



The Improvement of Student's Critical Thinking Skills on Motion System Material through Using Digital Book based on Problem Based Learning

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Abstract

One of its competency that students must have to face the 4.0 era is the critical thinking skills. These skills can be trained using appropriate learning media, one of which is by using digital books based on problem-based learning. The purpose of this study was to analyze the effectiveness of using problem-based books, problem-based learning materials, and analysis systems on students' critical thinking skills. The research sample was taken using purposive sampling method with a total of 108 students. Based on the results of the study, the average student learning outcomes obtained a score of 67. The results of the N-gain analysis with the medium category showed that digital-based learning problem-based books were effective for improving students' critical thinking skills. The results of the analysis with the Paired Sample t-test showed that the probability value (sig) $0.000 < 0.05$ means that there are differences in critical thinking skills between before and after using problem-based learning-based digital books. Thus it can be concluded that the use of digital books based on learning materials based on problems with the motion system is effective in improving students' critical thinking skills.

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INTRODUCTION

The world is currently entering the era of industrial revolution 4.0, the pattern of human life based on information technology. Currently, the development of Science and Technology has an effect on the development of the world of education. The effect includes a change in learning from previously using conventional models to now changing to technology-based learning

To face the 4.0 era, one of the things that students must have is the ability to think critically. Critical thinking skills are the abilities to analyze an idea based on logical reasoning to be able to give consideration by using certain measurements or standards.

According to the 2018 PISA results, Indonesian students' scientific literacy skills are still in the low category, ranking 6 from the top bottom or 75 out of 80 participating countries (OECD, 2019). The results of the 2018 evaluation obviously have decreased compared to the results in 2015 which ranked 64 out of 72 participating countries (OECD, 2015). The percentage of critical thinking skills in science lessons is also lacking because the learning process has not developed critical thinking skills optimally (Lestari et al., 2017). Seeing this, it is necessary to make efforts to improve the quality of the science learning process.

The ability to think critically is one of the demands in the Kurikulum 2013. To answer these challenges, a learning process which enables to facilitate students to be able to develop their potential through learning activities that refer to 4 learning characters (4C) namely Communication, Collaboration, Critical thinking and problems solving, Creativity and innovation is needed. Referring to the regulation established by Minister of Education and Culture, Number 22 of 2016 concerning process standards, at point 13, it is necessary to use information and communication technology to increase the efficiency and effectiveness of learning.

Based on the results of preliminary study that have been carried out in schools in Semarang and its surroundings involving SMAN 1 Ungaran, SMAN 12 Semarang, SMAN 13 Semarang, SMAN 16 Semarang and SMA Al Asror Semarang, most teachers still use the lecture learning model, which is 46.71 %, discussion

31.57% and other methods 21.71%. The level of understanding of students towards the material is also still lacking. 60.52% of students stated that they did not understand and only 39.48% stated that they understood. The students' lack of understanding was due to several factors, namely 58.55% due to difficult material, 21.05% of the teacher's way of conveying and 20.39% because the learning media used were less attractive. Based on questionnaires given to students and interviews with teachers, one of the difficult materials is the motion system. Taufiqoh et al., (2012) stated that the material consists of concepts that involve a process that is quite difficult to observe directly, and contains complex and essential concepts that must be mastered by students, therefore it needs media to visualize.

One of the media that can stimulate students' thoughts, attention and effective learning skills is digital books. The advantage of digital books compared to conventional books is that they are easily accessible anywhere and anytime, equipped with search, hyperlink and video features (Widodo, 2016).

The developed problem-based learning-based digital books are expected to improve students' critical thinking skills. In addition, it is hoped that it can help and facilitate teachers as an alternative to teaching materials used in learning. Furthermore, in this study, the use of problem-based learning-based digital books is to improve students' critical thinking skills.

METHOD

This research is an experimental research (Sugiyono, 2009). The design in this study used one group pre-test and post-test design which is presented in Figure 1.

Initial conditions	Treatment	Final conditions
O1	X	O2

Figure 1. Research Design

The subjects of this study were students of class XI MIPA 1, XI MIPA 2, XI MIPA 3 totalling 108 students. Problem-based learning-based digital books were used to improve students' critical thinking skills. Problem-based & learning-based digital books are innovative teaching materials

accessed through mobile phones as well as computers in learning.

The instrument used in this study was a problem-based learning multiple choice questions. Then the data analysis technique used in the descriptive quantitative analysis technique used the N-gain test to find out the effectiveness of using problem-based learning-based digital books in improving students' critical thinking skills assisted by SPSS software to determine the difference in values between before and after using digital book based on problem based learning.

The stages of using this problem-based learning-based digital book are simply by using the EPUBReader web browser students can access digital books.

RESULT AND DISCUSSION

The data of this research were obtained from the results of the scores of students' critical thinking skills. The value of students' critical thinking skills was obtained based on the results of the pre-test and post-test scores. Analysis of the pre-test and post-test data on students' critical thinking skills showed a difference in scores between before and after using digital books based on problem-based learning of motion system material in which there was an increase of score.

