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Material Teach Differentiated Style Study for Increase Mathematical Problem Solving Abilities

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Abstract- This research was carried out with the aim of finding out the problems found in tenth grade, or what is called Phase E. This research is expected to be able to overcome the problems of students who experience problems in solving problems by looking at students' learning styles. The type of research used in this research is a classroom action research method with a qualitative approach. The instruments used in this research were a learning style questionnaire, observation sheets to observe interactions between teachers and students, as well as interactions between students during the mathematics learning process. This research was conducted in phase E. From the research conducted, it was found that the use of teaching materials with differentiated learning styles can improve students' problem-solving abilities. It can be seen because there is an increase from the initial diagnostic student scores to the second cycle.

1. Introduction

Problem-solving in mathematics is a fundamental cognitive ability that can be trained and developed in students, so it is hoped that when students are able to solve mathematical problems well, they will be able to solve real problems after taking formal education (Gunsteren et al., 2001; Tsaparlis & Angelopoulos, 1999; Walker et al., 2008)). Problem-solving ability is an essential ability that students must have. Therefore, students must be trained to solve problems that can improve students problem-solving abilities.
According to Polya ((Shadiq & Mustajab, 2010), there are four aspects of problem-solving abilities as follows:

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a) Understand the problem
   In the aspect of understanding the problem, it involves deepening the problem situation, sorting facts, determining relationships between facts, and formulating problem questions. Every written problem, even the easiest ones, must be read several times, and the information contained in the problem must be studied carefully.
b) Make a problem-solving plan.
   The solution plan is built by considering the structure of the problem and the questions that must be answered. In the problem-solving learning process, students are conditioned to have experience applying various kinds of problem-solving strategies.
c) Implement a problem-solving plan.
   To find the right solution, the plans that have been made must be implemented carefully. Diagrams, tables, or sequences are constructed carefully so that the problem solver will not be confused. If inconsistencies arise when implementing the plan, the process must be reviewed to find the source of the problem.
d) Look (check) again.
   During the check, solutions to the problem must be considered. The solution must still be appropriate to the root of the problem, even though it seems unreasonable.

From the four aspects of problem-solving ability above, it can be seen that problem-solving ability has specific steps to be completed. So, students must have basic problem-solving abilities.

Problem-solving abilities are critical for students to have because they can discover new abilities. In addition, students' problem-solving abilities in learning mathematics are related to their way of learning (learning independence) ((Kemmis et al., 2014). Apart from that, problem-solving skills related to the real world can be integrated to solve problems and compete in the real world as well ((Cahyani & Setyawati, 2016). Good students' mathematical problem-solving abilities do not always accompany the importance of problem-solving abilities in mathematics lessons. One of these things happened to class 10th grade high school or what is called Phase E. Based on the results of observations (Pre-Cycle) at SMAN 8 Padang.

According to Hajar (2018), factors such as students who are not used to facing problem-solving questions because they are used to working on simple problems. Several efforts can be made to overcome student difficulties, such as using innovative learning approaches and media. According to (Rosita et al., 2021), problem-solving abilities show that male students are more prominent in the implementation stage only; female students write the stages of understanding, creating, implementing, and checking in sequence and are more inclined towards the process of imitating previous solutions. Students with self-confidence very high have better problem-solving abilities compared to other students (Pemecahan & Mathematics, 2021; Susanti, 2021) ;(Zhang et al., 2010).

There has been a lot of previous research carried out to address problem-solving abilities. However, there is still less research conducted to overcome this by paying attention to students' learning styles. Learning style is something that must be considered in an effort to improve students' problem-solving abilities because learning style is an internal factor that exists within students.

