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THE EFFECT OF DIFFERENTIATED LEARNING USING THE PBL MODEL ON STUDENTS' ABILITY TO UNDERSTAND MATHEMATICAL CONCEPTS

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ABSTRACT
Understanding mathematical concepts (PKM) is important and needs to be achieved first by students so that they can understand the material they are studying well and can learn advanced material. The results of the initial study at SMA Negeri 6 Tanjungpinang showed that students had not been able to master mathematical concepts well. Implementing differentiated learning combined with the problem-based learning (PBL) model is a solution teachers can offer to overcome student problems. This research aims to determine the effect of differentiated learning using the PBL model on students' PKM abilities at SMA Negeri 6 Tanjungpinang. A quasy experimental with a non-equivalent control group design was applied in this research. The research samples were classes X.1 and X.2, selected from all class X SMA Negeri 6 Tanjungpinang through cluster sampling techniques. Pretest-posttest was chosen as the data collection technique. Data were analyzed using an independent sample t-test with a significance level of 5%. The results of the research show that differentiated learning with the PBL model has a significant influence on students' PKM abilities.
Keywords: *differentiated learning, problem-based learning, ability to understand mathematical concepts*

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INTRODUCTION

Mathematics is a scientific discipline that plays an essential role and is very close to life. Through learning mathematics, students are taught to think in a structured manner, developing awareness, concern, and sensitivity in interpreting actual events encountered in real life (Juniantari et al., 2018). According to Minister of Education and Culture Regulation No. 58 of 2014, one of the goals of learning mathematics is understanding concepts. Being able to comprehend mathematical ideas both theoretically and in practical applications is known as

concept understanding (Suryadi, 2021). Understanding mathematical concepts (PKM) is crucial in learning because the concepts taught are interconnected.

Good student PKM abilities can help understand and solve mathematical problems, making it easier for students to learn the teaching material provided (Marliana et al., 2023). This is also in line with the view of Subroto & Sholihah (2018), which explains that to understand mathematics, students must master the concepts well. Students who understand the concepts well, can learn advanced material at a higher level. In this way, in learning mathematics, understanding concepts is a goal that must be achieved first so that students can understand the material they are studying well and learn advanced material.

The results of the 2022 Program for International Student Assessment (PISA) assessment show that the mathematical skills of students in Indonesia are still comparatively low with a score of 366 below the international average score of 472 (OECD, 2023). The PISA assessment in mathematics examines students' mathematical abilities, such as the capacity to analyze, formulate, solve and comprehend mathematical problems in diverse forms and contexts. This relatively low level of students' mathematical skills also shows low understanding of mathematical concepts (PKM). This is because the questions presented in the PISA assessment are in the form of descriptions. In this way, students are challenged to link mathematical images or ideas, situations, and real objects into mathematical models with correct and appropriate answers. Thus, if the results obtained are low, then this can show that the student's PKM abilities are still relatively low (Hasanah et al., 2023).

This low PKM ability of students is also supported by research findings conducted by Handayani & Aini (2019) through their research in class XI SMA Negeri 1 Teluk Jambe Barat with a sample size of 32 students. The research results showed that the PKM of students in the high category was 21.88%, the medium category was 46.88%, and the low category was 31.25%. Other research conducted by Aisyah & Firmansyah (2021) on class VIII students at MTs Negeri 4 Karawang as many as 34 students showed that, based on the data, the PKM ability of students in the high category was 8.82%, the medium category was 55.88%, and the low at 35.29%.

Apart from that, through interviews with class X mathematics teachers at SMA Negeri 6 Tanjungpinang, information was also obtained that students were not yet fully able to master mathematical concepts well. When students are presented with issues that are more difficult or different from the examples, they begin to have difficulties understanding and addressing the problem. This is because students do not understand the concept of the content being taught and just focus on the example questions that have been presented. Hence, students still have difficulties understanding the topic. Meanwhile, during the learning process, students are still less active and rarely involved in building their knowledge. Students also feel that learning mathematics is a difficult subject, and the symbols used are abstract, so they are lazy in understanding the material.

