

DEVELOPMENT BLENDED LEARNING BASED ON EDMODO TO IMPROVE STUDENTS' HIGHER ORDER THINKING SKILLS

Irmayanti

Tadris Matematika

Institut Agama Islam Muhammadiyah Sinjai

Sultan Hasanuddin No.20 Sinjai

irmayanti91@gmail.com

Sri Wahyuni

Institut Agama Islam Negeri Bone

Hos Cokroaminoto No.1 Bone

srhieunhy@gmail.com

ABSTRACT

This research is a research and development that aims to produce quality blended learning based on Edmodo to improve students' higher-order thinking skills IAI Muhammadiyah Sinjai mathematics education. The subjects of this study were 25 odd semester mathematics students, consisting of 5 men and 20 women. The instrument development procedure used is to adopt the development of 4D model research designs namely define, design, and develop. The results of this study indicate that quality blended learning based on Edmodo product has been produced which is measured based on the criteria of valid, reliable, and has the potential effect of (1) valid and reliable with a coefficient reaching 0.711. (2) has a potential effect on improving the higher-order thinking skills ability of students in mathematics education which can be demonstrated through the ability of students to answer higher-order thinking skills questions and get an average grade of B.

Keywords: Higher-order Thinking Skills; Edmodo; 4D model design (define, design, develop, and disseminate)

1. INTRODUCTION

As the development of science and technology so rapidly and massively shifts the paradigm of education in Indonesia. In this day and age skills are needed that are not just to remember, restate, or refer without doing processing or analysis. To anticipate this, high-level reasoning higher-order thinking skills are needed in the teaching and learning process.

One of the courses that require higher-order thinking skills is calculus 1. This course is one of the most widely used branches of mathematics in the world. The material includes limits, functions, derivatives, and integrals. The material is relatively difficult so that a lecturer must be creative in finding learning methods that can make students able to think critically, innovatively, systematically, and activities carried out by students following the steps of the scientific method. To produce a better evaluation of learning outcomes regarding calculus 1 it is necessary to use a learning achievement test instrument that demands higher-order thinking skills.

The higher-order thinking skills model based on Bloom's revised taxonomy includes analysis, evaluation, and creation that is can to stimulate the potential of students to do high-level reasoning so that it is not only fixed on one answer pattern that results from the memorization process, without knowing the concept of knowledge. Therefore, to improve higher-order thinking skills, a lecturer must be creative and innovative in applying learning models that can adapt to the era of the industrial revolution 4.0. A lecturer must be creative combining face to face learning with online learning. Combining face to face learning with online learning or e-learning is called blended learning (Sjukur, 2012: 4).

One of the popular e-learning applications in recent years is the Edmodo application. Edmodo is one of the web-based learning media used to control student activities both by teachers and parents in the form of virtual classrooms. In essence, Edmodo provides everything we can do in class with students in learning activities, plus facilities for parents to monitor all their children's activities on Edmodo provided they have a

parent code for their children (Kristiani, 2016). By using Edmodo based learning students not only learn on campus but can learn anywhere and anytime.

Based on observations and interviews with one of the Tadris Mathematics IAIM Sinjai lecturers, Nurjannah stated that one of the obstacles in learning Calculus 1 was the allocation of learning time. Besides, students are still very lacking in the ability to analyze, evaluate, and create a problem in the course of calculus 1. Understanding the concepts in calculus 1 requires quite a long time and continuously. If learning is only done a few times without repetition, it causes students to be confused in dealing with different questions. To maximize students' understanding of the concept of calculus 1 requires a lot of time to practice. Therefore, the authors are interested in conducting learning that combines face to face learning and online learning by utilizing the Edmodo application. The learning model is expected to be more practical and effective in improving student higher-order thinking skills. This was confirmed by the results of Zainuddin and Buyung's research which showed that the application of basic physics learning tools based on critical thinking skills using the Android platform Edmodo application could improve students' critical thinking skills (Zainuddin & Buyung, 2018).

Based on the description above, the writer is motivated to research the development of blended learning based on Edmodo to improve students' higher-order thinking skills. The formulation of the problem in this study is how to develop quality blended learning based on Edmodo to improve students' higher-order thinking skills. This research aims to produce quality blended learning based on Edmodo products to improve students' higher-order thinking skills.

2. METHODOLOGY

The type of research is research and development blended learning based on Edmodo to improve student's higher-order thinking skills. Learning tools developed by the semester learning plan and the semester learning plan validation sheet. For development that meet the quality criteria that are valid, reliable, and have potential effects, the content validity instrument is used.

