

A.1. Journal of Physics_Analysis Of Student Needs For Mathematics Teaching Materials

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Analysis of student needs for mathematics teaching materials

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Abstract. The purpose of this study is to determine the mathematics teaching materials needed by students to improve problem-solving skills. This research is a qualitative descriptive study. The subjects of this study were PGMI students in the Metro city, province of Lampung. Data collection uses a non-test method that uses a questionnaire. The questionnaire consisted of 16 questions, which included eight questions about the analysis of learning resources (teaching materials) and 8 questions about determining learning resources (teaching materials). The results of this study are 1) mathematics teaching materials that are used effectively help students understand mathematical material, but are not effective in helping students develop problem-solving skills, 2) students need mathematics teaching materials based on contextual approaches to improve problem-solving skills. Based on the results of this study, it is necessary to develop mathematics teaching materials based on a contextual approach to improve problem-solving skills.

1. Introduction

Mathematics is one of the subjects needed to build a generation that is able to solve everyday problems independently. This is important because daily activities that are often carried out are problem solving and mathematics is involved in solving solutions to problems in various contexts or situations [1]. One of the skills students must have in the 21st century is problem-solving. This is relevant to 21st-century education that focuses on developing critical thinking skills and problem-solving, communication, collaboration, and creativity [2–4]. Problem-solving is recognized as a life skill that is very important because it involves a series of processes including analyzing, interpreting, reasoning, predicting, evaluating and pondering [5].

Designing mathematics learning that focuses on developing problem-solving skills is not an easy job. Many factors influence the success of mathematics learning, one of which is teaching the material. Teaching materials are one of the important elements in the process of learning mathematics. Teaching materials such as mathematics textbooks are one of the most important sources for teaching and learning mathematics and empirically the use of mathematical textbooks as a tool for learning mathematics [6]. Textbooks have the potential to be a powerful tool to help students develop an understanding of mathematics. However, many learners cannot use their textbook effectively as a learning tool [7]. Therefore it is necessary to have the right analysis to determine the teaching material to be used so that



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¹ it can be a powerful and effective learning tool in achieving learning objectives.

In general, various types of teaching materials can be used in the learning process of mathematics, but not all are effective in achieving learning goals. Textbooks are considered better if student-centered, promote independent learning, allow students to learn on their own at their own pace and have activities for students to improve topic mastery [8]. If a textbook gives students the opportunity to be involved in a task that demands a higher level of understanding, students who use this book will have higher abilities [9]. Thus good teaching materials are teaching materials that can facilitate student learning activities to achieve goals and can develop their potential to the fullest.

But in reality, it shows that available mathematics teaching materials only develop conceptual understanding. Teaching materials, especially mathematics, are used to be more memorized and fast formulas [10]. Similar conditions are also shown from observations during the learning process that the teaching materials used are more about discussing mathematical material, formulas, and accompanied by examples of routine mathematical questions. Mathematical questions that are non-routine or problem solving are rarely given. This is one of the factors causing low problem-solving ability for PGMI students. In the current curriculum, one of the achievements of mathematics learning is that students are able to solve problems related to numbers. For this reason, teaching materials are needed that can facilitate students to solve mathematical problems. Therefore, development of teaching materials must be carried out that can facilitate students to develop problem-solving skills. The development of teaching materials can be done through several stages, namely needs analysis, compiling teaching material maps, and making teaching materials according to the structure of each form of instructional material [11].

Needs analysis is the first step that must be done to develop a teaching material. The purpose of the needs analysis is for teaching materials to be developed in accordance with the competencies that must be mastered by students. Analysis of the needs of teaching materials can be done through several stages, namely curriculum analysis, analysis of learning resources, and determination of learning resources, and the title of teaching material [12]. By conducting a needs analysis, the researcher will find out that there is a condition that should be (what should be) and the real situation in the field (what is) [13]. Therefore, the analysis of the needs of teaching materials is very important because it can produce an overview of teaching materials that are in accordance with the needs of students to improve their mathematical problem-solving skills.

The purpose of this study was to determine the mathematics teaching materials needed by students to improve problem-solving skills. This research is part of a preliminary study of research and development of mathematics teaching materials based on a contextual approach to improve problem-solving skills. The results of this study became a reference in developing mathematics teaching materials to improve problem-solving skills for PGMI students.

