Analysis of Students' Mathematical Literacy Capabilities Using the STEAM Approach Assisted by E-Mokase (Electronic Module Capita Selekta)

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Abstract

Mathematical literacy ability is a person's ability to formulate, apply, and interpret mathematics in various contexts through the process of analyzing, reasoning, and communicating their mathematical knowledge and skills effectively so that they can solve and interpret a problem. This research aims to analyze students' mathematical literacy skills using the STEAM learning approach assisted by E-Mokase (Electronic Module Capita Selekta). Mathematical literacy skills studied include formulating situations mathematically, using concepts, facts, procedures, and mathematical reasoning, as well as interpreting, applying, and evaluating mathematical results. This research used quasi-experimental research methods with 38 students. The instruments used were a mathematical literacy ability test, an E-Mokase (Electronic Module Capita Selekta) assessment, and an observation sheet. The results of the research show that 1) students' mathematical literacy skills have increased after implementing learning using the STEAM learning approach assisted by E-Mokase (Electronic Module Capita Selekta), with a normalized gain of 50.60% (medium); 2) The mathematical literacy ability that has improved the best is the ability to formulate situations mathematically, using concepts, facts, procedures, and mathematical reasoning.

Keywords: *STEAM Approach Assisted by E-Mokase (Electronic Module Capita Selecta), Mathematical Literacy Ability*

1. INTRODUCTION

In the 21st century, the need for problem-solving is increasing rapidly. Some other skills needed in the modern era are critical thinking skills, problem-solving, creative & innovation, communication & collaboration, and mathematical information literacy. Thus, mathematical literacy is one of the elements needed to develop abilities in the 21st century. Mathematics learning aims to equip students with mathematical literacy skills to use and apply mathematical knowledge in real-life situations [1].

Mathematical literacy is the ability to explain mathematics for various purposes in life including reasoning mathematically, using concepts, processes, and facts to describe, explain, and predict phenomena or events [2]. Mathematical literacy helps students understand the role

of mathematics in making decisions [3]. There are seven components of ability contained in mathematical literacy, namely: 1) communication, 2) mathematics, 3) restating, 4) reasoning 5) using problem-solving strategies. 6) using symbols, formal language, and techniques, 7) using mathematical tools [4].

Mathematical literacy is in line with the quality of education in Indonesia. Based on facts from data released by PISA (Program for International Student Assessment) to measure mathematical literacy abilities in junior high school students [5]. The PISA results show that the mathematical literacy skills of Indonesian students are not yet optimal. Therefore, by seeing how important this ability is in learning mathematics, students are required to have this ability. This effort can be realized by selecting appropriate and innovative learning models, one of which is the STEAM (Science, Technology, Engineering, Art, and Mathematics) learning model.

Learning using the STEAM approach will help students improve their thinking skills and answer the challenges of the era of globalization [6]. STEAM is a meta-discipline that integrates science, technology, engineering, arts, and mathematics into an integrated approach that can be applied in schools. The application of STEAM in mathematics learning can be done by understanding the conceptual relationship between mathematical concepts and concepts in other sciences contained in STEAM [7]. To understand this, of course, it can be built through critical, creative thinking and problem-solving skills to generate ideas to find solutions to the problems faced [8]. This STEAM approach can also encourage students to hone problem-solving skills, resulting in increased achievement in learning mathematics [9].

E-Module is a module made in electronic format that is run on a computer. E-modules can also be displayed via smartphone thanks to continuously developing technology. Another advantage is that it reduces the use of paper in the learning process, and is arranged systematically so that it is not confusing to understand. Its use is also not limited by place and time. In this way, the development of the E-module can be used anytime and anywhere using the smartphone that most students already own. So that limited teaching materials can be helped. Therefore, E-modules should facilitate students to understand the expected learning objectives, especially in the Capita Selekta course. The e-module capita selecta (E-Mokase) in this research was designed using the STEAM (Science, Technology, Engineering, Art, and Mathematics) approach. E-Mokase is a learning resource that contains learning material displayed attractively with pictures or illustrations [10]. The development of mathematics E-Mokase using the STEAM (Science, Technology, Engineering, Art, and Mathematics) approach is expected to make students have high mathematical literacy skills. With this, an analysis of students' mathematical literacy abilities will be carried out using the STEAM approach assisted by E-Mokase (E-Modul Kapita Selekta).

2. RESEARCH METHODS

The research method used was a quasi-experimental method with research subjects conducted on 38 students of the mathematics education study program at Jambi University. Data collection in research was carried out using observation guidelines, questionnaires, and tests. Data on students' mathematical literacy abilities was collected through tests and using the E-Mokase assessment rubric (E-Modul Kapita Selekta).

The test is made in the form of a reasoned multiple choice test with 26 questions which are divided into 3 indicators of mathematical literacy abilities, namely indicators of formulating situations mathematically with 13 questions, indicators of the use of procedural fact concepts, and mathematical reasoning with 7 questions, and indicators of the ability to interpret, apply and evaluate the mathematical results of 6 questions. The questions created have been assessed by expert lecturers and trials have also been carried out for each question item. Tests are given before and after studying.

