3	11.4	27.5	77.5
BL-Q (1)	40	63.2	14.5	30.0	87.5
BL-DQ (2)	40	77.4	12.5	50.0	95.0

BL-NA group (0): Blended Learning without activity

BL-Q group (1): Blended Learning with Quizzes

BL-DQ group (2): Blended Learning with Discussion and Quizzes

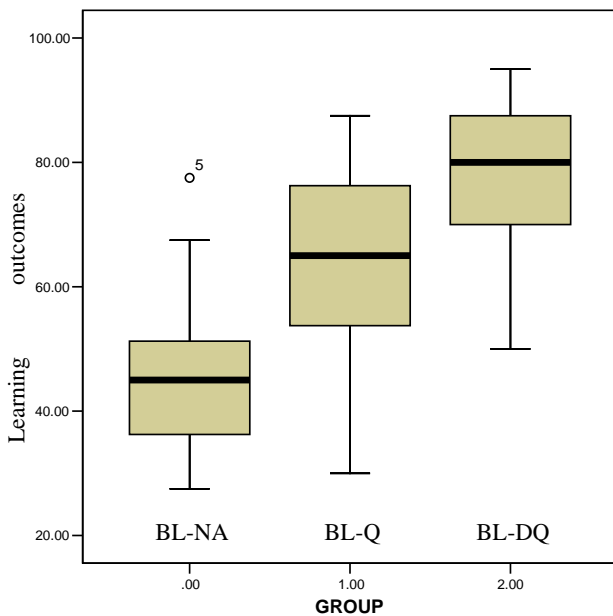


Figure 1. Boxplot diagram of experimental group's scores

Each of the three hypotheses to be tested in this study compares students' learning outcomes between the two groups. The data were analyzed using the Kruskal-Wallis test, which is the non-parametric version of ANOVA because this research design involved three groups. It was used to test whether there were differences between the three groups. The results showed that there were significant differences between the three groups ($p=0.000$). Using the Mann-Whitney U test would further prove whether there were differences between each pair of two groups.

The first hypothesis was tested by conducting Mann-Whitney U test with groups of BL-DQ and BL-NA as the between-subject factor, and learning outcomes score as dependent measure. From the data obtained, it was concluded that students who learned in Blended Learning with online discussions and quizzes (BL-DQ group) gained better learning outcomes significantly ($p=0.000$) than those who learned in Blended Learning without any online activities (BL-NA group). BL-DQ group mean = 77.4, and BL-NA group mean = 45.3.

The second hypothesis was also tested with the same tool by comparing BL-DQ and BL-Q groups. From the data collected there is strong evidence to suggest that the student's learning outcomes in BL-DQ group where students learned in Blended Learning with online discussions and quizzes were better significantly than in BL-Q group where students learned in Blended Learning with online quizzes ($p=0.000$). BL-DQ group mean = 77.4, and BL-Q group mean = 63.2.

Using the same statistical test, the third hypothesis was tested by comparing BL-Q and BL-NA groups. It was found that students who learned in Blended Learning with online quizzes (BL-Q group) gained better learning outcomes significantly ($p=0.000$) than those who learned in Blended Learning without any online activities (BL-NA group). BL-Q group mean = 63.2, and BL-NA group mean = 45.3.

Finally, the fourth hypothesis was tested using Spearman rho. The correlation coefficient value between online activity and learning

outcomes scores is 0.701 with $p = 0.000$. Therefore, based on the collected data, there is strong evidence that there is a positive correlation between online activity and student learning outcomes in e-learning courses significantly with a significance level of 5%.

3.2 Discussion

E-learning used in this study is part of the blended learning held at Yogyakarta State University, which is a combination of face-to-face instruction in classrooms or laboratories with online learning using Besmart. E-learning should not only contain teaching materials or learning resources but also contain online activities [17]. Besmart is used by some lecturers only to upload teaching materials, so online learning becomes less interactive. It happens because to create and manage online activities requires much time, especially outside the teaching hours. Online learning that contains only resources or teaching materials is called without online activities, because students do not do any online activities such as sending, working, responding, exchanging ideas, but only downloading materials.

Online activities can be used to optimize learning through discussion forums, quizzes, and assignments. In discussion forums, lecturers can submit problems to be addressed by students, so that in this forum, constructive ideas are exchanged to improve students' understanding in a particular week. In quizzes, lecturers can provide mild and short questions to maintain the memory of learning material in a particular week. For more complex topics, lecturers can use assignments.

In this study, students in the control group (BL-NA) were given face-to-face instruction plus online learning in the form of e-learning which is commonly used by lecturers namely e-learning which only contains teaching materials without any online activities. A higher level of treatment is in the experimental group 1 (BL-Q), which is given face-to-face instruction plus online learning in the form of e-learning with one type of online activities, namely quizzes. The highest treatment was in the experimental group 2 (BL-DQ), which was given face-to-face instruction plus online learning in the form of e-learning with two types of online activities, namely quizzes and discussion forums.

Overall, a summary of the learning outcomes scores of the three research groups is displayed on the Boxplot diagram in Figure 1. Graphically, the diagram shows the values of central tendencies and symmetry data from three research groups at once. This diagram can be used to help understand the characteristics and distribution of data in the form of learning outcomes scores from each research group. From the diagram, it can be seen that the average of BL-DQ score is the highest, followed by the averages of BL-D and BL-NA respectively.

Online activities from a combination of quizzes and discussion forums provide the most optimal understanding of the material for students. Moreover, It is also proven from the results of hypotheses 1, 2 and 3 testing. The results of hypothesis testing number 1 prove that student learning outcomes with online discussion and quiz activities are better than without online activities. While the results of hypothesis testing number 2 prove that student learning outcomes with discussion activities and online quizzes are better than online quiz activities only. The results of hypothesis testing number 3 prove that student learning outcomes with online quiz activities are better than without online activities.

The higher the level of student activity in online learning, the higher the achievement of learning outcomes. This is evidenced

by the results of testing hypothesis 4, which states that there is a positive correlation between the level of online activity and student learning outcomes in E-learning courses. The level of activity referred to in this study is the frequency of students participating in predetermined activities, namely online discussion and quiz forums for experimental group 1 and online quizzes for experimental group 2.

These findings are in line with other previous researchers such as Harnett [7], Huang and colleagues [9], and Kupczynski and colleagues [10] resulting in a positive correlation between activities and grades in an online environment. Good e-learning not only contains quality teaching materials but also must be able to facilitate student activities online. To make students active, interactive and collaborative so that they remain motivated throughout the semester it is not easy because students are accustomed to face-to-face learning. Therefore, lecturers must design scenarios that contain online activities in stages, as suggested by Conrad & Donaldson [6].

4. CONCLUSIONS

This study showed that the effect of online activities in a blended learning environment significantly improve students' learning outcomes in e-learning courses. The online activities in this study included a discussion forum as a means of exchanging ideas, responding to problems, answering other people's questions, and quizzes to assess students' understanding of learning materials. Besides, the more active students in the online activities, the higher their achievement in learning outcomes. This research suggested the lecturers use an e-learning by accommodating various online activities. Further research may investigate various types of interactions in online activities such as lectures-students, students-students, and students-systems.

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