Learning style is a crucial aspect that teachers and students must pay attention to because learning style is the key to student learning success (Lestari & Widda Djuhan, 2021; Vaishnav, 2013). Each student has a different learning style from others. Namely visual learning style, students receive material more through their sense of sight; auditory learning style means students more easily receive material through their sense of hearing; and kinesthetic learning style means students more easily receive material through body movements (Agustina Silitonga & Magdalena Universitas Muhammadiyah Tangerang, 2020; Middleton et al., 2013; Ocampo et al., 2023) Individuals have their characteristics and learning styles, including when receiving and processing information related to learning which has a significant impact on student learning achievement (Prabawati & Muhadi, 2021; Vaishnav, 2013). Teachers should know each student's learning style in order to facilitate methods that can be used to improve students' problem-solving abilities.

Of the various studies that have been carried out by other researchers on how to overcome students' low problem-solving abilities, only a tiny number have discussed or provided solutions by looking at students' learning styles to overcome low problem-solving abilities. For this reason, researchers are interested in conducting classroom action research (PTK) with the title "Use of teaching materials with differentiated learning styles to improve the mathematical problem-solving abilities of students in class E3 SMAN 8 Padang."

2. Methods

According to Kemmis and MC Taggart (2014), classroom action research is carried out in the form of a cyclical assessment process consisting of 4 stages, namely design, action implementation, observation, and reflection. This cycle can be described in Figure 1.

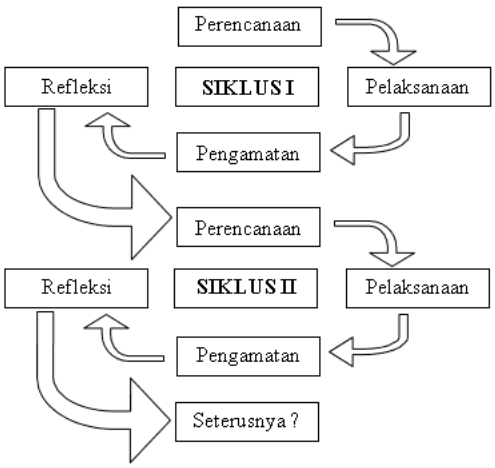

Figure 1. Model Alur Siklus
Note: P = Percentage of student learning outcomes

The instruments used in this research were a learning style questionnaire, observation sheets to observe interactions between teachers and students, and interactions between students during the mathematics learning process. Learning model using Problem-Based Learning (PBL)by using a diagnostic test in the form of essay questions. The essay question test instrument is used to measure problem-solving abilities. According to Miles and Huberman (Ahyar et al., 2020), data analysis is divided into three activity streams that co-occur. The three flows are (1) data reduction (data reduction), (2) data presentation (display data), and (3) concluding.
The Percentage of problem-solving ability per indicator is by using a percentage calculation (%) to find out how many levels of problem-solving ability the student has using the Figure 2 formula.

$$P = \frac{Skor\ Total}{Skor\ Maksimum} \times 100\%$$

Figure 2. Rumus menghitung skor total
Note: P = Percentage of student learning outcomes

The ability of each stage of problem-solving is qualified into four categories, namely high, medium, low, and very low, based on the assessment guidelines created by (2007) in Table 1:

Table 1. Qualification Percentage Results for Each Stage

Persentase	Criteria
$t > 75\%$	Tinggi (*high*)
$50\% < t \leq 75\%$	Sedang (*middle*)
$25\% < t \leq 50\%$	Rendah (*low*)
$t \leq 25\%$	Sangat Rendah (*fail*)

t = average Percentage of ability for each stage
Students are said to have completed learning mathematics if they have reached a score of 75, and learning is said to be successful if 75% of students have achieved a score above or equal to a minimum completeness score of 75. The cycle in this research will be terminated if students who have achieved a learning completeness score reach 75% or more.

