The Effectiveness of Physics Learning with Blended Learning Models using the Edmodo Application to Improve Students' Critical Thinking Skills

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Article Info

Abstract

This study aims to describe the effectiveness of learning physics with a blended learning model using the Edmodo application to improve the critical thinking skills of high school students. The sample of this study were students of SMA Negeri 1 Ngronggot which consisted of two classes, namely X MIPA 1 and X MIPA 2, each class totaling 30 students. This research is pre-experimental research with one group pretest-posttest design. Before learning is done, students are given an initial test (pre-test) and after learning, students are given a final test (post-test) with the same material. The collected data was then analyzed using paired t-test, n-gain calculation, and independent t-test. which were analyzed quantitatively. The results showed that there was an increase in students' critical thinking skills scores with an average value of n-gain on the high criteria in each experimental class and there was no difference in the average value of n-gain between the two experimental classes. It can be concluded that learning physics with a blended learning model using the Edmodo application can effectively improve students' critical thinking skills. This research implies that learning physics with a blended learning model using the Edmodo application can be used as an alternative learning model that can be used to improve students' critical thinking skills.

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INTRODUCTION

Education is the right of every citizen that must be implemented by the government under any conditions. Education today must be organized by providing appropriate needs in the face of competition in the 21st century both locally and globally. The strategy that can be used is the formulation of an educational paradigm by the National Professional Certification Agency (BNSP), such paradigms include changing the learning process from teacher center to student center, from passive to active in class, and from individual to group (Anggraini et al., 2020). 21st-century learning is designed by emphasizing 4C-based competencies, namely: Critical thinking, Collaboration, Creativity, and Communication (Zubaidah, 2018). According to research (Mitra & Purnawarman, 2019), three implementations must be considered in the 21st century, namely core competencies, teaching and learning processes, and learning outcomes assessment processes. This is supported by research (Wijaya et al., 2016) which shows that "the value of critical thinking competence and problem-solving is 96.21%, so critical thinking competence is needed for 21st-century learning skills.

Currently, the development of technology is growing rapidly, especially in the field of education. Technology and information play an important role in learning today, apart from the COVID-19 pandemic which began to spread to Indonesia in March 2020 (Natalia, 2020). Students are still required to have critical thinking skills even though learning takes place online.

According to (Budiarti et al., 2017) Each student has different skills in receiving material because these skills are determined from the thinking skills of each student. In the learning process, critical thinking is one of the skills that is considered important (Huber & Kuncel, 2016). Based on the results of interviews at SMA Negeri 1 Ngronggot, it was found that learning during the COVID-19 pandemic is recommended to apply distance learning by using the internet as the main medium of learning. According to teachers at SMA Negeri 1 Ngronggot, they find it difficult to interact and have limited internet access. The teacher-centered learning process and the lack of interaction between teachers and students are some of the fundamental factors for this condition, especially in physics subjects. Learning carried out by teachers using lecture or conventional methods, causes students to find it difficult to develop critical thinking skills (Fatmawati et al., 2014).

According to (Ahmad Susanto, 2016) Critical thinking is the potential that exists in humans that must be developed to get optimal abilities. Critical thinking skills are very important to be able to compete in the current era of globalization. Because someone who can think critically will not quickly believe the facts around him without doing real proof so that the facts become valid and reliable. In fact, in physics lessons, learning is still emphasized on students as reading material and formulas that must be memorized (Hong et al., 2012). In the learning process, the teacher can determine the appropriate strategy so that learning can run optimally and by the learning objectives (Dwi et al., 2013). A suitable solution is to combine face-to-face learning strategies in class with e-learning-based learning strategies, namely learning with the Blended Learning model (Sukawijaya & Sudiarta, 2018).

