



The Needs Analysis of Mathematics E-Module Based on Probing Prompting Model to Improve Problem Solving Ability

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Abstract. Problem solving is an integral part of learning that benefits students in seeing the relevance of mathematics to real life. The results of the pretest show that the value of the problem solving ability of Class VI students in Karanganyar Regency in mathematics only gets an average of 46. This study aims to identify students' difficulties in solving problems, describe the teacher's efforts in improving these abilities, and explore the weakness of textbooks used in learning. This type of research is descriptive qualitative. The research subjects consisted of 8 teachers and 16 students of grade VI primary school in Karanganyar Regency. Data were collected by interview, observation, and documentation methods. Data analysis techniques using data reduction, data presentation, and drawing conclusions. The results showed that the majority of students have difficulty in understanding the problems in the spatial material, besides that students cannot determine the right strategy to solve the problem, efforts that have been made by the teacher by conducting drill exercises, it is seen that the creativity of educators is low in improving problem solving abilities, and the textbooks used do not practice problem solving with uncoordinated systematics and language that is difficult for students to understand. The 21st-century learning process requires effective, interactive, and innovative teaching media, one of which is the E-module. The concept of probing prompting learning emphasizes the involvement of students so that they can experience their own knowledge as a result of the problem solving process. The development of E-modules is a necessity to provide teaching materials that can improve problem solving abilities. The results of the study recommend the development of an E-Module based on the Probing Prompting model that can guide students to gain understanding to solve mathematical problems.

Keywords: e-module, probing prompting, problem solving skill

1 Introduction

The ability to solve problems is a very important skill. Being a good problem solver can lead to big profits [1]. Through problem solving skills, students will be able to manage real-life situations mathematically. Every human being in his life will always face a problem that requires skill and ability to solve it.

This is in accordance with the learning theory proposed by Gagne, that high-level intellectual ability can be developed through problem solving [2]. Problem solving is an individual way of responding to or overcoming obstacles or time constraints for an answer or an answer method that is not obvious [3]. Problem solving can be interpreted as an effort to find solutions to the problems at hand. One of the efforts to train students' ability in solving mathematical problems is to solve problems according to Polya's theory. Polya revealed that the problem solving process has four stages, including (a) understanding the current problem, (b) determining the problem strategy, (c) implementing the problem strategy, and (d) conducting an assessment [4].

Students usually learn from questions. A question in mathematics can be defined as a problem if it is not a routine question [5]. Non-routine questions are questions whose completion procedures are not yet known by students, so students are interested in solving them. The problems posed are needed to enable them to have problem solving skills.

However, the observation results show that students' problem solving skills are still low. This is evidenced by the 2021 "Rapor Pendidikan", the average value of numeracy skills at the national level only reaches a value of 1.57 - out of a maximum value of 3.00. Meanwhile, in Karanganyar Regency, the score is 1.62 [6]. The results of this numeracy ability provide an overview of students' problem solving abilities [7]. The "Rapor Pendidikan" data shows that students' ability to solve problems is still low, one of which is experienced by students in Karanganyar Regency.

Based on reports on student learning outcomes in Mathematics, it was found that students had problems solving problems in geometry. Geometry is a mathematical material that is taught at all grade levels in elementary school with different levels of difficulty. Geometry is one part of the mathematical topic that is very close to students' lives, but students have difficulty solving problems related to the topic. Students have sufficient procedural skills in solving problems that are often encountered, but have difficulty applying the knowledge they have to solve non-routine problems. [8]. In addition, geometry is also a basic foundation that has an important role in supporting mastery of algebraic concepts, numbers, arithmetic, and further mathematical concepts. Furthermore, after a pretest that measures the problem-solving ability of building materials at the sample elementary school in Karanganyar Regency, the average value of 41.38 was obtained.

There are several factors that cause low student mathematics learning outcomes [9]. Among them are the dominant role of the teacher in the learning process, the unpreparedness of students in learning, the boredom experienced by students in learning mathematics due to the incompatibility of students' cognitive levels with the material being taught, incompatibility between the material being taught and the contents of books or teaching materials, and lack of self-confidence students on their mathematical abilities.