This low student PKM will result in mastery of learning material. Students will have difficulty learning advanced material and will find it challenging to solve mathematical problems because students will have trouble finding connections between concepts if they cannot understand the concepts well (Purnomo, 2018). In addition, students will have difficulty developing other mathematical skills due to a lack of adequate basic understanding. Thus, it is necessary to think of a way to overcome the problem of students' low PKM abilities.

The strategies implemented by teachers during the learning process are one of the aspects that result in students' low PKM abilities (Heriyaman, 2022). Teachers still do not implement learning strategies or methods that consider the diversity of students' learning needs, so students who do not meet their learning needs will find it difficult or slow to understand the lesson material. This is because each student has diverse learning needs. These learning needs make the student learning process different in a learning environment. On the other hand, learning that does not pay attention to the diversity of students' learning needs can cause students not to explore their potential optimally. This impacts students' understanding of the studied material (Bulu, 2023).

For this reason, in overcoming students' low PKM abilities, teachers must design appropriate learning strategies. One learning strategy that is appropriate and can take into account the diversity of students' learning needs is differentiated learning. Differentiated learning is a form of effort through a series of learning sessions that pays attention to student needs regarding learning readiness, interests and talents, and student learning profiles (Syarifuddin & Nurmi, 2022). Implementing differentiated learning aims to accommodate student differences in the learning process (Almujab, 2023). Based on the Learning and Assessment Guide by the Educational Curriculum and Assessment Standards Agency (2022), three differentiated learning approaches are adapted to students' needs in responding to the learning process, namely 1) content differentiation, which is what students learn; 2) process differentiation, which is the way students process ideas and information which includes how students choose their learning style; and 3) product differentiation, showing what has been learned.

According to Tomlinson (2000), categorizing student learning needs can be based on at least three aspects. These three aspects are 1) student learning readiness, which is the capacity to learn new material; 2) student interest, which is an essential motivator for students to be actively involved in the learning process; and 3) the student's learning profile, which is related to many factors, such as language, culture, family circumstances, and other specificities and this learning profile will also be related to a person's learning style. According to Sartika (2019), when students find a learning style that suits them, it becomes the most effective method in helping them organize, absorb and process the information received. Each student's learning style varies in terms of processing knowledge, so how they understand concepts varies. According to Sarfa (2016), students can learn through three learning styles. The auditory learning style allows students to understand concepts through their hearing, the visual learning style enables students to understand concepts through descriptions related to their vision, and the kinesthetic learning style allows students to understand concepts easily because it involves movement or kinesthetics.

According to Sartika (2019) research findings, learning style positively affected PKM abilities in class V MI Al-Hikmah students. The same research was carried out by Nurlia et al. (2021) the results showed that learning style positively influenced the PKM abilities of class XI students at SMK Al-Khairiyah 2. Laruli (2021) research findings also showed a positive relationship between learning styles and PKM abilities at SMP Negeri 3 Pagimana.

Differentiated learning can also provide meaningful, relevant and challenging learning experiences for each student to obtain maximum learning potential. Apart from that, in

differentiated learning, students will also be given the freedom to acquire knowledge according to the needs of each student based on their learning style. In this way, all students are expected to feel appreciated and motivated and participate actively in the learning process to achieve optimal learning potential, especially in understanding concepts in the studied material.

This differentiated learning can also be combined with learning models that suit the characteristics of learning in the 21st century, namely student-centred learning. Student-centred learning can foster student activity, and students gain the freedom and facilities to explore their knowledge to gain in-depth knowledge and improve the quality of their learning, especially in understanding learning concepts. One appropriate learning model for this learning is the problem-based learning (PBL) model. Through this model, learning activities will begin with presenting the problem. Then, students will be guided to construct their understanding through investigative activities so that they not only remember but also gain a more complete and in-depth knowledge of the concept (Rizqi & Ardana, 2022).

