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THE NEED FOR PROBLEM-BASED LEARNING MEDIA THAT IS ORIENTED TO IMPROVE STUDENTS' MATHEMATICAL LITERACY AND SELF-EFFICACY

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ABSTRAK

Mathematical literacy and student self-efficacy need to be considered because mathematical literacy skills are very important for students to possess and self-efficacy is needed so that students can have confidence in themselves to achieve academic goals. The purpose of this study is to find out what learning media is suitable to be applied to Mathematics Education students, Mercu Buana University Yogyakarta. In addition, this study also aims to determine the level of mathematical literacy and self-efficacy of Mathematics Education students at Mercu Buana University Yogyakarta. The research design used in this study is quantitative descriptive research. Data collection was carried out using questionnaire and test techniques. The instruments used in this study are preliminary study questionnaires, self-efficacy questionnaires, mathematical literacy test questions, The data analysis techniques used in this study are qualitative data analysis with the stages of analysis are: (1) Data Reduction; (2) Data Presentation; and (3) Conclusion Drawn. The procedure for this research includes 3 stages, namely the initial stage, the implementation stage, and the final stage. The results of this study show that there is a need for problem-based learning e-module learning media that is oriented to improve mathematical literacy and student self-efficacy. This can be seen in the results of the study which show that the level of mathematical literacy and self-efficacy still needs to be improved. In addition, students' interest in e-modules is also the basis for students' needs for e-modules. This can illustrate that the e-module is a learning medium that is suitable to be applied to Mathematics Education students, Universitas Mercu Buana Yogyakarta. Suggestions for further research are the need to develop problem-based learning e-modules to improve students' mathematical literacy and self-efficacy

A. INTRODUCTION

The rapid development of technology has had a significant impact on the world of education [1]; [2]. The thing that is significantly affected is how educators present the material [3]; [4]. Along with the times, educators at all levels of education are required to present varied and interactive materials, including at the university level [5]; [6]. Lecturers are required to be able to develop students' cognition while still paying attention to the affective of the students themselves [7]. In addition, students are also required to be able to carry out independent learning [8]; [9]. Therefore, learning media is needed that can improve cognitive, affective, and can help students in independent learning.

In line with the need for the development of learning media, mathematics literacy also needs to be improved for the level of students majoring in Mathematics Education [10]; [11]. According to the OECD, mathematical literacy is the ability to formulate, use, and interpret mathematics in various contexts, so students must be able to apply knowledge to solve real-world problems [12]. Kilpatrick et al [13] define mathematical literacy as a mathematical ability that includes understanding mathematical concepts, fluency in performing mathematical operations, the ability to formulate strategies to solve problems, logical and reflective thinking, and a positive attitude to mathematics. Mathematical literacy is also important to have in this 21st century because it includes concepts, procedures, facts, and tools for explaining, explaining, and predicting phenomena [14]; [15]. It helps individuals understand the role that mathematics plays in the

world and make the reasoned judgments and decisions needed by constructive, engaged, and reflective 21st-century citizens [16]; [17]; [18].

Therefore, in the development of learning media, a learning model is also needed that can be integrated into learning media [19]. Learning media is also needed that can help improve students' mathematical literacy [20]; [21]. Learning models also need to support independent learning for students so that independent learning is effective [22]; [23]. Previous research has revealed that the Problem-Based Learning model has been proven to improve mathematical literacy [24]; [25]; [26]. However, there have not been many studies that have researched the development of Problem-Based Learning-based learning media. The problem-based learning model is a focused and experiential learning model that is systematically organized so that the learning is meaningful [27]. The goal of the problem-based learning model is to provide learners with a structured experience in learning through problem-solving through the habituation of solving complex real-world problems [28].

In addition to mathematical literacy, student self-efficacy also needs to be considered. Bandura [29] defines self-efficacy as a belief in a person's ability to organize and carry out the actions necessary to produce certain achievements. Schunk [30] defines it as an individual's assessment of their ability to perform certain actions. In addition, Zimmerman [31] emphasizes that self-efficacy is part of self-learning. Zimmerman [31] adds that self-efficacy affects the goals that individuals set, their persistence in achieving those goals, and their response to setbacks. In addition, self-paced learning emphasized for college-level learning makes high self-efficacy important for students to have [32]; [33]. With this need, the development of learning media also needs to pay attention to self-efficacy variables.

Previous research has shown that the development of learning media is effective in improving mathematical literacy [34]; [35]; [36]. Other research has also shown that learning media can help increase self-efficacy [37]; [38]; [39]. The integration of problem-based learning models has also often been carried out into learning media [40]; [41]; [42]. However, there has never been a development of problem-based learning media that can improve students' mathematical literacy and self-efficacy.