The selection of the right teaching materials or learning media is certainly very influential on the success or failure of a teaching and learning process so that learning resources are needed that can maximize distance learning such as e-modules. Interesting teaching materials are needed by students who can make it easier to remember learning materials [10].

Observation findings in the field indicate that one of the causes of low mathematics learning outcomes is that students only learn and receive information from the teacher. Students do not learn independently other than at school. This is because no math module/handbook is suitable for independent learning by students. So far, students learn mathematics from textbooks whose presentation of the material is quite monotonous and does not stimulate students to solve problems and be able to solve problems. The systematics of textbooks that are difficult to understand and have an unattractive appearance make it very rare for students to open their textbooks.

Mathematical problem solving is seen as an important aspect of mathematics, mathematics teaching, and mathematics learning. When someone solves a problem, the greater the opportunity for that person to use higher order thinking [11]. So it can be concluded that students must be able to have mathematical abilities to solve problem solving problems. Problem solving must be owned by students, as a first step so that they can be trained to deal with problems in the field of mathematics and also problems of everyday life. The purpose of learning mathematics is that students are able to have problem solving abilities. In everyday life, consciously or not, we are faced with many problems that require us to solve these problems.

To practice problem-solving skills, you can develop learning resources, namely by developing mathematics modules. Modules can be designed systematically so that students can use them independently. The habit of students today is that they access gadgets more often than reading books. Distance learning, which had been running for 1.5 years, made most students now have their own devices. In addition, one of the government programs, namely the Minimum Competency Assessment / Asesmen Kompetensi Minimum (a program to measure student competence in literacy and numeracy) which is computer-based and takes place online, makes each educational unit improve technology infrastructure facilities in the learning process. Therefore we need an electronic module suitable to help students learn and understand material anywhere and anytime.

Learning media is needed to support mathematical skills, one of which is an electronic module. E-module can be a learning media that can make it more interesting and interactive. Learning using e-modules can change students' views to be more interactive in reading and become more comfortable. In addition, using electronic media makes learning more interesting anytime and anywhere [12]. Electronic modules are presented in an electronic format, each learning activity is connected by a link as navigation so that students are more interactive, equipped with videos, animations, and audio to enrich the student's learning experience.

The development of material in the form of modules will be more focused if it is compiled using a particular model that suits the needs of students. Probing-prompting learning is closely related to questions [13]. The questions raised during this lesson are called probing questions. Questions aim to explore and get deeper answers from stu-

dents. The concept of probing prompting learning emphasizes the involvement of students so that they can experience their own knowledge as a result of the problem solving process. Probing prompting is a method that is carried out in class with teacher direction, then applied in the context of independent learning by using modules as learning resources [14].

E-modules are proven to improve student learning outcomes in mathematics, including research that developing interactive e-module based on a realistic mathematics education approach and mathematical literacy ability [15] and research that developed e-module about geometry based on vee's heuristic strategy to train students' mathematical representation skills [16]. The probing prompting-based e-module that has been developed is used for students at the high school or college level [17] which is used to practice problem solving at the junior high school level. Also development of probing prompting-based module on students majoring in Mathematics Education STKIP Pamane Talino [18]. However, there has been no development regarding probing prompting-based building e-modules at the elementary school level.

In the research that will be carried out to develop the e-module, it is necessary to conduct a needs analysis to see how far the e-module is needed in the learning process and to know the real conditions in the field by collecting various kinds of information such as the availability of the teaching materials used. in learning activities through interviews with subject teachers and students.

This article aims to identify students' difficulties in solving problems, describe the teacher's efforts in improving these abilities, and explore the weakness of textbooks used in learning. Analysis of the needs for the development of learning modules based on Probing Prompting includes analysis of curriculum, materials, and student characteristics. Various analyzes were carried out to determine the need for the development of a comprehensive learning module in accordance with student conditions, curriculum, and conditions in the field. A thorough and accurate needs analysis is expected to be able to develop learning modules that are in accordance with the needs of the field.