This research was conducted at the Islamic Institute (IAI) of Muhammadiyah Sinjai. The subject of this research is the Tadris mathematics study program for odd semester 2018/2019 mathematics class A in calculus 1, which consists of 25 people consisting of 5 male students and 20 female students. The development procedure in this study refers to the development of 4D Thiagarajan. This development consists of four stages; namely defining, design, develop, and disseminate. This study is limited to development.

2.1 Define

The purpose of this stage is to set and determine learning requirements that include learning objectives and learning material constraints. The steps in this stage are as follows: The first, researchers get a preliminary and final analysis that causes the need to develop blended learning in learning at the student level, especially in the Tadris IAI Muhammadiyah Sinjai mathematics students namely the finding of obstacles in learning calculus 1 courses caused by the allocation of insufficient learning time to guide students in increasing higher-order thinking skills. Besides, students still lack understanding of the basic concepts of mathematics so that it takes hard work from the teaching lecturer to guide students to the stage of thinking ability to analyze, evaluate, and create a problem in the course of calculus 1. Understanding the concepts in calculus 1 requires considerable time and continuously. If learning is only done a few times without repetition, it causes students to be confused in dealing with different questions. To maximize students' understanding of the concept of calculus 1 requires a lot of time to practice so that one solution to overcome the difficulties faced by these students is to implement blended learning based on Edmodo to improve students' higher-order thinking IAI Muhammadiyah Sinjai mathematics education. The second, researchers conducted a student analysis aimed at observing the characteristics of students. The observed characteristics of students consisted of the ability and learning experience of students in solving problems of higher-order thinking skills. The results of the study are used as consideration for developing blended learning based on Edmodo. The third, researcher conducts a task analysis that aims to determine the tasks that must be completed by students during the learning process, and the tasks are adjusted to the level of high-level thinking ability (analyze, evaluate, and create).

2.2 Design

At this stage, researchers conducted the preparation and design of a semester learning plan based on an Edmodo and a high-level thinking ability test to obtain a prototype 1. This design phase includes: (1) the researcher compiled a semester learning plan based on an Edmodo. (2) the researcher designs test grids, integral and function questions, and limits to measure higher-order thinking skills. The design of the test lattice includes writing basic competencies, subject matter, indicators, time allocation, and forms of tests that are based on higher-order thinking criteria. (3) the researcher chooses media that is suitable for the results of student analysis, assignments, and material analysis. Besides, pay attention to the facilities owned by the campus. (4) the researcher chooses the format for designing learning such as student activities, lecturer activities, learning methods, learning approaches, and learning resources. (5) researchers designed a learning model that is blended learning (learning that combines face to face and online learning using Edmodo applications as e-learning

media) and test instruments to measure the extent of the effects of blended learning in improving students' ability to do higher-order thinking tests college of calculus 1.

2.3 Develop

The results of the design phase are consulted with experts to be validated and then carried out trials in the field. The steps of this development stage are: (1) the results of the prototype 1 design were consulted to someone who was considered an expert (expert judgment) to validate prototype 1. Suggestions from the validators were used as material for revision of blended learning based on Edmodo and instrument of higher-order thinking skills test instruments. (2) at this stage, prototype 1 which was revised by experts was trialed to odd semester students in a different class namely mathematics class B. Suggestions, comments, student responses, and observers were used as improvement material for the second prototype. (3) The research instrument developed was blended learning based on an Edmodo process validation sheet and a semester learning plan validation sheet.

3. RESULT AND DISCUSSION

3.1 Result of Development Blended Learning Based on Edmodo

The results of the development blended learning based on Edmodo to improve the higher-order thinking skills of students of IAI Muhammadiyah Sinjai mathematical education using the 4D development research model from Thiagarajan, Semmel, and Semmel and have been modified into three stages namely the defining stage define, design, and develop as follows:

3.1.1 Define

The purpose of this stage is to set and determine learning requirements that include learning objectives and learning material constraints. The steps in this stage are as follows:

The first, researchers get the initial and final analysis that causes the need to develop blended learning in learning at the student level, especially in students of IAI Muhammadiyah Sinjai mathematics namely the finding of obstacles in learning calculus 1 is caused by the allocation of learning time that is not enough to guide students in increasing higher orders thining skills. Besides, students still lack understanding of the basic concepts of mathematics so that it takes hard work from the teaching lecturer to guide students to the stage of thinking ability to analyze, evaluate, and create a problem in the course of calculus 1. Understanding the concepts in calculus 1 requires considerable time and continuously. If learning is only done a few times without repetition, it causes students to be confused in dealing with different questions. To maximize students' understanding of the concept of calculus 1 requires a lot of time to practice so that one solution to overcome the difficulties faced by these students is to implement blended learning based on Edmodo to improve the higher-order thinking of students of IAI Muhammadiyah Sinjai mathematics education.