According to Linsida et al. (2022), one of the goals of the PBL model is to make students active in learning, dare to put forward arguments and be able to solve individual or group problems so that this model can be applied during learning to improve students' PKM abilities regarding learning material. Apart from that, PBL also seeks to use contextual problems as a context for students to gain skills and knowledge about the concepts of learning material. Of course, this activity will build students' PKM in learning. Through good concept mastery, students will be helped to remember the material for a more extended period, which will help them solve various problems.

The results of research carried out by Simanjuntak et al. (2022) indicated that the PBL model had a substantial effect on students' PKM abilities. The same research was carried out by Silalahi et al. (2023), which provides results that the PBL model influences students' PKM abilities. Apart from that, the research results of Marliana et al. (2023) also showed that there were differences in students' PKM abilities between classes that studied using the PBL model and classes that studied using the direct learning model.

From this presentation, research using the PBL model has been widely carried out and is considered successful in improving the highlighted mathematical abilities. However, in implementing the learning process, these studies still treat students with the same treatment or have not implemented differentiated learning. Each student has diverse learning needs. Therefore, researchers are encouraged to combine differentiated learning based on learning styles with the PBL model using contextual problems. This research aims to determine whether learning that applies differentiated learning with the PBL model affects students' PKM abilities with problem formulation, namely, whether there is the ability to understand students' mathematical concepts at SMA Negeri 6 Tanjungpinang?. The title of this research is "The Effect of Differentiated Learning with the PBL Model on Students' Ability to Understand Mathematical Concepts".

METHODS

This research is a quasi-experimental type with a non-equivalent control group design. In this design, the experimental and control classes will be given a pretest. Then specifically, the

experimental class will be given differentiated learning treatment using the PBL model, and finally, both classes will be given a posttest.

The population in this study were class X students of SMA Negeri 6 Tanjungpinang. The cluster sampling technique is an applied sample selection technique that randomly selects samples based on groups. In this case, the group referred to is the class. The classes selected were class X.1, a control group of 31 students and class X.2, an experimental group of 30 students. The control class only received learning using the PBL model, while the experimental class received differentiated learning using the PBL model.

Research data was collected through a pretest-posttest, which was given to measure students' PKM abilities using several assessment indicators. The pretest and posttest questions used were in the form of essays, each consisting of 4 questions on the topic of three-variable linear equation systems (SPLTV). PKM capability indicators can be presented in Table 1.

Table 1. PKM capability indicators

No	Indicator
1	Classifying objects based on certain properties.
2	Presenting concepts in other forms of representation.
3	Using, utilizing and selecting certain procedures or operations.
4	Apply concepts and procedures to solve problems.

The data that will be analyzed is PKM initial ability data through the pretest and final ability data through the posttest. Data were analyzed with inferential statistics using parametric statistical tests, namely the independent sample t-test. The two data were first examined for requirements, namely normality using the Shapiro-Wilk test and homogeneity using the Bartlett test via SPSS before the independent sample t-test was performed. Both types of testing use a significance level of 5% ($\alpha = 0.05$). The test criteria are if the sig. SPSS test results are greater than the significance level ($\text{sig.} \geq 0{,}05$), then the data is normally distributed/homogeneous data and if the sig. SPSS test results are smaller than the significance level ($\text{sig.} < 0.05$), so the data is not normally distributed/the data is not homogeneous.

Next, the independent sample t-test was used to test the similarity/difference in average initial and final PKM ability data with a significance level of 5% ($\alpha = 0.05$). The test criteria are that H_0 cannot be accepted if the sig value is < 0.05, and H_0 cannot be rejected if the sig value is ≥ 0.05. In testing the difference in average final abilities, researchers want to see the positive influence of the learning treatment that has been carried out so that the test carried out is a one tail test. Therefore the sig. (2-tailed) needs to be divided by 2 (Stanislaus, 2009).