2 Research Methods

2.1 Research Design

This study uses a qualitative descriptive method, which is used to examine natural conditions. Qualitative research is a research that aims to understand the phenomenon of what is experienced by the research subject. For examples are behavior, motivation, action holistically and by way of description in the form of words and language in a special natural context and by utilizing various natural methods. [19]

The descriptive method aims to help solve problems that occur in the present and is centered on actual problems. The descriptive method is to clarify each step of the research in detail. This study aims to analyze the need for e-mathematical modules that can improve students' problem solving abilities.

2.2 Research Subject

The population in this study were all teachers and students of class VI in Karanganyar Regency. While the samples in this study were 8 teachers and 16 grade VI students from 8 different elementary schools in Karanganyar Regency. The sampling technique was purposive random sampling.

The teachers and students are from: 1). SDN 01 Dopleng is located in Karangpandan District, 2). SDN 01 Banjarharjo is located in Kebakramat District, 3). SDN 03 Karangmojo is located in Tasikmadu District, 4). SDN 03 Karanganyar is located in Karanganyar District. , 5). SDN 02 Wonosari is located in Gondangrejo District, 6). SDN 02 Dukuh is located in Ngargoyoso District, 7). SDN 02 Gentungan is located in Mojodang District, and 8). SDN 01 Harjosari is located in Karangpandan District.

2.3 Data Collecting

Data were collected by interview, observation, and documentation methods. Interviews were conducted with teachers and students of Class VI in Karanganyar Regency on April 3-10, 2022. The purpose of the interviews was to obtain in-depth information about the needs of teachers and students. Data from interviews is primary data because it is obtained directly from the first party.

As reinforcement and data complement to support data quality, observation and documentation activities were carried out. Observation is a way to make careful observations and record systematically [19]. Observation aims to obtain data about the model, the learning media used, the effectiveness of using the module, student activity, and observing students' ability to solve problems directly.

While the documentation method is carried out by taking information from the textbooks used, school curriculum, lesson plans, and a list of student grades. The data are taken to support the information obtained from interviews and observations.

Qualitative research in maintaining the validity of research data must determine the accuracy and credibility of the results by using appropriate strategies, such as member checking or triangulation [20] (a) Data triangulation means using various data and using more than one theory in processing research results. (b) Member checking; means that the results of the interview data are confronted again with the participants to read, correct, or strengthen the results of the data made by the researcher.

2.4 Instrument

Research instruments are tools used by researchers in collecting data so that their work is easier and the results are better [21]. In qualitative research, the researcher acts as an instrument as well as data collector. The instruments used in this study are interview guides, observation guidelines and documentation guidelines.

In the interview stage, the researcher used a semi-structured interview type to make the conversation more representative of the data to describe the instrument's mindset.

Aspects explored in interview activities are related to 1) students' ability to solve problems, 2) quality of textbooks used in learning, and 3) module criteria needed by teachers and students.

As for the observation activities, the observed aspects are related to: 1. The learning process carried out (the use of books/modules, models, and learning media used); 2. Student condition (student activity and problem solving ability); and 3. School conditions (facilities and infrastructure and support from school leaders)

The data obtained in the documentation study is used as a tool to check the suitability of the data obtained from interviews and observations as a data triangulation technique to obtain valid data. The data triangulation process will continue to be carried out until saturated data is found from the three qualitative data analysis techniques. The documents examined included the textbooks used, the school curriculum, lesson plans, and a list of math scores.

The validity of the interview, observation, and documentation instruments is carried out with content validity through expert judgment activities, is considered valid when the instrument items are arranged based on the specified rules and are representative of the whole thing being measured [22]

2.5 Data Analysis

The data analysis technique was carried out using the Miles and Huberman model (1984). Data analysis was carried out in three stages. The first stage is data reduction. Reducing data means summarizing, choosing the main things, focusing on the important things, looking for themes and patterns, and removing unnecessary ones. The reduced data provides a clear picture and makes it easier for researchers to collect data.

After the data is reduced, the second step is to present the data. The presentation of data in qualitative research is carried out in the form of brief descriptions, charts, and looking for relationships between categories. The last stage is drawing conclusions and verification. The conclusion drawn can answer the formulation of the problem that has been formulated, namely how the need for an E-Module for Mathematics learning is to improve problem solving skills.