The second, the development of blended learning based on Edmodo to improve higher-order thinking skills developed was tested on 2018/2019 odd semester students of A mathematics classes, amounting to 5 men and 20 women. Based on the results of the analysis of these students the following information was obtained: IAI Muhammadiyah Sinjai mathematics students only have two classes namely class A and class B. So one class is used as a prototype 1 trial class and one class as blended learning based an Edmodo implementation class as prototype 2; all students have an android mobile phone so that it is easy to download the Edmodo application on their mobile as well as having their laptops and the campus is equipped with Wi-Fi so that blended learning based on Edmodo is easily done by calculus 1 lecturers anytime and anywhere especially on online learning but for face to face learning continues to be carried out on campus; students are still less able to work on problems in calculus 1 at the analysis, evaluation, and creation stages to train students to be more proficient in working on higher-order thinking skills questions, learning cannot only be done face to face but also online learning and Edmodo applications that are used effectively to improve the ability to think of high-level students of mathematics education IAI Muhammadiyah Sinjai.

Third, the researcher gets the results of the analysis of the material from the lecturer in calculus 1. From the results of the analysis the material is integral, functions, and limits that can attract and train students to use several strategies and answer problems that require higher-order thinking skills. The fourth, the researcher gets the results of the analysis in the form of assignments that must be given to students as training material in increasing higher-order thinking skills through blended learning based on Edmodo which gives students forms of questions that are questions that can stimulate higher-order thinking skills by separating questions of analysis, evaluation, and create. Then give assignments in the form of open questions. Besides, it provides assignments in the form of quizzes that are answered based on the timeframe that has been formatted in the Edmodo application. The tasks given are all uploaded and formatted on the Edmodo application while face to face learning, the task is in the form of repetition of tasks delivered in the form of small group discussions in class face to face also sharing about assignments that still need detailed explanations from lecturers in calculus 1.

3.1.2 Design

At this stage, researchers compile higher-order thinking skills tests based on the results of material analysis. The results obtained by researchers at this stage are the grids of integral and function questions and

limits, integral and function questions and limits, key answers to integral and function questions and limits and assessment rubrics: based on Edmodo semester learning plan; lattice integral and function questions and limits, integral and function questions and limits, key answers to integral and function questions and limits and assessment rubrics; the results of the media selection are using computers, mobile phone, and Wi-Fi; the results of the learning format are set out in the table 1 learning design as follows:

Table 1 Learning Design

Learning in online classes	
Lecturer activity	Students activity
Register for the Edmodo application as a teacher Create a study group Uploading RPS that has been compiled as lecture information. In the reference menu, the lecturer uploads some material that can be used as a guide by students in answering the problems that have been provided. On the quiz menu, the lecturer creates a quiz to train higher-order thinking skills for students. In the assignment menu, the lecturer assigns individual assignments to train higher-order thinking skills for students.	Register for the Edmodo application as a students Download the RPS that has been uploaded by the lecturer Search information and process information to solve the problem given by the lecturer Provide responsible arguments about the problem calculus 1 that has been uploaded by the lecturer Discuss with other students in finding solutions to the problems that have been given Do quizzes and assignments given by the lecturer
Face to face learning	
Lecture activity	Students activity
Lecturers convey learning objectives and motivate students The lecturer explained completely again the concepts of material calculus 1 Lecturers conduct a question and answer about student arguments in online classes. Lecturers guide students to solve problems in online classes The lecturer does the reflection The lecturer and students conclude the material	Students pay attention to the complete calculus 1 material from the lecturer Students ask lecturers about problems that are not yet understood

Based on table 1 the learning design shows that in online learning, lecturers and students first create an edmodo account that acts as teachers and students on the Edmodo menu, then the lecturer creates study groups, quizzes, individual assignments, and uploads semester learning plans, and provides problems related to calculus 1 material to students. Students download the lesson plan then study the material described by the lecturer and do the assignments that have been given through edmodo. As for face toface learning, the lecturer explains the material completely and motivates students to attend lectures properly and enthusiastically in studying calculus 1 material and discussing problems given to online classes through question and answer. Students attend lectures and ask questions about calculus 1 material that is not understood and at the end of the lesson the lecturer reflects and together with the students concludes the material.