In this research, apart from testing mathematical literacy skills, an E-Mokase (E-Modul Kapita Selekta) assessment was also used when the STEAM (Science, Technology, Engineering, Art and Mathematics) learning approach was applied. This is done to find out the extent to which students understand and explore their mathematical literacy skills. This assessment was carried out 4 times according to the treatment given to students in 4 meetings. Then it is put into assessment categories, namely very good, good, and quite good.

To support the research results, observations were also carried out on students and lecturers. In this case, the researcher acts as a lecturer so that he can minimize errors in using the STEAM (Science, Technology, Engineering, Art, and Mathematics) learning approach. Observations were carried out by 2 observer lecturers who had been given observation sheets by the researcher, consisting of lecturer and student observation sheets. Apart from that, video recording is also carried out during each lesson so that researchers can observe again through the videos that have been made.

3. RESULTS AND DISCUSSION

The mathematical literacy abilities studied include the ability to formulate situations mathematically, using concepts, facts, procedures, and mathematical reasoning.

3.1 Students' overall mathematical literacy abilities.

The students' mathematical literacy abilities in this study were obtained from mathematical literacy test scores before and after learning. The average value of students' mathematical literacy abilities before and after studying along with normalized gains can be seen in Figure 1.

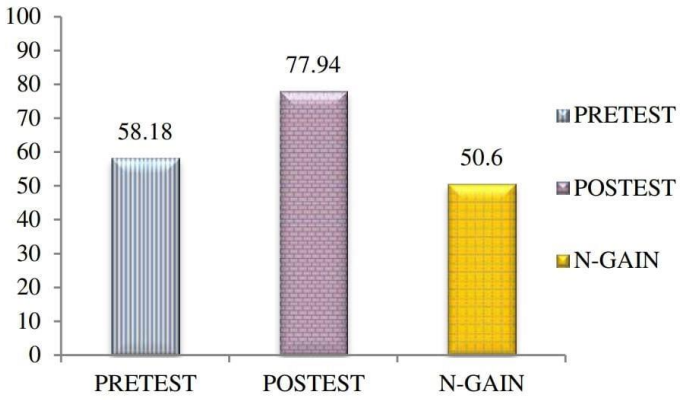


Figure 1. Graph of the average pretest, posttest, and N-Gain scores for students' mathematical literacy abilities.

Based on Figure 1, it can be seen that there was an increase in students' mathematical literacy skills before and after being given project-based learning assisted by E-Mokase (E-Modul Kapita Selekta). This increase can be seen from the results of the average value which was previously 58.18, increasing to 77.94 with a normalized gain of 50.60%, and this increase is included in the moderate category.

Based on this, it shows that learning using the STEAM (Science, Technology, Engineering, Art, and Mathematics) learning approach with the help of E-Mokase (E-Modul Kapita Selekta) can improve mathematical literacy skills which include the ability to formulate situations mathematically, using concepts. , facts, procedures, and mathematical reasoning. Learning uses an approach that aims to increase student engagement, creativity, innovation, problem-solving skills, and other cognitive benefits. STEAM is a meta-discipline that integrates science, technology, engineering, arts, and mathematics into an integrated approach that can be applied in schools

Table 1. Recapitulation of E-Mokase Assessment Results (E-Modul Kapita Selekta)

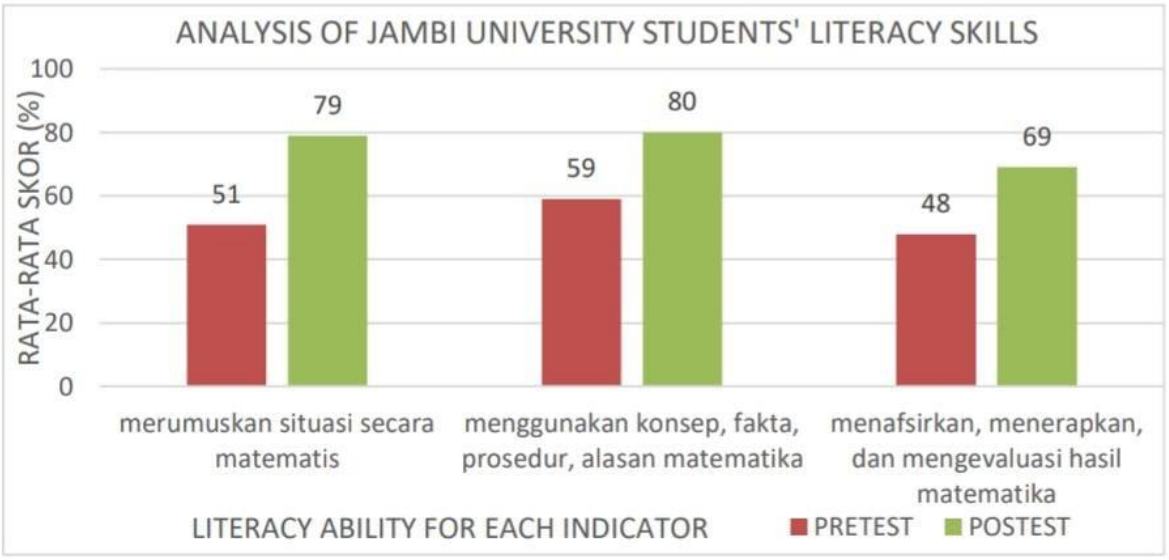
No	Kategori Penilaian	Persentase Jumlah Siswa1
1	Sangat Baik	18,18%
2	Baik	42,42%
3	Cukup Baik	39,39%

