

Blended Learning and Creativity-Based Learning for Promoting Mathematics Achievement and Information Technology Performance

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Abstract

This study aimed to develop blended learning activities and creativity-based learning in the Mathematics for Computer Course (MCC), compare mathematics achievement in the MCC at a 70% threshold score, compare students' information technology usage performance, and investigate students' learning satisfaction. The participants were freshmen who enrolled in MCC at Kalasin University, academic year 2021. Purposive sampling was employed in the recruitment of 25 students. The research tools included: six activities in the MCC, multiple-choice achievement test with 30 items, the information technology competency assessment form, and a 15-item activity satisfaction scale. The statistics used in the data analysis are descriptive for calculating mean, standard deviation, and percentage, as well as one sample *t*-test for hypothesis testing. The findings indicated that the academic achievement of students representing 76.67% higher than the specified threshold of 70% with statistical significance at the 0.05 level. Students' competency in using information technology is 81.67 percent, which is higher than the threshold and they were satisfied with learning approach.

Keywords: Blended learning activities, Creativity-based learning, Information technology competency promoting activities

1. Introduction

1.1 Introduce the Problem

Higher education institutions are being challenged to provide effective teaching techniques, online learning, high-quality technology, and a self-paced social environment to meet the needs of 21st-century learners (O’Flaherty & Phillips, 2015). It emphasizes learning management processes that allow students and teachers to choose their preferred teaching style (Alsalmi et al., 2021). Educational institutions began to seek out high-quality teaching methods in order to instill student enthusiasm and positive interactions. To improve educational outcomes, the United Nations has recommended teaching methods for teachers to use. The combining traditional education with a wide range of e-learning technologies and electronic innovation inside and outside the classroom are examples of such methods (United Nations, 2019; Nuangchalem, 2020). Students can interact in person with teachers while also participating in web-based activities such as group discussions, reading assignments, and writing assignments that support blended learning goals. It combines the best aspects of traditional classroom and online learning to encourage self-study while reducing time spent in traditional classes.

1.2 Explore Importance of the Problem

The MCC, taught and learned at Kalasin University’s Faculty of Education and Educational Innovation, is a subject that is required for computer work and thus differs from general mathematics. It contains difficult and complex content. That are the reasons that researchers who are the instructors interested in researching on blended learning. It is an innovative education that combines modules and teaching styles. It is a style of blending distance learning via online networking with face-to-face learning, resulting in more effective learning and students’ information technology performance than sitting and listening to lectures in traditional classrooms. This is consistent with the findings of Alsalmi et al. (2021), who discovered that blended learning is more effective. Learners outperformed their peers in mathematics courses by the idea of blending. It could be a combination of various teaching methods. Blended learning activities, over the whole, are excellent at improving students’ ability to think creatively. However, a student’s ability to think creatively is influenced by their metacognition, which influences their talents as well. As a result, one of the most important aspects of math study and application is the capacity to think creatively. It is up to the teacher in the classroom to ensure that students not only grasp the learning materials but are also prepared for further study of applied mathematics (Kusuma et al., 2021).

1.3 Describe Relevant Scholarship

As a result, the researcher has combined the creative-based teaching and learning model serving as the foundation with the information technology competency promoting activities developed by Sinlapaninman (2016), which consists of four activities: select, search, produce, and communicate, abbreviated “SSPC” (Sinlapaninman, 2016). The SSPC activities are the

activities that encourage students to use technology and digital media in their learning, allowing students to become competent in using information technology, which is a critical skill in the twenty-first century, and a lack of competency in using technology will cause students to struggle with learning (Kuzminska et al., 2018). Digital technology has an impact on many different activities. As a result, people will have more confidence in their activities as a result of their digital capacity to use information and communication technology (ICT) tools. As a consequence, people must be encouraged to learn how to use technology. The SSPC consists of four steps to blend the creative-based teaching and learning approach as the foundation: (1) arousing interest; (2) problem solving and interest-based grouping; (3) conducting research; (4) evaluating; and (5) Presentations (Rukchaipanit, 2015). Individualism, collaboration, independence, and involvement are all supported by blended learning. Because learners may learn at their own pace, take control of their learning, and track their progress, it allows for more flexible and less stressful skill practice (Adam & Nel, 2009). The researcher performed research on the development of blended learning in MCC based on the significance and origins of the concerns.