Therefore, the researcher is interested in conducting a research "The Need For Problem-Based Learning Media That Is Oriented To Improve Students' Mathematical Literacy And Self-Efficacy". The purpose of this study is to find out what learning media is suitable to be applied to Mathematics Education students, Universitas Mercu Buana Yogyakarta. In addition, this study also aims to determine the level of mathematical literacy and self-efficacy of Mathematics Education students at Universitas Mercu Buana Yogyakarta.

B. METHODS

The research design used in this study is quantitative descriptive research. Quantitative descriptive research is research that uses measurement instruments such as questionnaires, observations, and tests to obtain organized data so that it can be described with a scientific narrative. The selection of this research design aims to assist researchers in depicting, explaining, and analyzing mathematical literacy, self-efficacy, and student media needs. The research was carried out at Universitas Mercu Buana Yogyakarta which is located on Jalan Wates KM 10, Argomulyo Village, Sedayu District, Bantul Regency, Special Region of Yogyakarta Province. The subjects of this research are students of the Mathematics Education study program, Faculty of Teacher Training and Education, Universitas Mercu Buana Yogyakarta. The number of samples used in this study was students in the 4th and 6th semesters of Mathematics Education, Universitas Mercu Buana Yogyakarta.

The selection of research subjects is based on strategic and academic considerations, including the following: (1) As prospective educators, mathematics education students are required not only to master mathematical content, but also to have high mathematical literacy skills in order to be able to relate mathematical concepts to real-life contexts; (2) Based on initial observation and informal interviews with lecturers and students, it was found that some students still had difficulties in understanding and applying mathematical concepts in non-routine contexts, as well as lack confidence in solving problem-solving-based problems; (3) As an institution that is developing technology-based

learning innovations and student-centered learning approaches, the Mathematics Education Study Program, Universitas Mercu Buana Yogyakarta provides a wide space for relevant educational experiments based on student needs.

Data collection was carried out using questionnaire and test techniques. The questionnaire technique will use 2 instruments, namely a preliminary study questionnaire and a self-efficacy questionnaire. The preliminary study questionnaire was used to find out the needs of Mathematics Education students at Universitas Mercu Buana Yogyakarta related to the development of learning media to improve students' mathematical literacy and self-efficacy. The self-efficacy questionnaire was used to determine the level of self-efficacy possessed by students of Mathematics Education, Universitas Mercu Buana Yogyakarta. The test technique will use a mathematical literacy test instrument which aims to find out the level of mathematical literacy possessed by Mathematics Education students, Universitas Mercu Buana Yogyakarta.

The data analysis technique used in this study is qualitative data analysis which refers to Rijali [43] with the stages of analysis are: (1) Data Reduction, which is a stage of selective data selection and focuses on simplifying and transforming raw data from research results; (2) Data Presentation, which is the stage of collecting data that has been reduced and then presented in the form of text, graphs, or diagrams; and (3) Drawing of Conclusions, which is the stage of drawing conclusions from the data that has been presented as a result of data reduction.

The procedure for this research includes 3 stages, namely the initial stage, the implementation stage, and the final stage. The initial stage is carried out by preparing the research instruments to be used and validating the instruments so that the instruments used are valid. The implementation stage is carried out using instruments that are valid to the research subject. The final stage is the last stage by analyzing the data that has been obtained at the implementation stage.

C. RESULTS AND DISCUSSION

The results of the research that have been carried out will be described in accordance with the following research procedures:

1. Early Stages

The initial stage of this research begins with the preparation of the instruments to be used. There are 4 instruments used in this study, including: (a) Preliminary Study Questionnaire; (b) Self-Efficacy Questionnaire; (c) Mathematics Literacy Test; and (d) Observation Guidelines.

The preliminary study questionnaire focuses on analyzing students' needs for learning media to improve students' mathematical literacy and self-efficacy. The preliminary study questionnaire consisted of 18 questions related to students' preferences for learning media, student conditions, and students' views related to mathematical literacy and self-efficacy possessed by each student. The self-efficacy questionnaire used in this study consists of 30 questions with 4 aspects in it. The aspects in the self-efficacy questionnaire are: (a) Self-Efficacy; (b) Motivation; (c) Positivity; and (d) Resilience. This self-efficacy questionnaire is used to determine the level of self-efficacy of Mathematics Education students at Universitas Mercu Buana Yogyakarta.