Based on the findings of the E-Mokase (E-Modul Kapita Selekta) assignments made by students, it was found that students who had high mathematical literacy ability scores could answer the questions in E-Mokase (E-Modul Kapita Selekta) correctly. Students responded very positively to the use of pocketbooks as a mathematics learning tool in class. During the learning process with E-Mokase (E-Modul Kapita Selekta), they are actively involved in the steps at the STEAM stage such as identifying surrounding problems that are relevant to the lesson material, carrying out experiments that are appropriate to the material,

and being guided to analyze data based on evidence and existing sources, then draw your conclusions. This is by the definition of mathematical literacy, namely mathematical literacy skills that enable individuals to read, write, understand, and apply information effectively in various contexts. It includes a deep understanding of written language, including text comprehension, grammar rules, spelling, and writing skills. In addition, mathematical literacy also includes the ability to interpret, evaluate, and use information found in texts or other media to solve problems, make decisions, and participate actively. Mathematical literacy skills are not limited to mastery of written language but also include digital mathematical literacy, namely the ability to operate in the digital world, assess and manage information found on the internet, and use digital devices intelligently. Mathematical literacy skills have great relevance in a person's daily life, education, and career. It helps individuals become proficient readers, critical thinkers, and efficient communicators [10].

Analysis of Mathematical Literacy Ability of Jambi University Students

Figure 2. Graph of the average percentage of pretest and posttest scores for students' mathematical literacy abilities for each indicator



3.2 Mathematical literacy skills for each indicator.

The indicators of students' mathematical literacy abilities studied include formulating situations mathematically, using concepts, facts, procedures, and mathematical reasoning, as well as interpreting, applying, and evaluating mathematical results. The research results obtained from the pretest and posttest scores on students' mathematical literacy abilities were processed using the average percentage score for each indicator of the aspect being measured. The average percentage achievement score for each ability indicator measured can be seen in Figure 2.

Based on Figure 2, it can be seen that there has been an increase in student literacy skills for each indicator. The indicator of the ability to formulate situations mathematically before learning was 51%, increasing to 79% after receiving project-based learning with E-Mokase (E-Modul Kapita Selekta). Indicators of the use of concepts, facts, procedures, and mathematical reasoning from 59% increased to 80% after receiving learning. The results indicator of interpreting, applying, and evaluating mathematics increased from 48% after learning to 69%.

Of the three indicators measured in this research, the indicator of the ability to use mathematical concepts, facts, procedures, and reasoning improved better than other ability indicators. This can be caused by several factors, one of which can be caused by the level of difficulty of the questions given in the mathematical literacy ability test, from the test results for indicators of ability to use concepts, facts, procedures, and mathematical reasoning, the questions given are in the easy to medium category. So that students can still complete well on this ability indicator. Moreover, the questions created are tailored to the problems that students often face.

Apart from that, many factors can improve student achievement in mastering problem-solving skills, one of which is the use of appropriate learning models. This is because this learning model functions as a basis for teaching and learning activities. If each delivery of learning material through a project is equipped with good delivery methods and learning media, this will have an impact on increasing students' mathematical literacy skills.

From the data processing results, it was also found that the indicator of the ability to interpret, apply, and evaluate measured mathematics results experienced the lowest increase compared to the other three indicators of mathematical literacy ability. The low increase in indicators of the ability to interpret, apply, and evaluate mathematical results is also caused by the level of difficulty of the questions given. The questions given are categorized as having a high level of difficulty. So this has an impact on the results of achieving these indicators. Apart from that, this can also be caused by several factors that may be very influential, such as students not being used to working on mathematical literacy skills questions so they need to practice when working on questions. Apart from that, students need to practice repeatedly in solving these problems and also to get students used to reading repeatedly and thinking critically.

4. CONCLUSION

The results of the research show that the literacy skills of Jambi University students through STEAM-based learning have increased after implementing learning using the STEAM (Science, Technology, Engineering, Art and Mathematics) approach using E-Mokase (E-Modul Kapita Selekta) with a normalized gain of 50. 60% are in the medium category. The indicator that experienced the best improvement was the ability to use concepts, facts, procedures, and mathematical reasoning compared to other indicators. Students' literacy abilities can be developed and optimized through learning using the STEAM (Science,

Technology, Engineering, Art, and Mathematics) approach in mathematics learning with the help of E-Mokase (E-Modul Kapita Selekta).

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