1.4 State Hypotheses

This study aimed to develop blended learning activities and creativity-based learning in the MCC, compare mathematics achievement in the MCC at a 70% threshold score, compare students' information technology usage performance, and investigate students' learning satisfaction. The findings will help educators plan their learning lesson and teaching strategies to engage students with course.

2. Method

This study is quantitative research aiming to develop blended learning approach in MCC. The research design involved One-Group posttest-only, was used by the research method as following:

2.1 Participants

Participants were computer science majoring students from Kalasin University. They were purposive sampling and consisted of 25 first-year students enrolled in MCC, semester 2/2021.

2.2 Research Instrument

(1) The blended learning approach in the MCC consisted of six activities, each of which was quality-checked by three experts. The experts' assessment of the learning management activities yielded an average score of 4.79, indicating that they were at the most suitable level.

(2) Content of Mathematics for Computer academic achievement test were consisted of 30 questions with IOC values ranging from 0.67 to 1.00, difficulty from 0.38-0.69, discriminant indices from 0.25-0.75, and reliability at 0.81.

(3) Assessment of information technology competency usage included 4 activities such as Select, Search, Produce, and Communications. These activities were qualified by three

experts with IOC indices ranging from 0.67 to 1.00.

2.3 Data Collection

(1) Inform the sample group about the instructor's role, learners' role, how to test, evaluate, and what to learn from the program.

(2) The researcher carried out an experiment using the developed teaching method, which consisted of six activities of 50 minutes each, for a total of 16 periods. Then comes the Information Technology Competency Assessment Form, which consists of four activities: (a) Select, (b) Search, (c) Produce, and (d) Communication. The operators and instructors are researchers and research assistants.

(3) At the end of the six-activities experiment, the researchers conducted a mathematics achievement test for the study's groups (Post Test). It is a multiple-choice test with four options and thirty items worth one point each for a total of thirty points. The test lasts 50 minutes, and the students' responses are distributed after they have completed the learning activities.

(4) Score the information technology competency assessment form, the mathematics achievement test, and the student satisfaction assessment. In the following steps, the scores were statistically analyzed to configure the results.

2.4 Data Analysis

(1) Using a one-sample *t*-test, compare the learning achievement and competency of using information technology with the 70% criterion. According to the results, researchers determine the learning achievement and conclude the research experiment.

(2) Analyze the quality of the appropriateness of the learning management plan and the satisfaction of the students after studying by developing a learning method in the MCC and distributing the assessment form to them. The data was analyzed based on mean and standard deviation, and the research findings were summarized.

3. Results

The objectives of this paper were to develop blended learning approach in the MCC. The researcher presented the following summary analysis of the research findings.

3.1 An Analysis of the Blended Learning Approach in the MCC

An analysis of the blended learning approach in the MCC as shown in Table 1.

Table 1. The results of an analysis of a blended learning approach in MCC

Learning Activities	<i>M(SD)</i>	Interpretation
Activity 1 story set	4.75 (0.44)	Suitable
Activity 2 Number systems and equations	4.76 (0.43)	Suitable
Activity 3 Number base-system	4.83 (0.37)	Suitable
Activity 4 Logic	4.83 (0.37)	Suitable
Activity 5 Boolean algebra	4.80 (0.41)	Suitable
Activity 6 Matrix	4.76 (0.43)	Suitable
Overall	4.79 (0.41)	Suitable

According to the results in table 1, the developed blended learning approach in the MCC overall consisted of a mean of 4.79, indicating the most suitable.

3.2 Comparative Analysis of Mathematics Learning Achievement of MCC

Comparative analysis of mathematics learning achievement of MCC after receiving blended learning approach with the criteria of 70% using one-sample *t*-test statistics. The results were shown in Table 2.