The next instrument is a mathematical literacy test. The mathematics literacy test used in this study has 3 questions containing 7 indicators of mathematical literacy, namely:

a. Communication
   Students are able to identify and understand a problem such as reading, translating, and interpreting statements that can be asked questions and solutions
1. Mathematics
   Students are able to compose, conceptualize, make predictions, and formulate mathematical models and solve problems using mathematical solutions
2. Representations
   Students are able to represent mathematical objects and situations involving interpretation, translation, and the use of various representations in the form of tables, graphs, drawings, and diagrams
3. Reasoning and Arguments
   Students are able to engage a logical process to argue, analyze, and argue in exploring problems to draw conclusions and test the truth of a problem

4. Designing a problem-solving strategy
   Students are able to find and create mathematical problem-solving solutions
5. Use of Symbols
   By engaging comprehension, students are able to interpret, manipulate, and utilize symbolic expressions by understanding definitions, rules, and algorithms
6. Using Mathematical Tools.
   Students are able to use mathematical tools as aids or measuring tools.

This mathematics literacy test functions to determine the level of mathematical literacy of Mathematics Education students at Universitas Mercu Buana Yogyakarta. The last instrument is an observation guideline which serves as a guideline in observations made by observers.

Furthermore, at this initial stage, instrument validation will be carried out. Validation will be carried out on January 13, 2025. The validation results show that the instrument that has been prepared and will be used is valid. Therefore, the research can be continued to the implementation stage.

2. Implementation Stage

The implementation phase will be held on Monday, January 20, 2025 at the Mathematics Education study program, Universitas Mercu Buana Yogyakarta. The students who attended were 24 students consisting of 4th semester and 6th semester students. The researcher first distributes a preliminary study questionnaire to be filled out by students first. The researcher gave 15 minutes for students to fill out the preliminary study questionnaire. After completion, students collect the results of filling out a preliminary study questionnaire accompanied by taking math literacy test questions. The researcher gave 90 minutes for students to work on the mathematics literacy test questions. While the work is ongoing, the observer will fill in the observation guidelines. After students finish working on the math literacy test questions given, students collect the results of the work and take a self-efficacy questionnaire to be filled out by students. The researcher gave 15 minutes for students to fill out a self-efficacy questionnaire. After all students have finished, the researcher collects all the results of the students' work and recaps the data of the research results using Microsoft Excel software.

3. Final Stage

The final stage of this study is to analyze the data that has been collected. The results of the analysis related to the categorization of the level of mathematical literacy of the research subject, namely students of Mathematics Education, Universitas Mercu Buana Yogyakarta can be seen in Figure 1.

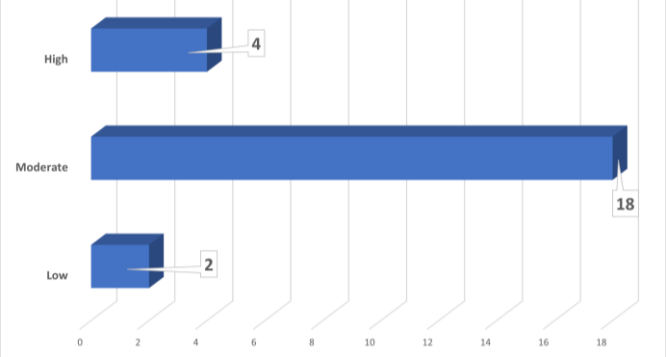

Figure 1. Categorization of Mathematics Literacy Level

Figure 1 shows that out of 24 students of Mathematics Education, Universitas Mercu Buana Yogyakarta, there are 4 students who have a high category related to the level of mathematical literacy. Followed by 18 students who have a medium level of mathematical literacy and 2 students with a low level of mathematical literacy. Furthermore, Figure 2 is presented for the analysis of each indicator of mathematical literacy of Mathematics Education students, Universitas Mercu Buana Yogyakarta.

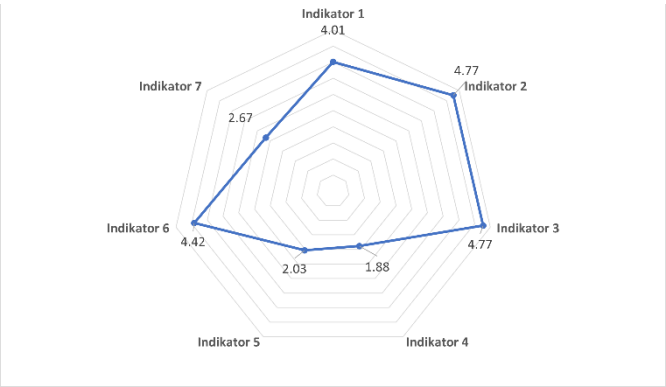

Figure 2. Assessment of Each Mathematics Literacy Indicator

Figure 2 shows that students are strong in indicators 1, 2, 3, and 6 which are indicators of communication, math, representation, and using symbols. Meanwhile, students are still weak in indicators 4, 5, and 7 which are indicators of

reasoning and argument, designing problem-solving strategies, and using mathematical tools. This needs to be considered because there is a gap that is quite far from the indicators that have been mastered by students.