Blended learning is an alternative learning strategy that can be done anytime and anywhere by the teacher so that it can increase students' knowledge (Chew & Wee, 2015). According to (Ardianti et al., 2019; Zarei & Abdi, 2016) The blended learning model can significantly improve students' critical thinking skills. In meeting student learning needs, appropriate and appropriate arrangements and blending of varied learning are needed (Smaldino & McElreath, 2016). According to (Ateş Çobanoğlu, 2018) Students feel happier and more interested in using Blended Learning compared to conventional learning. The advantages of blended learning according to (Gyamfi & Gyaase, 2015; Prayitno, 2015) namely Learning that is carried out independently and conventionally can complement the advantages of both, students can learn easily in accessing the material being taught. Although students and teachers do not carry out direct learning, learning can still be carried out.

This is by the opinion (Bryan & Volchenkova, 2016) The purpose of direct learning (face to face) can make students have an interactive experience. And when distance learning can make students access the material at any time, anywhere as long as they have internet access. Blended learning can be designed in such a way as to make it easier for students to understand it. So far, the use of printed teaching materials has helped students understand the concept of learning, however, printed teaching materials are sometimes left behind or lost and are not interactive. Therefore, other teaching materials are needed, such as the Edmodo application (Wahyuni et al., 2020).

This Edmodo application is in the form of learning management software or commonly known as the Learning Management System (LMS). LMS is software that can assist educators in creating virtual classes so that they can access subject matter and interact at any time as long as they have an internet network (Rosy, 2018). The Edmodo application is a learning tool that uses the internet that aims to collaborate between teachers and students in managing assignments or projects, sharing educational content, and knowing notifications of every activity (Putranti, 2016). Edmodo-based learning can be a breakthrough for schools that rarely use online learning.

Based on the explanation above, to be able to optimize learning during this pandemic by improving students' critical thinking skills, it can be integrated into learning tools using the Edmodo application. With this, learning tools using the Edmodo application are expected to help students find a concept related to the material presented and learning indicators can be achieved well without misconceptions. So with this, the researcher designed and conducted research entitled "The Effectiveness of Physics Learning with Blended Learning Model Using Edmodo Application to Improve Students' Critical Thinking Skills". The purpose of this study was to analyze the effectiveness of learning physics with the Blended Learning model using the Edmodo application to improve students' critical thinking skills.

METHOD

The method used in this research is Pre-Experimental research using One Group Pretest – Posttest Design (Indra et al., 2021). The design is described in Table 1.

Table 1. Experiment Design One Group Pretest-Posttest Design

Class	Pretest	Treatment	Posttest
X MIPA 1	O_1	X	O_2
X MIPA 2	O_1	X	O_2

Information :

O_1 : Pretest before treatment

X : Treatment of the application of the blended learning model using the Edmodo application

O_2 : Postest after treatment

In class X MIPA 1 and X MIPA 2 were given a pre-test before learning was carried out. Learning is done with the Blended Learning model using the Edmodo application on the parabolic motion material. After being given treatment, at the end of the lesson all students were given a post-test to see the results. The results of the post-test are used to see the effect of using Blended Learning using the Edmodo application on students' critical thinking skills. The sample in this study were students of classes X MIPA 1 and X MIPA 2, each class consisted of 30 students.

Learning is carried out with a limited face-to-face learning system, where face-to-face learning is divided into 2 sessions. The first session is the morning session for even absences, then the second session in the afternoon session for odd absences. Face-to-face learning is carried out in 4 meetings with the time each meeting being 80 minutes, and online learning can be done at any time using the

Edmodo application which contains material and assignments that students must do. Learning with the blended model using the Edmodo application is said to be effective if: there is a statistically significant increase in the KBK score at 5% alpha, the average n-gain is at least in the moderate category, the mean n-gain is not different between the two classes, and student responses are in a good category. The data from this study are quantitative data from test scores used to measure students' KBK.

Instruments in the study were in the form of learning device validation sheets, student response questionnaires, and critical thinking skills tests consisting of 5 description questions using four critical thinking indicators, namely interpretation, analysis, inference, and evaluation. (Jatmiko et al., 2018). Student response questionnaires are given after the entire learning process is carried out, namely to see student responses to Blended Learning using the Edmodo application.