RESULT AND DISCUSSION

RESULT

1. Description of Data on the Ability to Understand Mathematical Concepts

The pretest results determine students' initial understanding of mathematical concepts related to the three-variable linear equation system (SPLTV) material. This was done to ensure that experimental and control class students had the same initial ability to understand concepts in the SPLTV material. The students' final ability to understand mathematical concepts regarding

the SPLTV material was analyzed through posttest data. This was done to determine whether the experimental and control classes' average final scores on students' comprehension of mathematical topics differed. Initial PKM ability data was obtained through a pretest, and final PKM ability data was obtained through a posttest. The results of students' initial and final PKM abilities can be shown in Table 2.

Table 2. Data on initial and final PKM capability results

Information	Experimental Class		Control Class	
	initial	final	initial	final
Average	23,00	63,45	23,55	54,82
Minimal	0	35	0	30
Maximum	55	85	60	85
Standard Deviation	16,74	14,77	15,61	16,19

The results of these data calculations show that in the experimental class, the average initial ability value for understanding mathematical concepts was 23.00, while the average final ability value for understanding mathematical concepts was 63.45. In the results of the initial ability assessment of understanding mathematical concepts, students who got the lowest score were 0, and students who got the highest score were 55. This shows that students still do not understand the material that will be given. Meanwhile, in the final ability assessment results for understanding mathematical concepts, students with the lowest score were 35, and those with the highest score were 85. This data shows that there has been an increase in the ability to understand mathematical concepts, as seen from the comparison between the initial and final ability scores. Thus, it can be said that the average final ability score is higher than the average initial ability in understanding students' mathematical concepts using differentiated learning using the PBL model.

The standard deviation was calculated. In the experimental class, calculating the standard deviation for the final PKM ability were lower than the standard deviation for the initial PKM ability. Namely, the value for the final ability was 14.77, and the value for the initial ability was 16.74. This also shows that the initial PKM capability data is more widespread than the final PKM capability data. In the control class, calculating the standard deviation for the final PKM ability were higher than the standard deviation for the initial PKM ability. Namely, the value for the final ability was 16.19, and the value for the initial ability was 15.61. This shows that the final PKM capability data is more widely distributed than the initial PKM capability data.

Based on the results of calculating students' PKM ability data, it also proves that the average initial ability to understand mathematical concepts of students in both the experimental class and the control class does not have much difference, namely 23.00 for the experimental class and 23.55 for the control class. Meanwhile, the average final ability of students in the two classes to understand mathematical concepts is quite different. Namely, in the experimental class, it is 63.45, and in the control class is 54.82. From these results, it is necessary to test the hypothesis through statistical tests to see whether the difference in the average initial and final PKM abilities of students in the experimental class is significant. To carry out statistical tests, the requirements that must be met first are carrying out normality testing and homogeneity testing.

Furthermore, to find out the number of students who have mastered and understood mathematical concepts, you can see the indicator table for the ability to understand mathematical concepts, as presented in Table 3 below.

Table 3. PKM Capability Indicators

No Question	Indicator	Percentage of Number of Students
1	Classifying objects based on certain properties.	74,67%
2	Presenting concepts in other forms of representation.	77,33%
3	Using, utilizing and selecting certain procedures or operations.	45,33%
4	Apply concepts and procedures to solve problems.	48%

Table 3 shows that the majority of students have been able to master the indicators of presenting concepts in other forms of representation and also the indicators of presenting concepts in other forms of representation with percentages of 74.67% and 77.33%. Meanwhile, students are still less able to master the indicators of using, utilizing and selecting certain procedures or operations, and the indicators of applying concepts and procedures to solve problems, with a percentage of 45.33% and 48%.