3 Results and Discussion

3.1 Students' Difficulty in Solving Problems

Based on the results of interviews, students have various abilities in the mathematics learning process. Some students are very good, moderate, and even very weak in mathematics. However, the difficulties mentioned in each research location stated that students experienced the same thing in learning mathematics in class VI, namely the low learning outcomes of students in building material, whether it was looking for volume or surface area.

A respondent teacher answered "During my teaching in sixth grade, mathematics material that always got low scores occurred in the learning of geometric shapes. This

is because the understanding is not comprehensive and may not be able to understand the concept in real.” This statement is also supported by the results of the documentation of student learning outcomes and the results of observations during the learning process.

The majority of students have difficulty understanding the problems asked, besides that students cannot determine the right strategy to solve the problem. In problem solving, several stages are needed in solving problems. Students find it difficult to apply the formulas they have learned.

This is in line with the results of the study that showed that the mistakes made by students when working on problems related to mathematical problem solving abilities were errors due to carelessness or lack of accuracy, errors in transforming information, errors in process skills, and errors in understanding questions. [23].

In addition, other problems occur when students do not understand the prerequisite material, such as not being able to convert units of length and volume. Some students also still need a long time to do multiplication and division calculations. This problem is caused by various factors, including the limitations of learning media, and the low independence of students in learning. Each educator also explained that the use of learning media is not a priority. In addition, it is also caused by the complexity of the material, lack of examples, descriptions and explanations in books, students have difficulty memorizing formulas, and students are not careful in doing calculations. In addition, students also do not understand the concepts of volume and space. This immature understanding of the concept is one of the factors causing the low ability of students to solve problems in learning mathematics. There are no quality modules to support mathematics learning.

The condition of the school and its surroundings, after observing directly the researchers found the fact that the school has adequate facilities and facilities, comfort for the continuity of the learning process both in terms of location. However, educators tend to be less creative to be able to use media according to the needs and pleasures of students.

The findings in this observation process indicate that students have slightly different responses from other subjects. Students show less active participation in the learning process. This is also due to the limitations of the teaching materials and media they use during the learning process. Therefore, it is necessary to produce media that facilitate learning as a whole to be able to increase student responses.

3.2 Teachers' Efforts to Improve Problem Solving Ability

Based on the results of interviews, it was found that to improve mathematics learning outcomes, the teacher carried out more drill exercises. Sometimes teachers apply cooperative learning models and use 3-dimensional media to study geometry. However, the things that have been done by the teacher have not been able to improve students' ability to solve problems.

The teaching resources that teachers use in learning mathematics are using math books from the government. In addition, teachers use other textbooks, for example the

book ESPS Publisher Erlangga. Sometimes teachers show math learning videos and use supportive teaching aids.

One of the respondent teachers said, "The teaching resources that I use in learning mathematics are using 2013 curriculum books, besides that sometimes I show videos of learning materials, and use 3-dimensional building media."

Through the documentation of the Learning Implementation Plan (RPP) in mathematics, it can be seen that the teachers have not considered the ability to solve an important thing to be mastered. Through interviews and observations, it can be seen that the creativity and lack of innovation of educators in improving problem solving skills are seen. Teachers tend to continue learning to pursue the material that must be completed.

Teaching materials have an important meaning for teachers and students. Teachers will have difficulty in increasing the effectiveness of learning if it is not accompanied by adequate teaching materials. Likewise with students, without good teaching materials, students will have difficulty in learning. Learning by using modules can help schools in realizing quality learning. Modules can facilitate students to be more interested in learning, students automatically learn from prerequisites and can improve learning outcomes [24].

3.3 Weakness of Textbooks

Media analysis was carried out to obtain information related to the real conditions of using textbooks and learning media in schools. Researchers found the fact that most teachers only use textbooks from the government in teaching mathematics. Of course, this is not enough to realize quality learning. Based on interviews conducted with sixth-grade teachers in Karanganyar Regency, the teacher thought that the quality of the book was still lacking, indicated by the lack of explanations in the material and limited practice questions.

