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Differentiated Learning Management in the Field of Mathematics Study and Its Influence on Students' Creative Thinking

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ABSTRACT

This research discusses the influence of differentiated learning management in the field of mathematics studies on students' creative thinking at MIN 1 Sidoarjo. The era of globalization demands innovation in the learning process, especially in developing students' creative thinking abilities. Mathematics, as a mandatory field of study, requires an approach that can stimulate students' creativity. This research uses a quantitative approach with quasi-experimental methods. The research population involved all students at MIN 1 Sidoarjo, with a sample of class VI students. Data was collected through pre-test, post-test, and questionnaires, and analyzed using t-test. The research results show that differentiated learning management in the field of mathematics studies has a significant effect on students' creative thinking. The experimental group, which received the differentiation approach, experienced greater improvements in creative thinking compared to the control group using conventional methods.

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1. INTRODUCTION

The era of globalization will have a significant impact on various sectors, including the education sector. In the education sector, the influence and development of globalization is marked by the emergence of creative thinking for students and also the use and use of learning technology that is more innovative, creative and has beneficial value for student development. Likewise, in student development, teachers in the digital era must also emphasize and pay more attention to the characteristics and development potential of students according to their individual personalities (Kahar et al., 2021). Because every student has different talents and interests. Involving students in creative thinking activities in mathematics not only improves their

understanding of the material, but also forms the basis for problem solving in real-world contexts (Astria & Kusuma, 2023).

Creative thinking is a learning process that is able to motivate and encourage students' creativity during learning by applying appropriate strategies (Astuti et al., 2023). Understanding and developing creative thinking is becoming increasingly important in facing global challenges in various fields. One of the problems that arises is a lack of creativity in solving problems. According to Yustina's research results, it was found that around 75% of respondents from various countries considered themselves less creative. This data reflects the priority need to develop creative thinking in various levels of society (Anggraini et al., 2023). Creative thinking is a thought process where someone creates something new. The indicators for creative thinking include the following: (a) Fluency, (b) Flexibility, (c) Elaboration, (d) Originality (Handayani et al., 2021).

Mathematics is one of the mandatory fields of study for students in formal education institutions from primary to secondary education levels, as written in the Law of the Republic of Indonesia concerning the National Education System Number 20 of 2003 article 37 paragraph 1 (Adiwijaya, 2022). Mathematics is a lesson that can train students to develop creative thinking because thinking is one part that is of concern in learning activities (Erni et al., 2022). Creative thinking is one of the goals of mathematics learning in schools from primary to secondary education levels. Creative thinking is really needed in mathematics, including in solving math problems. By thinking creatively, students are expected to be able to solve mathematical problems with a variety of new approaches and ideas (Febriani et al., 2021). The results of the IMSTEP-JICA Development Of Science And Mathematics Teaching For Primary And Second Education In Indonesia - Japan International Cooperation Agency Survey, stated that the current reality is that student achievement in mathematics is still low at both primary and secondary levels. This is because the mathematics learning taught by teachers discusses various practice problems, which causes students to not be interested in mathematics, so they do not focus and think that mathematics is difficult (Ariana et al., 2023). Mathematics learning activities at school have not met expectations. The learning that takes place is teacher-centered, where the teacher uses conventional methods and students record it in their notebooks so that when students learn mathematics they only memorize the formulas (Astuti et al., 2023).

Differentiated learning is an effort to adapt learning activities that take place in the classroom to the individual learning needs of each student (Iksan et al., 2023). Differentiated learning in developing students' potential certainly cannot be separated from problems that arise in the field, because until now many teachers treat their students the same in the learning process on the pretext that there is no feeling of envy among students. And in the context of distribution and fulfillment of the same student rights. If there is a difference in treatment, they think it will cause envy among other students because one student gets special treatment. Even though the character and potential of each student is different, perhaps only a few students have the same competencies. Therefore, teachers must identify children's competencies (Aprima & Sari, 2022). The teacher's role must be optimal in preparing learning that is attended by students with different competencies, ensuring that all students participate in learning optimally.