2. Test for Similarity in Average Initial Ability of PKM

Based on the results of the average initial PKM abilities, it is known that the two classes do not have much difference in average. A statistical test of the difference in means is carried out to determine whether the difference is significant or not. The first step will be to carry out prerequisite tests, namely normality testing and homogeneity testing. The Shapiro-Wilk test is used to test the normality of students' initial PKM ability data. The test results show a sig. value in the experimental class, which was 0.10, and in the control class, it was 0.16, where the sig. value is greater than 0.05 (sig. $\geq$ 0.05) so the hypothesis (H_0) cannot be rejected. Through these results, it is known that the initial PKM ability scores of students in both classes are normally distributed equally.

Then, the homogeneity of students' initial PKM abilities was carried out using the Bartlett test. The test results show a sig. value of 0.71, where the sig. value is greater than 0.05 (sig. $\geq$ 0.05), so the hypothesis (H_0) cannot be rejected. Through these results, it is known that the initial PKM ability scores of students in the two classes have no different homogeneity.

Next, to test the similarity of the average initial PKM abilities, an independent sample t-test was used. Table 4 below displays the test results.

Table 4. Results of the average similarity test of PKM initial abilities

Initial Ability Results	*df*	*Sig. (2-tailed)*	Information
Equal variances assumed	59	0.89	There is no significant difference

Through the test results, a sig. value is produced (2-tailed) of 0.89. Because of the sig. value $\geq$ 0.05, then H_0 cannot be rejected, meaning there is no significant difference in the

average initial PKM ability scores of students in the two classes. Based on these results, it is known that the differences in students' descriptive PKM ability results do not have a significant meaning. It can be concluded that both classes have initial PKM abilities that are no different from the SPLTV material.

3. Test the Difference in Average Final Ability of PKM

The main results of this research are the students' final PKM abilities through posttests in both classes. Of the 31 students in class X.1 (control class), only 28 people were present during the posttest, so that only 28 data could be used for the control class. As for class X.2 (experimental class), of the 30 students, only 29 were present during the posttest, so only 29 data could be used for the experimental class.

Based on the results of the average final PKM abilities, it was found that there were differences in the average scores in the two classes. A statistical test of the difference in means is carried out to determine whether the difference is significant or not. The first step will be to carry out prerequisite tests, namely normality testing and homogeneity testing. The Shapiro-Wilk test is used to test the normality of students' final PKM ability data. The test results show that the sig. value in the experimental class it was 0.18, and the control class was 0.08, where the sig. value is greater than 0.05 (sig. $\geq$ 0.05), so the hypothesis (H_0) cannot be rejected. Through these results, it is known that the final PKM ability scores of students in both classes are normally distributed equally.

Then, the homogeneity of students' final PKM abilities was tested using the Bartlett test. The test results show a sig. value of 0.63, where the sig. value is greater than 0.05 (sig. $\geq$ 0.05), so the hypothesis (H_0) cannot be rejected. Through these results, it is known that the final PKM ability scores of students in both classes have no different homogeneity.

Next, differences in the average final PKM abilities were tested using an independent sample t-test. Table 5 below displays the test results.

Table 5. Test results for differences in average final PKM abilities

Final Capability Results	*df*	*Sig. (2-tailed)*	Information
Equal variances assumed	55	0.04	there are significant differences

Based on the test results, the sig. value (2-tailed) was found to be 0.04. Because the test carried out is a one tail test, therefore the sig. $= \frac{1}{2} \times 0.04 = 0.02$ and it is known that $0.02 < 0.05$. So it is obtained that the sig. value < 0.05 then H_0, meaning that the average difference in students' final PKM ability results has a significant difference. Based on the results of the average final PKM ability of students in the experimental class of 63.45 and the control class of 54.82, it can be concluded that students who study using differentiated learning with the PBL model are higher than students who study using the PBL model.