Not many educators know about learning media and teaching aids that can be used for learning. Therefore, the existing learning tools in schools are less well maintained and cannot be used in the learning process. This should be an encouragement for educators to be able to take advantage of learning tools that are in accordance with the needs of fulfilling basic competencies. However, this continues to happen because educators only prioritize the convenience of printed books and cheap media without paying attention to the convenience that can be obtained by students in terms of their developmental tasks.

Based on these conditions, educators need to improve their abilities so that they can encourage students' ability to understand spatial material and be able to solve problems related to the material. Because based on the results of interviews, building space is the most difficult material to master compared to other materials. Therefore, educators need to conduct a more in-depth analysis in determining learning tools that are in accordance with the conditions of students, such as independent learning.

One of the teaching materials that can be used is e-module so that students are facilitated in learning the material with limited guidance from educators. All teachers think

that the electronic module it will make it easier and help students in learning. The limitations of learning media in the research location indicate that there is a need for learning media according to the conditions and needs of students and teachers. This condition was confirmed by the teacher's statement in the interview process in terms of the need for easy and inexpensive media. Every school in the research location does not yet have an e-module in learning.

However, educators do not act actively to be able to provide this. When questions about e-modules were asked to educators, they simultaneously answered with almost the same statement, in which they stated that the provision of e-modules was indeed good for students to use. However, educators have never made it so that using the existing printed books is the most appropriate choice according to them.

Educators need to provide media according to their needs, as well as media that encourage students to be able to learn independently, so that students can be responsible for their duties in learning. Not only for doing assignments, but also can help students to increase interest in learning mathematics. This is indeed a challenge for educators, but the achievement of this competence is of course to be able to improve the ability of students in solving life problems, especially in the material of building space. Students often think that learning mathematics is difficult, even though they have not yet learned it. This paradigm needs to be changed by presenting the right learning process

Previous studies have described the use of e-modules that can increase their effectiveness and demonstrate their practicality in mathematics. Research by Feriyanti (2019) shows that the development of e-modules can improve the learning outcomes of third grade elementary school students [25]. While research by Turnip (2021) proves that the development of e-mathematical modules can improve critical thinking skills [26].

An e-module that deserves to be developed to improve problem-solving skills is an e-module based on probing prompting, according to the meaning of the word probing is an investigation or examination, while prompting is encouragement. The probing-prompting-based module is a learning resource that was developed using a learning strategy in the form of giving problems as a stimulus to get good mastery of the material, then balanced with several questions that guide and direct students to explore understanding of the material. [17].

The provision of e-modules is an option that can be used for the learning process with the characteristics of being able to explain independently, this helps students to be able to learn independently. Because in the e-module there are learning instructions and a complete description of the material aimed at the target. Educators can develop e-modules for use with limited meetings to facilitate the learning process. Analysis of the needs of this e-module will have an impact on the continuity of the learning process and students' interest in learning mathematics. In addition, the development of e-modules can also project the use of technology in compiling teaching material as a learning tool. E-modules can also be a medium that can be used to improve the learning outcomes of students.

4 Conclusion

E-modules are a form of teaching materials that can be used in the learning process of building materials that are considered difficult for elementary school students to master. The conclusion of this study showed that the majority of students have difficulty in understanding the problems in the geometry that students cannot determine the right strategy to solve the problem, efforts that the teacher has been made by conducting drill exercises, it is seen that the creativity of educators is low in improving problem solving abilities, and the textbooks used do not practice problem solving with uncoordinated systematics and language that is difficult for students to understand.

The limited supply of teaching materials encourages the need for development or renewal in the use of existing teaching materials. In addition, development needs to pay attention to the characteristics of generations, technological developments, cognitive, psychological and problem solving abilities of students. The development of this e-module is a necessity to provide teaching materials that can improve problem solving skills with the probing prompting model. This model is suitable to be used because it can guide students to gain understanding to solve problems. Teachers and students stated that they needed a mathematics e-module that could be understood, and motivated in learning, there were many real problem models, so that teachers and students agreed and supported the creation and development of mathematics modules to improve problem solving skills.

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