Then, the results of the analysis related to the categorization of the level of self-efficacy of the research subject, namely students of Mathematics Education, Universitas Mercu Buana Yogyakarta can be seen in Figure 3.

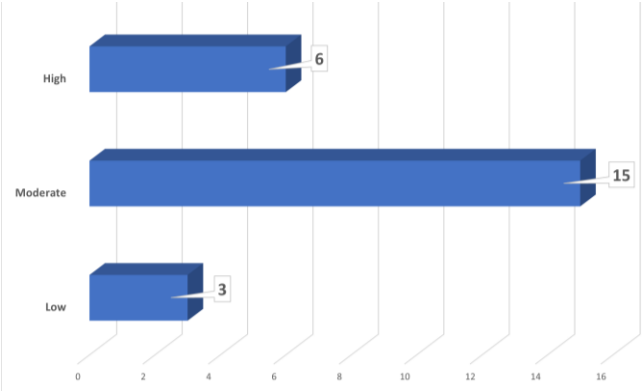

Figure 3. Categorization of Self-Efficacy Levels

Figure 3 shows that out of 24 students of Mathematics Education, Mercu Buana University, Yogyakarta, there are 6 students who have a high category related to the level of self-efficacy. Followed by 15 students who had a moderate level of self-efficacy and 3 students with a low level of self-efficacy. Furthermore, Figure 4 is presented for the analysis of the results of each indicator from the self-efficacy of Mathematics Education students, Universitas Mercu Buana Yogyakarta.

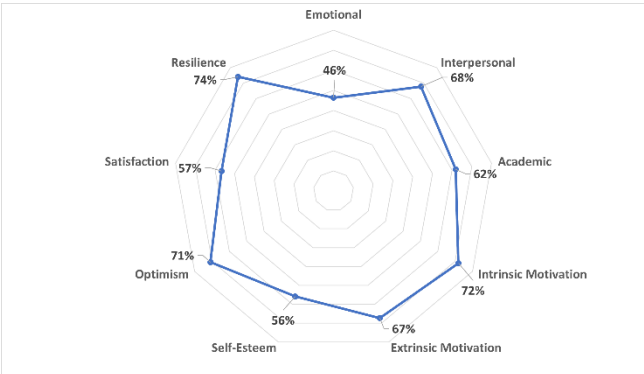

Figure 4. Assessment of Each Self-Efficacy Indicator

Figure 4 shows that overall, students are strong in indicators of resilience, interpersonal, intrinsic motivation, extrinsic motivation, and optimism. In addition, students are quite strong on academic indicators. Then students are quite weak in satisfaction, emotional, and self-esteem. The gap in each indicator is also a concern because there is a considerable gap.

Furthermore, the results of the preliminary questionnaire show the difficulties of students in statistical material which can be seen in Figure 5.

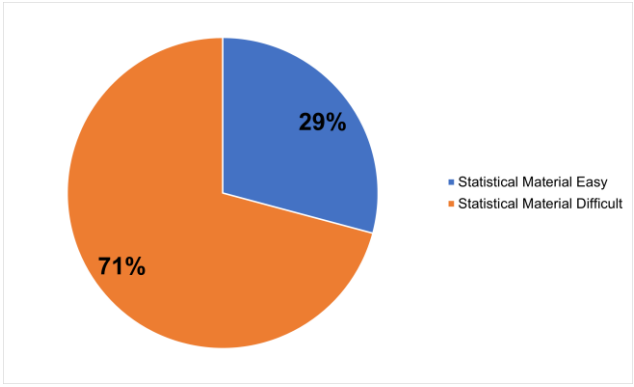

Figure 5. Students' Difficulties in Statistics Materials

Figure 5 shows that only 29% of college students feel that statistics are easy. Another 71% of students feel that the statistical material is difficult. 24 Mathematics Education Students, Universitas Mercu Buana Yogyakarta who were the subjects of research in their learning 100% used books and e-modules as sources. In addition, there are 8% of students who use video learning as a learning resource

Other results showed that 100% of students were interested if statistical materials were packaged in the form of e-modules and 17% of students were of the opinion to add learning videos to the e-module. 100% of students also feel that technology-based learning media can help students understand the material. In line with this, 100% of students are also interested if statistical materials are packaged in the form of e-modules. 100% of students are also interested in using the e-module.