Analysis of the level of improvement in students' critical thinking skills is calculated using the N-gain calculation with the equation :

$$N - gain\ (g) = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

Information :

g $\quad$ = *N-Gain*
S_{post} $\quad$ = Posttest score
S_{pre} $\quad$ = Pretest score
S_{max} $\quad$ = Maximum score

Furthermore, the results of the N-gain are converted to low, medium, and high criteria according to Table 2.

Table 2. Category N-gain

Score	Category N-gain
0,7 < *N-gain*	High
0,3 ≤ *N-gain* ≤ 0,7	Medium
N-gain < 0,3	Low

(Hake, 1999)

RESULTS AND DISCUSSION

Before this research was conducted at SMAN 1 Ngronggot, the learning tools used had been validated by a physics teacher at SMAN 1 Ngronggot and two expert lecturers in the physics department at the State University of Surabaya. The results of the validity of the physics learning device with the blended learning model using the Edmodo application are shown in Table 3.

Table 3. Value of Learning Device Validity

Research Aspect	Average Value	Criteria
Syllabus	3,6	Very valid
RPP	3,5	Very valid
Handout	3,7	Very valid
LKPD	3,6	Very valid
Test Questions	3,4	Valid

Based on table 3, it can be seen that the average value of the instrument validity includes the syllabus, Rpp, handouts, LKPD, and critical thinking skills test questions which all have very valid criteria except for the Critical Thinking Skills Test (KBK) which has valid criteria. Thus, physics

learning tools with blended learning models are suitable for use in physics learning at SMAN 1 Ngronggot.

Before the learning process is carried out, students are given pretest questions to determine the student's initial abilities. Furthermore, the learning process is carried out with a blended learning model using the Edmodo application. After the learning process, students are given post-test questions to determine their final ability of students. The pretest and post-test scores were used to measure the differences in students' critical thinking skills between before and after learning with the blended learning model using the Edmodo application on the parabolic motion material. To find out the level of improvement in students' KBK scores, the n-gain calculation is carried out in that class. As shown in Figure 1.
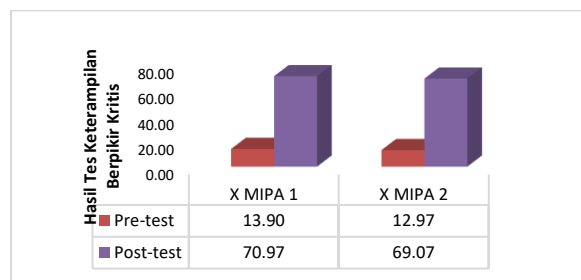

Figure 1. Average Result of the Critical Thinking Skills Test for Class X MIPA 1 and X MIPA 2

Based on Figure 1, it was found that before learning physics using the blended learning model using the Edmodo application, KBK students X MIPA 1 and X MIPA 2 got a low average score. After the blended learning model learning process was carried out using the Edmodo application, the average value of students' critical thinking skills X MIPA 1 and X MIPA 2 increased.

Based on the 5 valid items, the analysis prerequisite test was conducted using the normality test to measure whether the data had a normal distribution or not. The normality test in this study used the Kolmogorov-Smirnov test with a value of T_{table} at the level of significance $\alpha = 0,05$ where the data is normally distributed if $T_{count} < T_{table}$. As shown in Table 4.

Table 4. Normality Test Results

Class	Ttable	Tcount		Distribution Information
		Pre-Test	Post-Test	
X MIPA 1	0,24	0,14	0,14	Normal
X MIPA 2		0,15	0,13	

Based on table 4 the results of the calculation of the normality test obtained the value of T_{count} smaller than T_{table}. It was concluded that the pre-test post-test data for both classes were normally distributed. Furthermore, the data that are normally distributed are tested for homogeneity with a significance level of $\alpha = 0,05$ where if the value $F_{count} < F_{table}$ then the data is homogeneous. As shown in Table 5.