From the researcher's experience of teaching at MIN 1 Sidoarjo, there are still many students who experience difficulties in learning mathematics delivered by teachers, so teachers need to apply learning methods that are appropriate to the material being taught. Learning methods are very important to improve at every level of school, because from the reality found in the field the learning models applied by teachers have not helped improve students' creative thinking. Thus there must be efforts to improve the learning process. In accordance with existing conditions, to make it easier for students to improve their creative thinking abilities, there must be innovation in the learning process. One way to design and carry out a learning process based

on student characteristics is with a differentiation learning strategy (Aprima & Sari, 2022).

According to Efendi, differentiated learning is considered a learning process that has great possibilities for students to learn and is adapted to their abilities, preferences and needs. (Faiz et al., 2022). Teachers who implement differentiated learning need to understand the different characteristics of each student and develop student potential according to pedagogical competence (Marlina 2020). According to Ausubel, as referenced by Ruseffendi, it is also recommended that in learning an approach should be used that uses problem solving methods, inquiry, and learning methods that can foster creative thinking. Therefore, one of the efforts that can be made to create meaningful learning for students is to innovate in learning. Innovation in learning must be supported by good learning management. Learning management is an interaction between three main elements: teachers, teaching materials and students. The interaction of these components also includes other elements such as learning planning, implementation and evaluation (Mumthaza et al., 2021).

The important role of teachers in learning management is the main support in the success of the learning process in the classroom. Teachers must have the skills to identify student learning styles, develop differentiated learning plans, and provide the necessary support to create an inclusive and responsive learning environment. (Turnbull et al., 2019). Before conducting learning, teachers must prepare learning tools which include implementation and evaluation based on learning management. As for the steps in learning management, the first is planning, planning is the initial activity carried out by the teacher before holding teaching and learning activities in the form of preparing learning tools, whether syllabus, lesson plans or teaching modules. Second, organizing is an activity carried out by the teacher in grouping themes and sub-themes in learning activities and distributing them according to the time allocation and lesson schedule that has been determined. Third, actuating, namely the teacher's efforts to mobilize all teaching and learning activity programs and students, so that they are focused and ready to accept mathematics lessons happily. Fourth, evaluation is the final step carried out by the teacher to find out the extent to which teaching and learning activities are carried out in accordance with expectations (Istikomah, 2022).

In carrying out learning activities, teachers must prepare learning tools starting with preparing the syllabus and Learning Implementation Plan (RPP). These activities have a significant impact on the quality of teaching and learning carried out by teachers in the classroom (Istikomah, Dzulfikar Akbar Romadlon, 2023). Scientific studies highlight several key factors that teachers need to consider to ensure the preparation of syllabi and lesson plans that are effective and oriented towards optimal learning outcomes. First, research conducted by Sakinah shows that a deep understanding of student needs and diversity is an essential basis for teaching preparation. Teachers need to identify students' learning styles, their level of understanding, and various individual needs to design appropriate learning experiences (Enramika, 2022). Implementing appropriate teaching methods with clear steps can increase the effectiveness of mathematics teaching. The learning implementation plan is prepared by the teacher to support the learning process, for this reason the learning plan has been prepared in such a way that the teacher carries out the learning steps clearly depicted in the RPP. The learning steps in the RPP can actually be used as guidelines and learning scenarios that provide a real picture of the actions that must be carried out by teachers and students, as well as the results that will be achieved, which are measured using predetermined instruments, while still referring to the curriculum. applies. Teachers need to design evaluation instruments that are appropriate to learning objectives and are able to provide information that can be used to improve teaching in the future, especially in the field of mathematics studies (Enramika, 2022).