2. Method

This research is a qualitative descriptive study that describes the needs of students for mathematics teaching materials to improve problem-solving skills. The subject of this study was the fifth-semester PGMI students in Metro city, Lampung province. The number of research subjects was 30 students. Determination of research subjects was carried out using purposive sampling. The reason for choosing V semester students is a) in general these students have relatively low problem-solving abilities, and b) these students have attended elementary mathematics courses so that comprehensive information can be obtained regarding teaching materials needed by students to improve problem-solving skills.

Data collection uses a questionnaire. The aspects studied include 1) analysis of learning resources and 2) determination of learning resources. These aspects were taken from the stages of the analysis of teaching materials proposed by Andi Prastowo [12]. The questionnaire consists of 16 questions, namely eight questions about learning resource analysis and 8 questions about determining learning resources. Each question has a choice of "yes" or "no" answers, and the reason why students choose the answer ". The research data analysis technique was carried out using qualitative descriptive analysis and percentage.

1 3. Result and discussion

The purpose of this study was to determine the mathematics teaching materials needed by students to improve problem-solving skills. The aspects of teaching material need analysis in this study were 1) analysis of learning resources including the availability of mathematics teaching materials, suitability of mathematics teaching materials, ease of teaching materials used, and 2) determination of learning resources (teaching materials).

3.1. Analysis of learning resources or teaching materials

Analysis of learning resources in this study include a) the availability of mathematics teaching materials, b) the suitability of mathematics teaching materials, and c) the ease of teaching materials used. Based on the results of the questionnaire about the analysis of learning resources, the following data are obtained:

3.1.1. *Availability of mathematics teaching materials.* The researcher gave four questions to students about the availability of mathematics teaching materials. Data on the availability of mathematics teaching materials that have been used by students are as follows:

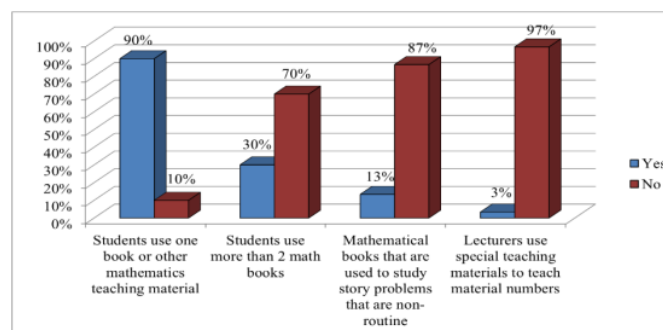


Figure 1. Availability of mathematics teaching materials.

In Figure 1 shows that 90% of students have one math book when studying number material and 10% do not have math books, 30% of students use more than 2 mathematics books and 70% of students do not use more than 2 mathematics books, 13% of students state that books used to study problem solving questions and 87% of the books used did not study problem solving questions, 3% of students stated that lecturers used special teaching materials such as modules to study problem-solving questions and 97% of students stated that lecturers did not use special teaching materials when studying problem-solving material related to numbers.

Based on this information, it was described that in general students had at least one teaching material or mathematics book. Furthermore, some students try to use additional teaching materials when studying material numbers. But teaching materials used by these students rarely study non-routine questions or problem-solving. In addition, lecturers also do not use teaching materials that focus on teaching problem-solving material related to numbers. This shows that the availability of mathematics teaching materials that focus on learning about mathematical problem solving is still limited. Therefore, it is necessary to develop mathematics teaching materials that focus on developing problem-solving abilities.

3.1.2. *The suitability of mathematics teaching materials.* The suitability of mathematics teaching materials in this study is the suitability of teaching materials to achieve goals or develop expected competencies. The researcher gave two questions to students about whether the mathematics teaching materials used supported them to understand the material and develop problem-solving abilities. The data are as follows:

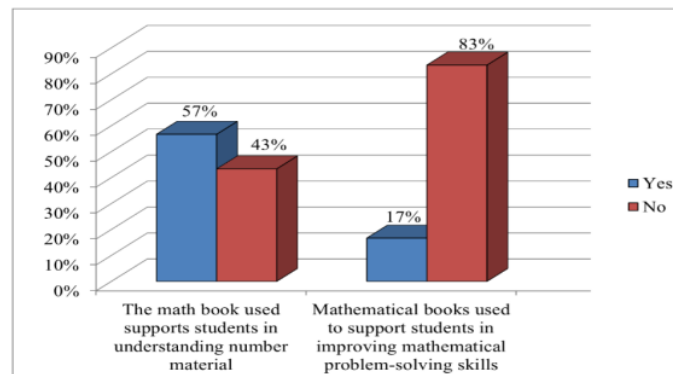


Figure 2. The Suitability of mathematics teaching materials.