Table 5. Homogeneity Test Results

Class	F_{table}	F_{count}		Variance Information
		Pre-test	Post-test	
X MIPA 1	1,86	0,51	1,08	Homogen
X MIPA 2				

The results of the homogeneity test calculation in the table above, obtained a score of F_{count} = 0,51 and 1,08, while the level of significance α = 0,05 and get results F_{table} = 1,86. So F_{count} is less than F_{table} then the two data are said to be homogeneous.

Based on the results of the prerequisite test, the data analysis of the two classes has met the requirements of normality and homogeneity, so it can be continued with the t-test. The following are the results of an independent t-test using pre-test data to determine students' initial abilities. As shown in Table 6.

Table 6. Initial Ability Test (*Pretest*)

Class	T_{count}	t_{table}	Conclusion
X MIPA 1			
X MIPA 2	0,44	2,05	H_0 accepted

Based on Table 6 the results of the calculation of the initial ability test of students in class X MIPA 1 and X MIPA 2, it can be seen that the value of t_{count} = 0,44 with significance level α = 0,05, get t_{table} = 2,05. Because t_{count} is less than t_{table}, means H_0 accepted H_1 rejected means that there is no difference in the results of the pretest between class X MIPA 1 and X MIPA 2. This shows that the condition of students before getting treatment for physics learning with the blended learning model using the Edmodo application has the same ability.

Furthermore, to determine the improvement of students' critical thinking skills, a paired t-test was conducted using pretest and posttest data in class X MIPA 1 and X MIPA 2 at SMAN 1 Ngronggot. The following are the results of the paired t-test. As shown in Table 7.

Table 7. Paired t-test result

Class	T_{count}	t_{table}	Conclusion
X MIPA 1	20,93		
X MIPA 2	23,46	2,05	H_0 rejected

Based on Table 7, it can be seen that the value of $t_{count} > t_{table}$ for each class, means H_0 rejected and H_1 accepted. This means that the post-test value is significantly greater than the pre-test value calculated statistically for each class. So it can be concluded that after learning physics using the blended learning model, students' critical thinking skills have increased. Then an independent t-test was conducted on the n-gain data to determine the differences in the improvement of students' critical thinking skills. Presented in table 8.

Table 8. The result of the t-independent test on the n-gain data

Class	T_{count}	t_{table}	Conclusion
X MIPA 1			
X MIPA 2	0,58	2,05	H_0 accepted

Based on Table 8, it can be seen that the value of $t_{count} < t_{table}$, means H_0 accepted and H_1 rejected. This means that there is no difference in the improvement of students' critical thinking skills for each class. With such results, it can be said that there is a consistent increase in students' critical thinking skills. Furthermore, to determine the criteria for improving students' critical thinking skills using n-gain analysis of the pretest and posttest scores. The following table shows the results of the n-gain analysis:

Table 9. Result of n-gain analysis

Class	<g>	Criteria
X MIPA 1	0,74	High
X MIPA 2	0,72	High

Based on Table 9, it can be seen that the value of the results of the n-gain analysis of the two classes is high, thus it can be said that the blended learning model learning process using the Edmodo application is effective in improving students' critical thinking skills.

From the results of the data obtained, in Figure 1 there is an increase in the average pretest and posttest scores. The average pretest score before being given physics learning using the blended learning model using the Edmodo application is lower than the average posttest score after being given physics learning using the blended learning model using the Edmodo application. Learning Management System (LMS) in the form of Edmodo which is used as part of physics learning with the Blended Learning model.