3. Results and Discussion

This classroom action research was carried out in Phase E at SMAN 8 Padang City, especially E3. The following are the results of research and discussion in Picture 3 regarding the analysis of the use of teaching materials with differentiated learning styles to improve the abilities of E3 students at SMAN 8 Padang.

a. Learning Style Questionnaire Results

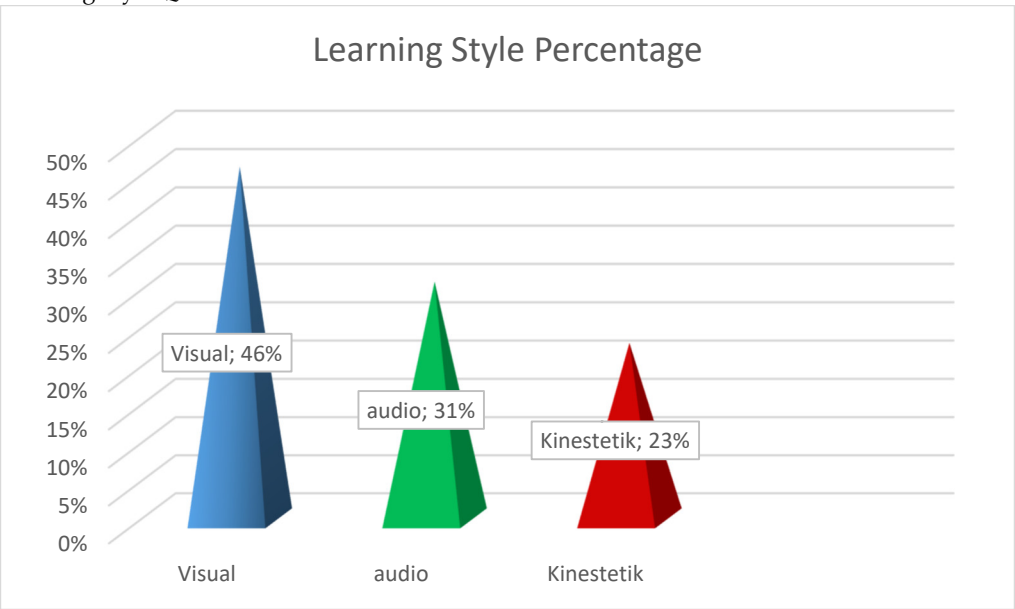

Figure 3. Percentage of Student Learning Styles

From the picture above, it can be seen that students have different learning styles, so the implementation of the learning process does not only highlight one learning style. A teacher must be able to see and facilitate all learning styles in students.

b. Diagnostic Test Learning Results

Researchers conducted diagnostic tests to see the results of students' problem-solving abilities by giving questions in the form of essays. After analyzing it, there are still many students who can't solve problems in the form of solving these problems, as can be seen in Figure 3.