In Figure 2 above shows that 57% of students stated that the math books used to support them in understanding number material or 43% of students stated that the mathematics books used did not support them understanding number material, and 17% of students stated that the mathematics books used supported the improvement of problem-solving skills or 83% of the books used do not support students in improving problem-solving skills.

Based on this information, it was described that the mathematics books available had helped students understand mathematical material, but 83% of students stated that existing mathematics books had not helped improve problem-solving skills. The ability to solve problems related to mathematics is part of the learning achievement that must be mastered by students. Thus it can be explained that the available mathematics teaching materials are not yet appropriate in achieving the expected competencies. Therefore, it is necessary to develop mathematics teaching materials that can support the improvement of problem-solving skills.

3.1.3. Ease of teaching materials. The ease of teaching materials in this study is whether teaching materials that have been used effectively help students to understand the material and improve problem-solving skills. The data about the ease of teaching materials that have been used in the mathematics learning process are as follows:

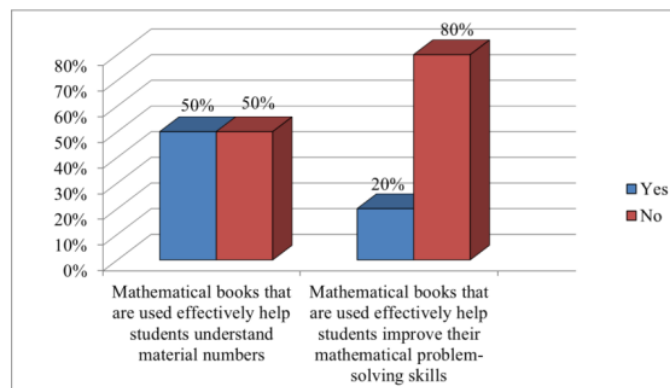


Figure 3. Ease of mathematics teaching materials used.

In Figure 3 describes that 50% of the math books used are easy and effective to help students understand material numbers, and 50% of students answer that the books used are not effective to help

1 them understand the material. Furthermore, only 20% of students stated that mathematical books that are used effectively help students develop mathematical problem-solving abilities, and 80% are ineffective in helping to improve problem-solving skills.

Based on this information indicates that in general students need easy and effective teaching materials used to understand and solve problems. This is very important because the ability to understand and solve problems is part of the achievement of mathematics learning that must be mastered by students. Therefore, it is necessary to develop an easy and effective mathematics teaching material to understand the material and solve mathematical problems.

3.2. Determination of learning resources

Determination of learning resources or teaching materials in this study is to determine the appropriate mathematics teaching materials and students need to develop mathematical problem-solving skills. The data generated is as follows:

Table 1. Teaching materials needed by students.

No	Teaching Materials needed by students	Answer	
		Yes	No
1.	Alternative teaching materials in studying material numbers	97%	3%
2.	Mathematics teaching materials that associate mathematical material with everyday life	100%	0%
3.	Mathematics teaching materials that can help to find or construct a concept, formula, procedure related to numbers	97%	3%
4.	Mathematics teaching materials that can help develop the ability to ask questions, analyze, answer questions, and reflect	100%	0%
5.	Teaching materials that can provide motivation in solving math problems	100%	0%
6.	Mathematics teaching materials that can help to develop mathematical problem-solving abilities (eg non-routine story questions)	100%	0%
7.	Students agree when developing teaching materials that specifically study material numbers and their application in daily problem solving	100%	0%
8.	Students agree when developing mathematics teaching materials based on a contextual approach to improve problem-solving skills	100%	0%

1 In Table 1 shows that students need 1) alternative teaching materials to study number material, 2) mathematics teaching materials that link mathematical material with everyday life, 3) mathematics teaching materials that can help find or build their own concepts, formulas, procedures relating to numbers, 4) mathematics teaching materials that can help students develop the ability to ask questions, analyze, answer questions, and self-reflection, 5) teaching materials that can provide motivation in solving mathematical problems, 6) mathematics teaching materials that can help students developing mathematical problem-solving abilities, 7) teaching materials that specifically study material numbers and their application in daily problem solving, and 8) students agree if mathematical teaching materials are developed based on a contextual approach to improve problem-solving skills.