Table 2. The results of the analysis of mathematics learning achievement of MCC after school with 70% criteria

Test	<i>n</i>	Full score	<i>M</i>	<i>SD</i>	Percent	<i>t</i>
Post-test	25	30	23.00	3.40	76.67	2.28*

Note. * The *t* value was statistically significant at the .05 level ($t_{.05, 24} = 1.71$).

The results from the analysis of the comparison of mathematics achievement in the MCC are shown in Table 2. After receiving the blended learning approach, the mean score was 23.00 and the standard deviation was 3.48, representing 76.67 percent, which was higher than the specified threshold of 70%. In comparison to the *t*-value, it was found that *t* calculated (2.28) was higher than *t* critical (1.71), indicating math achievement in the MCC after developing and testing teaching approaches, indicating that it's greater than the 70% threshold with statistical significance at the .05 levels.

3.3 A Comparison of Students' Information Technology Utilization Performance

A comparison of students' information technology utilization performance after receiving the blended learning approach in the MCC after learning with a 70% criterion using one-sample

t-test statistics. Table 3 displays the results.

Table 3. The findings of an analysis of students' competency in using of information technology after introducing blended learning approach in the MCC while learning with a 70% success rate

Test	<i>n</i>	Full score	<i>M</i>	<i>SD</i>	Percent	<i>t</i>
Post-test	25	72	55.24	5.17	76.72	4.68*

Note. * The *t* value was statistically significant at the .05 level ($t_{.05, 24} = 1.71$).

According to Table 3, the comparison of mathematics achievement in the MCC after studying with the blended learning approach revealed that the mean score was 55.24, the standard deviation was 5.17, and the percentage was 76.72 percent. The *t* calculated (4.68) was higher than the *t* critical (1.71), indicating that the mathematical achievement of Mathematics for Computer after studying with the developed program was higher than the 70% threshold with statistical significance at the .05 levels. When considering SSPC, Table 4 shows the number and percentage of students who have been assessed on the worksheet.

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Table 4. Shows the number and percentage of students assessed from the activity sheet.

SSPC	Full Score	<i>M</i>	Percent
(1) Select	18	14.44	80.22
(2) Search	18	13.24	73.56
(3) Produce	18	13.80	76.67
(4) Communicate	18	13.76	76.44
Total	72	55.24	76.72

3.4 Analyze Student Satisfaction

Analyze student satisfaction after receiving the blended learning approach by distributing the assessment form to students. Table 5 displays the findings of the analysis.

Table 5. The results of students' opinions after studying with blended learning approach

Issues	Opinion level	
	<i>M(SD)</i>	Levels
1. Students enjoy the teacher-provided activities.	4.33(0.78)	Satisfied
2. Students are happy with their studies.	4.08(0.80)	Satisfied
3. Teachers provide students with opportunities to voice their opinions.	4.63(0.56)	Very Satisfied
4. There is no stress on the students during the course.	3.93(1.00)	Satisfied
5. Students are disappointed when they are unable to complete the tasks assigned to them.	3.52(1.28)	Satisfied
6. Learners are happy when they can work independently.	4.44(0.64)	Satisfied
7. When learners work on their own, they feel good.	4.38(0.70)	Satisfied
8. Students are pleased with their studies.	4.22(0.64)	Satisfied
9. Students enjoy expressing their opinions and asking and answering questions from teachers.	4.07(0.87)	Satisfied
10. Assist in the creation of more responsibility at work, such as follow-up work, etc.	4.26(0.66)	Satisfied
11. Encourage students to take an active role in the teaching and learning process.	4.41(0.64)	Satisfied
12. Make space for students to express themselves and collaborate.	4.37(0.63)	Satisfied
13. It promotes improved interaction between teachers and students.	4.30(0.67)	Satisfied
14 Assist students in using technology to complete tasks in a variety of ways.	4.37(0.63)	Satisfied
15. Use a variety of multimedia media to help students understand the lesson better.	4.26(0.71)	Satisfied
Total	4.23(0.54)	Satisfied

Table 5 revealed that the received blended learning approach increased students' satisfaction after studying with overall values of a high mean ($M = 4.23$) and a standard deviation of 0.54.