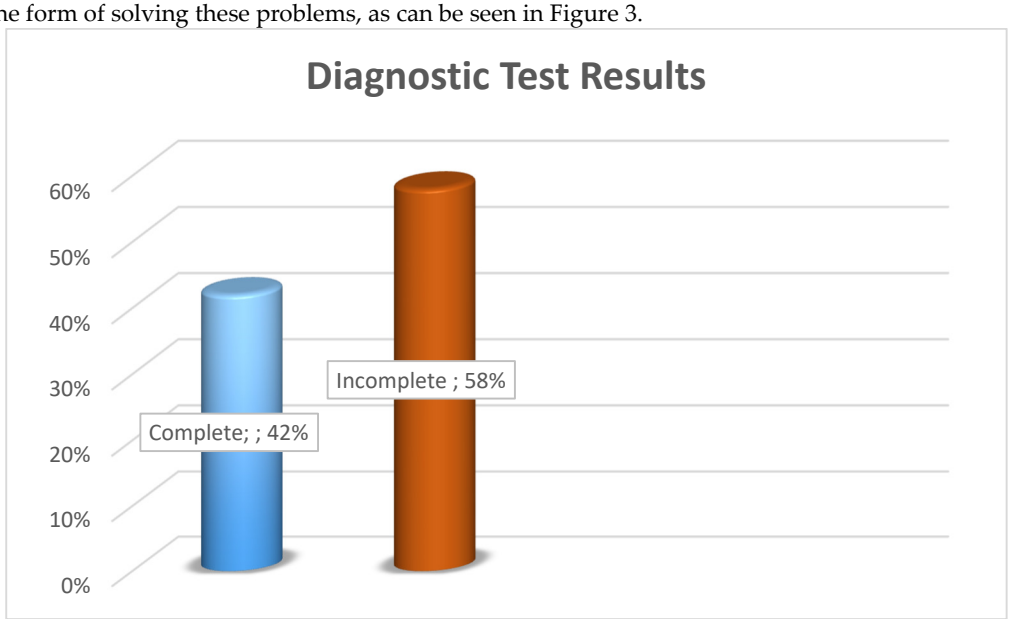

Figure 4. Percentage of Diagnostic Test Results

From the picture above, it can be seen that 43% of students got low scores when given problem-solving questions, 14% were in the middle position, and the other 43% were able to understand problem-solving questions.

The next step is that the researcher carries out learning planning for each cycle; the learning procedures that will be carried out are:

1) Designing problem-based LKPD

   It is hoped that the LKPD given to students can meet their needs. The learning style of students who have a visual learning style can be seen in Figure 5.

Figure 5. Problem-Based LKPD Design

2) Designing Learning Media

   Learning media is in the form of videos designed using the Vidio scribe application. The purpose of the learning videos is to help meet the needs of students who have an audio-learning style, as can be seen in Figure 6.

Figure 6. Learning Video Design

3) Give coins and dice for experimentation.

   Give coins and dice to students to do. Try to complete the questions given. This activity is carried out to facilitate students who have a Kinesthetic learning style.

c. Analysis Results

This research activity was carried out with details of two meetings per activity cycle learning. Every cycle, a final test will be carried out once to see the results of improving students' problem-solving abilities at E3 SMAN 8 Padang. The activities carried out in the learning process using the PBL model can be seen in Figure 7.

Figure 7. Teacher Giving Instructions

This research activity was carried out with details of two meetings per activity cycle learning. Every cycle, a final test will be carried out once to see the results of improving students' problem-solving abilities at E3 SMAN 8 Padang. The activities carried out in the learning process using the PBL model can be seen in Picture 7. Students are having discussions with group members, as seen in Figure 7. The teacher guides students, as seen in Figure 8.

Figure 8. Students sitting in groups

Figure 9. Students present the results of the discussion

In Figure 9, you can see students presenting the results of their discussions with group members. The selection of group members who will appear is carried out randomly using the spin application so that each group has the same possibility of presenting the results of their discussion.
Based on the results of data analysis during research carried out over two cycles, results were obtained as in Table 2.

Table 2. Recapitulation of Problem-Solving Ability Test Results

Implementation	Category			
	Complete	Percentage(%)	Not Completed	Percentage (%)
Diagnostic tests	15	42%	20	58%
Cycle 1	22	63%	13	37%
Cycle 2	30	86%	5	14%

From the table above, it can be seen that there was an increase of 21% in the first cycle and an increase of 23% between the first cycle and the second cycle in the classroom action research carried out. The students' completeness score reached 86% in cycle 2, which is categorized as high (Apipah et al., 2018; Tamrin et al., 2020).

Based on the results of classroom action research conducted by researchers by providing teaching materials with differentiated learning styles, it was seen that there was an increase in the Percentage of students' problem-solving abilities from the initial diagnostic test to cycle 2. So, it can be concluded that teachers are required to know students' learning styles so they can provide materials teaching that can facilitate all students with various learning styles.

4. Conclusion

Based on the results of classroom action research and the discussion that has been presented, it can be concluded that mathematics learning using teaching materials that differentiate students' learning styles can improve the problem-solving abilities of phase E students in class E3 at SMAN 8 Padang.

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