Regarding e-modules, the results of the preliminary study questionnaire showed that 96% of students are of the opinion that a video explanation of the material is needed to be integrated into the e-module. 46% of students also think that practice questions and their discussions are needed to attend the e-module. 21% of students also think that there should be an example of the application of the material presented in daily life. In addition, there are 54% of students who give the opinion that the e-module should be blue. 25% of students feel that the e-

module should be yellow and the other 21% of students feel that the e-module should be purple.

Regarding the devices that are often used by students in accessing learning media, 100% of students feel that smartphones are the most comfortable device to access learning media. This is supported by 100% of students who use smartphones for more than 5 hours. This is in contrast to the use of laptops/computers where 92% of students only use it within a period of 1 hour – 3 hours. Another 4% of students use laptops/computers for a period of 3 hours – 5 hours and another 4% of students for a period of more than 5 hours.

The results of the research that have been described show the need for learning media that can improve students' mathematical literacy and self-efficacy. This can be seen that the level of mathematical literacy of students still needs to be improved. This statement is based on the results of the categorization of students' mathematical literacy levels where there are 2 students who have a low level of mathematical literacy and 18 students who have a moderate level of mathematical literacy. Only 4 students have a high level of literacy. Improving mathematical literacy is also necessary if you look at the results of the analysis of each indicator of mathematical literacy where students are still weak in terms of reasoning and arguments, designing problem-solving strategies, and using mathematical tools. Learning media that can improve mathematical literacy is needed.

The results of the study also show the importance of improving student self-efficacy. This statement is based on the results of the categorization of student self-efficacy levels which show that there are 3 students who have a low level of self-efficacy and 15 who have a moderate level of self-efficacy. Meanwhile, only 6 students have a high level of self-efficacy. The results of the analysis of each self-efficacy indicator also show that students are still weak in the indicators of emotional, satisfaction, and self-esteem. Therefore, learning media that can increase student self-efficacy is needed.

Based on the results of the research, e-modules are one of the learning media that can be used to help students improve mathematical literacy and student *self-efficacy*. This is based on students being used to using e-modules in learning at universities so that there is no need for adaptation time for students to use e-modules. 100% of students also support the development of e-modules to be used. In addition, the reason for choosing e-modules is because 100% of students feel that *smartphones* are the most comfortable device to access learning media. In addition, 100% of students use *smartphones* for more than 5 hours. Therefore, the development of e-modules is an interesting option for researchers to do.

The material that will be integrated into the e-module is statistics. This is because 29% of college students feel that statistics are easy. Another 71% of students feel that the statistical material is difficult. Therefore, statistical material is selected to be integrated into the e-module. Regarding the e-modules to be developed, 96% of students are of the opinion that a video explanation of the material is needed to be integrated into the e-module. 46% of students also think that practice questions and their discussions are needed to attend the e-module. 21% of students also think that there should be an example of the application of the material presented in daily life. In addition, there are 54% of students who give the opinion that the e-module should be blue. 25% of students feel that the e-module should be yellow and the other 21% of students feel that the e-module should be purple. These results will be considered by researchers in developing e-modules.

In the development of e-modules that are oriented to improve mathematical literacy and self-efficacy of students, a learning model that can be integrated into e-modules is needed [44]. One of the learning models that can improve mathematical literacy and self-efficacy is the problem-based learning model [45]; [46]. This is evidenced by previous research that shows that the development of learning media using problem-based learning can increase mathematical literacy and self-efficacy [47]; [48]. Therefore, it is evident that the need for problem-based learning e-modules that are oriented towards improving mathematical literacy and student self-efficacy. The implication of this research is the need for the development of e-modules that are oriented towards improving mathematical literacy and self-efficacy of students. In addition, literature review is also needed as a reference in the development of e-modules.

D. CONCLUSIONS AND SUGGESTIONS

The results of this study show that there is a need for problem-based learning e-module learning media that is oriented to improve mathematical literacy and student self-efficacy. This can be seen in the results of the study which show that the level of mathematical literacy and self-efficacy still needs to be improved. In addition, students' interest in e-modules is also the basis for students' needs for e-modules. This can illustrate that the e-module is a learning medium that is suitable to be applied to Mathematics Education students, Universitas Mercu Buana Yogyakarta. Suggestions for further research are the need to develop problem-based learning e-modules to improve students' mathematical literacy and self-efficacy.

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