The results showed that the pre-test and post-test mean scores showed a difference, it is that there was an increase in the mean value from 48 to 67. Then the gain test results obtained a value of 0.36 in the medium category.

The N-Gain value is 0.36 in the medium category. The N-Gain value in the medium category means that the use of problem-based learning-based digital books trains students in critical thinking skills. Additionally, the interesting design and the equipment of problem-based questions related to daily life to make it easier for students to understand and to be active in learning.

The results of the normality test of the pre-test (0.002) and post-test values were (0.000) > 0.05, which means the data was normal. The results of the pre-test - post-test homogeneity test were (0.717) > 0.005, which means the data was homogeneous. The prerequisites for the paired sample t test have been fulfilled by performing the normality and homogeneity test. After the

prerequisites were met, then the parametric analysis with the t test, paired sample t test was obtained by comparing the probability value (sig) $0.000 < 0.05$, then H_0 was rejected. This means that the average value of students' critical thinking skills before and after using problem-based learning digital books was not the same / significantly different. Thus, that the use of digital books has significantly increased students' critical thinking skills.

Indicator data for students' critical thinking skills in the pre-test and post-test scores include 4 indicators, namely 1) Focusing on questions, 2) Determining actions, 3) Inducing and considering the results of induction and 4) Analyzing arguments. Each indicator of critical thinking skills can be seen in Figure 2.

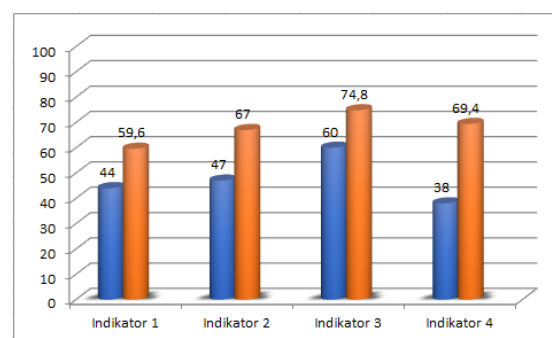


Figure 2. Diagram of critical thinking indicator

The diagram in figure 2 shows the comparison of the pre-test - post-test mean scores of each indicator as a whole. The highest pre-test value on indicator 3 (inducing and considering the results of the induction) has a value of 60, and the lowest value on indicator 4 (analyzing arguments) has a value of 38. While the highest post-test value is on indicator 3 (inducing and considering the result of induction) has a value of 74.8, and the lowest value on indicator 1 (focusing on questions) has a value of 59.6. Comparison of the pre-test - post-test scores, both the highest and lowest indicator values on each indicator as a whole have an average post-test score that is higher than the pre-test score.

Indicator 1 (Focusing on questions)

Indicator for focusing on questions is a part of critical thinking skills to provide simple explanations (Elementary Clarification). It is one of the skills critical thinkers must possess. In learning, students show good results in which students are

able to discuss and convey their opinions regarding cases in the digital book. Students are also able to answer questions in more detail and detail and are able to explain related motion systems.

Indicator 2 (Determining action)

Indicator for determining action is a part of the strategic and tactical thinking skills (Strategies and Tactics). It is one of the skills that critical thinkers must possess. In the learning process using digital books based on problem based learning students discuss the problems that exist in digital books about motion systems. For example, regarding crooked bone disorders, students understand what must be done to cure the disorder and what medical methods can be used. Students are able to determine actions on cases of motion systems in digital books.

Indicator 3 (Inducing and considering the result of induction)

Indicator for inducing and considering the results of the induction is a part of critical thinking skills to conclude (Inference) which is one of the skills that must be possessed by critical thinkers. With the existence of digital literacy facilities in the process of finding sources of information in this digital book, students are ready and trained to conclude something. The ability of students to conclude is obtained after students fully understand the case that has occurred either through the process of seeking information or exchanging opinions among group members. After students look for sources of information through digital books or other sources, students can make conclusions about the case discussed.

Indicator 4 (Analyzing Argument)

Indicators for analyzing arguments are part of critical thinking skills in providing simple explanations (Elementary Clarification). According to Farida (2015), arguing is a part of making decisions, defending them, and influencing others. According to Agoestanto et al., (2019), it is important to analyze arguments in critical thinking. This is supported by Jannah (2018) that in critical thinking skills, students are required to think critically by analyzing arguments. Indicators to analyze arguments are the ability to identify arguments that support conclusions. The ability of

students to identify arguments is better because this ability is strongly supported by digital literacy skills in digital books and group discussions. With good digital literacy, students get a variety of information that can be used as arguments from relevant and valid sources.

CONCLUSION

Based on the results of the research, the conclusions that can be drawn are (1) the use of digital books based on problem-based learning material on motion systems can improve students' critical thinking skills (2) the increase in students' critical thinking skills is the highest in indicator 3, namely inducing and considering the results of induction and the lowest is in indicator 1 which is focusing on questions.

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