The results of the initial design were prototype 1 consisting of Edmodo-based Semester Learning Plans and research instruments consisting of higher-order thinking skills questions, validator grading sheets, grading rubrics, test grids, and question-answer keys.

3.1.3 Develop

This stage is to produce Edmodo-based blended learning prototypes that are based on the advice of experts and data obtained from the results of trials. Activities at this stage consist of two activities carried out in succession, namely: (1) expert review aims to revise prototype I to prototype 2; (2) Edmodo-based blended learning trials aim to revise prototype 2 into the final prototype. A brief description of the results of each activity at this stage is as follows:

Expert Review Results

At this stage, a validation process is carried out for the instruments that have been developed. The validation process for the developed research instrument includes two stages, namely the validation stage for the initial design of the Edmodo-based Semester Learning Plan instrument and the higher-order thinking skills test kit for the integral calculus course and the functions and limits that have been made by the researcher and the second

validation is carried out on the revised results which have been done based on the suggestions given by the validator. The results of the first and second validations are described as follows:

First Validation The first validation process is carried out by submitting an initial draft of the learning kit, which is an Edmodo-based semester learning plan and a test kit that has been developed to the validator team. The research instruments developed include Edmodo-based blended learning media and test instruments consisting of (1) lattice tables; (2) Questions about higher-order thinking integral material and functions and limits; and (3) assessment rubric. The results of the validation carried out in the first validation process include suggestions from the validator team as follows:

In the integral problem which is the initial design consists of 5 number of questions about the level of thinking to start from analysis, evaluation, and creating. In the analysis problem, it does not illustrate that the analysis problem still needs to be broadened to the integral concept and integrated with the derivative concept. also, the problem needs to be revised in terms of the language of the question that needs to be revised so as not to cause a double interpretation of the tester.

The format of the assessment rubric is changed following the questions and answers to the questions

In the e-learning media, especially in the quiz menu, it still needs to be revised, especially the problems that have not trained students to think at a higher level.

In the learning device especially the semester learning plan it is better to describe in detail the material and learning models used in class.

Second Validation The second validation process is carried out by submitting the revised results of the first validation process by the notes provided in the first validation process from the validator team. From the results of the validation in this second stage, the validation team has provided an assessment of the research instruments that have been developed through a validation sheet for each instrument that has been developed. The results of the analysis of the agreement of two experts on the instrument can be stated as follows:

Table 2 results of the agreement between the two experts on the instrument

		Validator 1	
		Relevance is weak Score (1-2)	Relevantly strong Score (3-4)
Validator II	Relevance is weak Score (1-2)	0	0
	Relevantly strong Score (3-4)	0	20

Based on the assessment given by the two validators in table 2, the validity level can be calculated based on the formula of the content validity coefficient as follows:

$$\text{Validity of contents} = \frac{D}{A+B+C+D} = \frac{20}{20} = 1$$

So, it can be concluded that the validity obtained is 1 or $V = 100\%$. This means that the results of the assessment of the two validators have strong relevance with the content validity coefficient greater than 0.75 or $V > 75\%$, it can be said that the results of measurements or interventions carried out are valid.

The final stage of conducting research using the development model of Thiagarajan is field trials. This stage is carried out in a limited and simple way by giving tests to many of students in mathematics. The prototype III produced is valid and reliable so that field trials can be carried out to see the potential effects on students' higher-order thinking skills. A total of five questions were solved by students in mathematics in one meeting for 100 minutes. Each student answers the questions on the answer sheets that are available and are collected after the allotted time is over. After conducting the test, student test results are then analyzed to determine the potential effects of the implementation of face to face and online learning that can be seen through the results of higher-order thinking skills tests. The potential effect resulting from blended learning based on Edmodo is that the average student gets a B on the higher-order thinking skills test.

3.2.1 Discussion

In this chapter, three things will be stated, namely: (1) the achievement of research objectives; (2) constraints encountered by researchers during the course of the study which is not included in the scope of the research objectives; and (3) assumptions and limitations in the study. These three things can be described as follows:

Achievement of Objectives

This research produces Edmodo-based blended learning to improve higher-order thinking skills in mathematics students. The blended learning development process that has been passed consists of three stages, namely the defined stage, the villageign stage, and the development stage. At the development stage of Edmodo-based blended learning and higher-order thinking skills tests, a learning design was carried out that resulted in prototype I. Furthermore, the prototype I consisted of semester learning plans, and 5 higher-order thinking questions which included questions analyzing, evaluating, and creating validated by experts who see in terms of content and language. A valid prototype I am drawn from the validator's assessment, where all the validators state that Edmodo-based blended learning products and higher-order thinking skills are valid. The prototype I was then tested on students of Class B mathematics tadaris. Based on suggestions from students and validators, the prototype I was still lacking mainly in terms of language, and content of questions.