Learning through this method lets students have the opportunity to express their views directly to their teachers. The level of disagreement is at an all-time high. The standard deviation was 0.56, and the mean was 4.63.

4. Discussion

The developed plans for the blended learning approach in the subject of the MCC were found to be the most suitable, with a mean of 4.79. This could be since the organizing activities consist of a five-step process: Step 1: Select an activity that piques your interest. Step 2: Identify problems and tools based on your interests. Step 3: Conduct research and put ideas into practice. Step 4: Create work and present it Step 5: communicate together to evaluate. Each step is designed to learn online under learning in epidemic situations where learners have anxiety in learning. The activities are student-centered, allowing students to manage their own learning at any time and from any location, and they are flexible and independent. Manipulation of time will decrease learning anxiety (Phanchamong et al., 2022). Assignments and examinations should be always aware of them and in all places. Additionally, instructional solutions focused on flexible learning may be prepared throughout the epidemic. As a result, blended learning is an effective way to address learning difficulties. It blends a theoretical learning strategy in the classroom with concrete online classroom comprehension strategies, resulting in an independent learning community that can detect difficulties and challenges and find practical solutions quickly. Applications and learning tools that address the needs of scenarios where technology is not a new problem that is only used by a small group of people (Widjaja & Aslan, 2022).

On the mathematics learning achievement of the MCC and the ability to use information technology after learning by a blended learning approach, with a statistically significant level of 0.05. This finding is consistent with the hypotheses. Blended learning activities, according to the research, are effective in developing the ability to think creatively. Encourage students to come up with a variety of inventive solutions and ideas (Kusuma et al., 2021). Academic achievement is influenced by the creative thinking abilities of students with high metacognition. All indicators of creative thinking ability should be enhanced. Students are aware of current math problems. Capable of creating a systematic flow of solutions, as well as the concept of combining teaching and learning technology with practical work, giving students the confidence to use technology for learning and so affecting their capacity to use information technology. These findings back up Bersin's (2004) claim that blended learning is an important part of organizational training. It combines e-learning with other approaches. Knowledge distribution in learning and training combined with CBL consists of five steps, such as (1) creating interest: Get inspired by watching YouTube videos, lessons from Nearpod, playing games from Mathplayground; (2) Assign problems to students and group them according to their interests: Instructors can assign different activities to students based on their interests, such as activities from Desmos worksheets; (3) Brainstorming after joining a group of students: brainstorming assignments and discovering presentation methods, such as using Canva Diagram.net, Miro, Google Slides, Microsoft Math Solver, and so on; (4) Job search and job creation evaluation: Review the information in order to present and exchange methods for each group that is later acquired.

Presentation: This is a circular presentation for each group to have different activities and present their way of thinking and methods of acquiring the assigned activities, presenting, and asking questions in class. Therefore, the blended learning supports learners'

individualism, collaboration, independence, and engagement. It allows for flexible and less-stressful skills practice because learners can learn at their own pace, take charge of their learning, and track their achievements (Adam & Nel, 2009). This will allow students to learn a variety of tools that are both interesting and non-boring.

The overall satisfaction of the students with the blended learning approach was at the highest level. This could be due to the use of a blended learning approach in the board of learning committees. Furthermore, the selected learning activities included searching, creating, producing, and communicating for themselves, including a learning environment. Students are delighted with the integrated learning experience, leading to great self-confidence in technology (Alowedi, 2020; Duangpim et al., 2021).

5. Recommendations

5.1 Recommendations on Applying the Research Findings

(1) While participating in activities, teachers should encourage students to participate in activities that promote their ability to use information technology. Then, the researcher can assist and consult, and keep a close eye on student behavior.

(2) A researcher creates an environment for fostering integrated competency both online and offline through Google Classroom social media and classroom learning. As a result, students should first be taught how to apply for and use Google Classroom social media.

5.2 Recommendations for Future Research

(1) Future studies should be conducted to develop various methods to encourage students to transfer the knowledge gained from training to others so they can be competent in using information technology.

(2) Should be integrated with other teaching methods to develop teaching styles with a diversity of new things to improve teaching and learning effectiveness.

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