Description of Learning Activities

The learning activities were carried out in 2 meetings. In learning activities, researchers divided students into ten study groups based on the results of the learning style test. The study groups consisted of three visual groups, five auditory groups, and two kinesthetic groups, with each group consisting of 3 people. In forming this study group, the researcher paid attention to

learning styles with the aim that the researcher could facilitate students in learning according to each student's learning style so that students could be more comfortable in learning and could also attract students' interest in obtaining learning material.

Each meeting carries out preliminary, core and closing activities. In the core activity, researchers show contextual videos related to the implementation of SPLTV. After showing the video, the researcher asked questions related to the video and invited students to respond to the questions given. To ensure that students' answers are correct or not, the researcher directs students to work on student worksheets (LKS) that have been prepared with the group that will be distributed.

This LKS is divided into 2, namely LKS for the visual and audiovisual groups and LKS for the kinesthetic group. The researcher explained that in the LKS, there are learning outcomes and learning objectives that students must achieve, work instructions, problem-based learning model syntax, supporting information related to SPLTV material and sources or references that students can use in solving the problems given in the LKS. The difference between LKS for the visual and auditory group and LKS for the kinesthetic group lies in the work instructions, where for the visual group, learning resources are provided in the form of e-books and also e-modules via QR code to help them solve the problems given in the LKS, while for the group Auditory provides learning resources in the form of learning videos from YouTube which students can access via a QR code.

Next, a buying and selling simulation was carried out for the kinesthetic group. The researcher provided a mini shop where the shop provided stationery packages consisting of packages 1, 2, and 3 with different prices and imitation money. Each group member must choose one different package that they will buy. Then, the researcher invited each kinesthetic group to discuss and determine who bought packages 1, 2, and 3. After that, they bought stationery packages and returned to their seats. They were then directed to fill in the worksheet that had been given previously. In the worksheet, they are asked to create their problems according to the example questions based on the items purchased in the stationery package. Next, they were asked to solve the problem based on the work steps provided by the researcher in the worksheet.

All groups hold discussions to solve problems on the worksheets provided by utilizing various sources provided based on learning styles. Researchers monitor the progress of discussions and guide students both individually and in groups in solving problems on the worksheet. After completing the worksheet, the researcher asked group representatives with different learning styles to make presentations.

After the presentation is finished, the researcher provides confirmation and feedback and strengthens the results of the group work and newly learned material. In the closing activity, the researcher reflected on the learning that had taken place by asking students questions and asking students to conclude the learning activities that had been carried out. Students are also invited to look for and study material at the next meeting, namely regarding the substitution method and the combined method (elimination-substitution).

Positive interactions happen in differentiated learning with problem-based learning, both between students and the teacher as well as amongst students. Students are pretty enthusiastic about participating in the learning carried out. This is because students have never attended to

learning, which takes into account their learning style. Learning like this provides new experiences for students so that learning becomes more varied.

DISCUSSION

Before starting research, it is essential to know the similarity of students' initial abilities. This aims to ensure that students' initial conditions are uniform so that differences in student ability improvement are genuinely caused by the application of the learning model that has been implemented and not because students' initial conditions are different (Isnawan, 2020). Apart from that, before learning begins, teachers need to know students' initial abilities. The aim is to find out whether students have learned the required material and to predict how well students understand the material to be studied. In this way, teachers can design better learning.

Data analysis revealed that the starting abilities of the two research classes were the same. This is shown through the sig. value (2-tailed) independent t-test of 0.89 (nilai sig. $\geq$ 0.05), meaning that the initial ability values of the two selected classes do not have a significant difference. Thus, it has been confirmed that the two research classes have no different initial abilities.

Furthermore, after receiving different learning treatments and carrying out a final PKM ability test (posttest) in both classes, it was found that the average final PKM ability of experimental class students was 63.45 and the control class was 54.82. If you look at it, the final PKM ability scores of students in the two classes have quite a big difference. Through the results of hypothesis testing of students' final PKM abilities using the average difference test in the two classes, it is known that there is a significant difference of 0.02 at the 5% significance level. According to data analysis conducted for this study, students who study using differentiated learning in conjunction with the PBL model have an average final PKM ability higher than those who study using the PBL model alone.