The results of student comments, the prototype I was revised to produce prototype II. In prototype II a field test was conducted on 25th grade A students to see the extent to which students' high-level thinking skills after Edmodo-based blended learning were applied. This was done to see the validity and reliability of HOTS questions on prototype II empirically. Based on the analysis of calculations performed from the test data obtained the results that all the questions in the number of 5 questions are valid. Tests that contain valid high-level thinking questions encourage students to think deeply about Barnett & Francis's subject matter (Istiyono, Mardapi, & Suparno, 2014). The validity of the test is due to several reasons, namely: (1) items are developed according to the correct instrument item development procedure; (2) items are developed from high-level thinking indicators; (3) tests consisting of 5 items have passed the content validity test with expert judgment; and (4) students who are tested seriously in working on the test. Thus, because the HOTS test developed is valid it will measure students' higher-order thinking skills with valid results as well as encourage students to think deeply.

The test reliability reached 0.711, which means satisfying. Based on Kehoe's opinion (Widodo, 2006) states that the reliability coefficient of 0.5942 to 0.8924 for each subscale is still satisfactory because for short tests, with the number of items between 10 to 15 pieces, the reliability coefficient above 0.5 is satisfactory. In its implementation, researchers analyzed the ability of students to think at a higher level through the answers and reasons given on the answer sheet.

Based on the results of student work, it is analyzed to see qualitatively the potential effects of tests produced on tests that have been developed. According to Hasratuddin (2009), if this high-level thinking ability is not trained and polished then students do not have enough tools to become a wise problem solver. Therefore, to improve students' higher-order thinking skills, they must be confronted with a situation or problem that is challenging and interesting to solve (Hasratuddin, 2009). Looking back at the results of the analysis of the potential effects of students qualitatively on valid instruments to measure the ability to think at a high level the average student gets a value of B.

Obstacles Encountered by Researchers During the Study

The implementation of an Edmodo-based blended learning development test to improve higher-order thinking skills in mathematics education students in limited trials experienced some obstacles that could not be avoided, but these obstacles could be overcome by finding solutions. This is done so that the obstacles faced in the implementation of this research, especially when the application of blended learning is not found again at the next application. These constraints and their solutions are Wi-Fi facilities which are often on-off resulting in an uninterrupted online learning process, but in this case, the researchers overcome the solution by asking students to use private wi-fi.

Research Assumptions Many Things Cause the Research Results to be Biased.

To avoid this, the researcher must assume several things, as follows:

- The validator actually evaluates all instruments that have been developed objectively
- The researcher actually makes improvements according to the suggestions made by the validator
- Other factors that influence the results of the study but are not the focus of the study and cannot be controlled by the researcher are considered to be normal.

4. CONCLUSION

This research was carried out with the aim of obtaining blended learning based on Edmodo to improve for students of IAI Muhammadiyah Sinjai mathematics qualifications in this case valid, reliable, and have potential effects through the development process. The conclusions that can be obtained from this study are as follows: blended learning based on Edmodo prototype to improve higher-order thinking skills in mathematical education students developed to meet valid and reliable criteria with a coefficient of 0.711; the process of developing blended learning based on Edmodo prototypes developed has a potential effect in increasing the higher-order thinking skills of students in mathematics. Evidenced by the results of the higher-order thinking skills test of integral material, functions, and limits the average student gets a value of B.

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Biographies

Irmayanti is a lecturer at the Tadris Mathematics of the Muhammadiyah Sinjai Islamic Institute. She also serves as a lecturer at the Sinjai Muhammadiyah University campus and the Sinjai 12 State Junior High School. She also served as an assessor for BAN PAUD and PNF for the South Sulawesi region. Besides being happy with numbers, he also likes writing. He actively writes articles and anthology books for short stories.

Sri Wahyuni, born in Sinjai, June 29, 1991. Has completed his undergraduate study (S1) in the Mathematics Education Study Program of Alauddin State Islamic University in Makassar in 2013 and Masters in Mathematics Education at Makassar State University in 2016. In 2017 until now he has been a Lecturer at the State Islamic Institute. Bone, after previously gaining teaching experience in several places, from 2013 to 2014, taught at SMPN 5 Sinjai Selatan and while taking his master's degree from 2014 to 2016 he became a Mathematics tutor at the Gama College Indonesia Tutoring Institute.