Blended learning is a learning process that combines offline learning in the classroom with online learning outside the classroom. Offline learning is carried out through discussion and question and answer between students and teachers. Before the learning process begins, the teacher checks student attendance provides learning motivation and apperception by the parabolic motion material. Next, the teacher explains the material and invites students to conduct experiments through phet simulation about the parabolic motion to determine the effect of the angle of elevation on the distance traveled by objects. Through experiments using phet simulation, students learn to find answers to problems so that they can improve students' critical thinking skills (Adnyana, 2012). Then the teacher invites students to discuss the material that has not been understood by students. Before offline learning in the classroom is closed, the teacher gives homework to find out students' understanding of the concepts in the material that has been taught. This is by research (deNoyelles et al., 2014) stated that the provision of continuous assignments, namely online discussions, can increase the level of student analysis involving critical thinking skills and their involvement with peers has a positive relationship.

Online learning outside the classroom using the Edmodo application. In online learning, students are asked to enter their respective classes according to the code that has been given by the teacher. In the Edmodo application, students are asked to read the material and observe the phenomenon of parabolic motion. Furthermore, students note things that have not been understood about the material so that it can be discussed when offline learning in the classroom is carried out. Through observing the phenomenon of parabolic motion and providing information related to the phenomenon, it can improve students' critical thinking skills (Putra & Sudarti, 2015).

Based on Table 6, a pretest has been carried out which serves to determine the initial ability of students' critical thinking skills before being given the treatment of physics learning with a blended learning model using the Edmodo application. The result of the calculation of the initial ability test on the pretest data is the value of $T_{count} < T_{table}$. This shows that students' critical thinking skills before being given physics learning with the blended learning model using the Edmodo application are the same. This means that there is no difference in initial ability in the two experimental classes.

Furthermore, in Table 7, a paired t-test is performed which serves to determine the improvement of critical thinking skills in each class. The result of the paired t-test is the value of $t_{count} > t_{table}$. This shows that the application of blended learning has a significant effect on students' critical thinking skills in each class. In the n-gain analysis, a value of 0.74 was obtained for class X MIPA 1 with high criteria and 0.72 for class X MIPA 2 with high criteria. This is by research (Utomo & Wihartanti, 2019) states that the application of blended learning is effective for improving students' critical thinking skills.

In Table 8, an independent t-test is carried out which serves to determine whether or not there is a difference between the two classes using n-gain data. From the calculation obtained a score t_{count} < t_{table}, which means that there is no difference in the increase in students' critical thinking skills scores between the two classes. So it can be said that the increase in the score of students' critical thinking skills in class X MIPA 1 and X MIPA 2 is the same.

Based on the results of the questionnaire given to students after learning the blended learning model using the Edmodo application, that many students are interested in blended learning. The learning system is easy to follow to facilitate the learning process. The rest, students are motivated to learn because it can be done anywhere and anytime and is more aware of the use of technology that can be used in the learning process. This is following research (Yulia, 2017) that student responses are very positive with the application of blended learning compared to learning that only focuses on class or conventional.

Based on the results of the analysis, it can be seen that the blended learning model using the Edmodo application can improve students' critical thinking skills. The results of this study are supported by previous research that blended learning can improve students' critical thinking skills (Anggraeni et al., 2019; Ningsih et al., 2018; Suana et al., 2019). This is supported by research (Zainudin & Pambudi, 2019) that students' critical thinking skills increased significantly by using the Edmodo application and student responses to Edmodo-based learning were flexible, easy to install, and practical. So it can be concluded that learning physics with the blended learning model using the Edmodo application is effective in improving students' critical thinking skills.

CONCLUSION

Based on the results of the discussion on the research that has been done, it can be concluded that the blended learning model using the Edmodo application can effectively and significantly improve students' critical thinking skills (KBK) at SMA Negeri 1 Ngronggot. This is indicated by an increase in the KBK score which is statistically significant at 5% alpha, with a high level of KBK improvement, there is no difference in the increase in KBK between the two classes, and the average student response to the blended learning model learning using the Edmodo application on the material. parabolic motion is 83.7% or a very good category.

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