Based on the results of the analysis of indicators of understanding mathematical concepts, it shows that the majority of students have been able to master the first indicator, namely classifying objects based on certain properties and also the second indicator, namely presenting concepts in other forms of representation with percentages of 74.67% and 77.33%. Meanwhile, students are still less able to master the third indicator, namely using, exploiting and selecting certain procedures or operations and the fourth indicator, namely applying concepts and procedures to solve problems, with a percentage of 45.33% and 48%.

Based on the results of this analysis, it can be seen that the percentages for the first and second indicators are above 50%, and the third and fourth indicators are below 50%. Of the four questions presented representing each indicator, there are two questions that students still have difficulty working on. This is because most students are less careful and make mistakes in understanding the questions given, carrying out calculations and using appropriate methods or formulas. This is in line with the opinion of Annisa & Kartini (2021) that students are mistaken if they cannot formulate an appropriate formula.

These results show that implementing differentiated learning with the PBL model influences students' PKM abilities. The results of this research support the research results of Sitorus et al. (2023), who concluded that implementing differentiated learning strategies using the PBL model has a very good effect and can enhance students' learning results.

This is normal because differentiated learning is an effort through a series of learning that pays attention to students' needs in terms of learning readiness, their interests and talents, as well as students' learning profiles (Syarifuddin & Nurmi, 2022). Through differentiated learning, students' differences can be accommodated in the learning process, and students are given the freedom to acquire knowledge according to each student's needs. In this case, the student's needs are viewed from each student's learning style. According to Sartika (2019), when students have acquired the right learning style, this learning style becomes the most effective method to help them organize, absorb and process the information they receive.

Every student has a unique way of absorbing and processing knowledge, so how they understand concepts will also vary. For this reason, teachers need to utilize various teaching methods that suit the needs of each student. For example, teachers can use visual aids such as pictures for students with a visual learning style. For students with an auditory learning style, teachers can provide learning videos. For students with a kinesthetic learning style, teachers can provide learning media, or students can be directly involved in learning activities (practice). That way, students who receive learning according to their learning style tend to feel more comfortable and are able to follow the learning process more easily.

Learning by adapting students' learning styles is a form of differentiated strategy implemented by teachers (Wahyuni et al., 2023). This is supported by research findings conducted by Sartika (2019) that learning style has a positive effect on PKM abilities in class V MI Al-Hikmah students. Meanwhile, research conducted by Nurlia et al. (2021) found that learning style influences the PKM abilities of class XI students at SMK Al-Khairiyah 2.

Apart from that, differentiated learning combined with the PBL model provides a more significant impact. The PBL model provides students with various factual and meaningful problem conditions, which are helpful as a basis for student inquiry and investigation (Octavia, 2020). The implementation of problem-based learning allows students to determine appropriate learning resources based on the problems given and trains students to find information so that learning becomes student-centred actively. Differentiated learning offers students the freedom to gain knowledge according to the needs of each student. That way, if differentiated learning is combined with the PBL model, it will have a positive influence on achieving learning goals. The findings of a study by Sitorus et al. (2023) demonstrating that PBL-based differentiated learning strategies improve class VIII students' learning outcomes at SMP Negeri 13 Medan lend credence to this. Meanwhile, through research conducted by Mahmudah et al. (2023) shows that the use of the PBL model with differentiated learning provides an increase in the critical thinking abilities of class X-4 students at SMA Negeri 18 Surabaya.

CONCLUSION

The average final PKM ability of experimental class students was significantly higher than that of the control class. Differentiated learning using the PBL model provides a more significant contribution or impact on students' PKM abilities compared to learning using the PBL model alone. It can be concluded that differentiated learning using the PBL model influences students' PKM abilities.

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