The mathematics teaching materials above have several characteristics of contextual approaches, such as linking material to everyday life, discovering concepts (inquiry), asking questions, and reflecting. The contextual approach helps students connect the material learned with real-life situations. Linking the material helps students find meaning in the learning process [14]. Learning with a contextual approach has 7 components, namely constructivism, inquiry, asking questions (questioning), learning community (learning community), modeling (modeling), reflection (reflection), real assessment (authentic assessment) [15]. Thus it can be concluded that students need mathematics teaching materials based on a contextual approach to improve problem-solving skills. This is also reinforced from the

¹ results of the eight-point questionnaire, namely 100% of students agreed when developing mathematics teaching materials based on a contextual approach to improve problem-solving skills.

This research is a preliminary study which aims to find out mathematics teaching materials that are suitable with the needs of students. The initial problem in this study was that many students had difficulty solving mathematical problems or non-routine problems. The results of observations in the learning process show that the teaching materials used have not maximally facilitated students to develop problem-solving skills. Thus, the needs analysis of teaching materials must be carried out according to the needs of students so that they can improve problem-solving skills. The aspects of the needs analysis of the teaching materials studied included the analysis of learning resources and the determination of learning resources (teaching materials).

On the results of the research described earlier about the analysis of learning resources (teaching material) shows that 1) the availability of mathematics teaching materials that focus on learning about mathematical problem solving is still limited, 2) existing mathematics teaching materials are not yet appropriate in achieving the expected competencies namely solving skills problems, and 3) mathematics teaching materials used are quite effective in developing conceptual understanding but have not been effective in developing problem-solving abilities. Problem-solving is one of the abilities that must be mastered by students after attending mathematics lectures. Problem-solving is a high-level capability. Problem-solving is recognized as a life skill that is very important because it involves a series of processes including analyzing, interpreting, reasoning, predicting, evaluating and pondering [16]. Therefore, it is necessary to develop mathematics teaching materials that can help students improve problem-solving skills.

Furthermore, the results of research relating to the determination of learning resources or teaching materials indicate that students need mathematics teaching materials based on a contextual approach to improve problem-solving skills. It can be understood that the contextual approach has components that support the creation of active and enjoyable learning. Significantly, a contextual approach can increase learners' motivation [17]. Mathematical learning with a contextual approach can improve students' understanding and problem-solving skills in terms of overall and mathematical ability categories [18], [19]. Contextual game-based learning approaches effectively enhance the effects of student learning on learning achievement, motivation, and satisfaction levels [20]. With contextual learning, students' ability to study, predict and make conclusions can develop well compared to students who use ordinary learning [21].

As previously explained, this research is part of a preliminary study on research and development of mathematics teaching materials. Therefore, the results of this study are used as a reference for developing mathematics teaching materials that are in accordance with the needs of PGMI students. Based on the results of this needs analysis, the development of mathematics teaching materials based on a contextual approach will be carried out to improve problem-solving skills. The mathematics teaching materials referred to in this study are teaching materials that contain seven components of the contextual approach. This component is reflected in the learning activities provided in teaching materials. In addition, problem-solving activities such as understanding problems, making plans, carrying out solutions, and looking back is also provided in teaching materials. Problem-solving activities can be given at the beginning or at the end of the presentation. When a problem is given at the beginning it aims as a starting point to find yourself a mathematical concept or procedure. When a problem is given at the end of the presentation the material aims to train students to be more skilled in solving mathematical problems. Thus it is expected that the teaching materials to be developed can help students understand the material meaningfully and improve the ability to solve problems optimally.

4. Conclusion

Based on the results of the study it can be concluded that 1) the availability of mathematics teaching materials that focus on learning about mathematical problem solving is still limited, 2) existing mathematics teaching materials are not yet appropriate in achieving the expected competencies, especially problem-solving skills, 3) mathematics teaching materials used are quite effective in

1 developing conceptual understanding, but not effective in developing problem-solving skills, and 4) students need mathematics teaching materials based on a contextual approach to improve problem-solving skills. The teaching material based on the contextual approach in question is teaching material that can relate the material to everyday life, facilitate students to discover or build new knowledge, motivate students to solve mathematical problems, facilitate students to skillfully solve problems, facilitate students to ask questions and answer questions, and facilitate students to do self reflection.

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