Research related to this title has already been carried out. Among them: *first*, research conducted (Gusteti & Neviyarni, 2022) with the title "Differentiated learning in mathematics learning in the independent curriculum" in the journal Education Volume 6 Number 2 of 2021. This research focuses on Differentiated Learning Management in the field of Indonesian language study class IX SMPIT Khairunnas Bengkulu City. The subjects were class IX students at SMPIT Khairunnas, Bengkulu City. The strategy used in this research is a classroom action research approach. The results of his research state that differentiated learning management really helps students carry out effective, creative and enjoyable learning, so that it can increase students' interest in learning, especially learning languages (Manggalastawa, 2023). *The second* was carried out by (Aprima & Sari, 2022) entitled "Analysis of the application of differentiated learning in the implementation of the independent curriculum in elementary mathematics lessons" which was published in the Scholar's Journal in 2022. The methodology of this research is ex post facto research, namely comparative causal research, where The researcher tried to find out the cause and effect relationship in certain events, with a population and sample of all students at Pelita Rantepad High School. Analysis techniques using descriptive statistics, correlation and multiple linear regression. The results of his research revealed that differentiated learning management provides opportunities for students to develop optimally. One of the advantages of differentiated learning management is its ability to adapt the curriculum and teaching methods according to the level of needs and readiness of students, which is not overlooked by the teacher's role in implementing it (Fatimah & Mashar, 2023).

Third, research conducted by (Siringoringo et al., 2023) entitled "Differentiated Learning Strategy: Acceleration Increases Students' Potential". This research uses a systematic literature review method which begins by looking for articles related to research topics covering the last five years from 2018 - 2023. The results of the research state that differentiated learning is learning that fulfills, provides and recognizes the diversity of students in learning appropriately. with students' readiness, interest and liking for learning. And finally, research conducted by (Astria & Kusuma, 2023) was published in the Multidisciplinary Journal with the title "Analysis of Differentiated Learning to Improve Mathematical Creative Thinking Ability". This research includes quantitative experiments with a One Group Pretest Posttest Design type design. The population was students of Class VIII of Tri Sakti 2 Catholic Middle School Medan, while the research sample was students of class VIII-C. In taking samples, researchers used random techniques. The data obtained was analyzed using the t-test and the results showed that the differentiated learning model had a significant effect on students' creative thinking abilities (Kusuma et al., 2023).

Thus our research is different from previous research. The first difference is because this research was conducted in basic education, namely at Madrasah Ibtidaiyah, which is an initial level of education that requires wholehearted teacher assistance. The two researchers emphasized creative thinking more in mathematics lessons, because mathematics lessons at Madrasah Ibtidaiyah level were considered difficult for students. The problem formulation in this research is how to manage differentiated learning in the field of mathematics study at MIN 1 Sidoarjo and how differentiated learning influences students' creative thinking at MIN 1 Sidoarjo. The aim of this research is to determine the management of differentiated learning in the field of mathematics study at MIN 1 Sidoarjo and the influence of differentiated learning management in the field of mathematics study in improving the creative thinking of MIN 1 Sidoarjo students.

2. METHODS

This type of research is quantitative research with a quasi-experimental method where this research will directly test the influence of one variable on other variables (Sari & Hafandi, 2022).

The independent variables in this research are differentiated learning management and the dependent variable is critical thinking.

The research population was all MIN 1 Sidoarjo students, with a sample of class VI students. In taking research samples using a purposive sampling technique by paying attention to population characteristics that are appropriate to the research (Sugiyono, 2017).

The data collection techniques used pre-test, post-test and questionnaires. After the data was collected, the researcher then analyzed the data using the SPSS t-test. Where the two-sample t-test is a statistical method used to compare two different groups to see whether there are significant differences between the two groups (Tellur et al., 2017).

Measurement of Creative Thinking Mathematics in class VI at MIN 1 Sidoarjo is based on:

1. Understanding Mathematical Concepts (understanding problems/questions)
Ensure a strong understanding of the basic mathematical concepts relevant to the problem. A solid understanding provides the basis for formulating a creative approach.
2. Alternative View (choosing a concept/formula)
Consider alternative solutions to math problems. Think about whether there is another way to approach the problem.
3. Problem Solving Steps (carrying out the stages of problem solving)
Use a systematic problem-solving approach. Identify the information provided, determine what is requested, and think of steps to reach a solution.
4. Analogy
Use analogies or metaphors to connect math problems to other, more familiar situations or concepts. This can help generate new ideas.
5. Results construction
Answer questions appropriately according to procedures.

Hypothesis testing was carried out using the independent t-test with the help of the SPSS application with a significance level of 0.05 (5%). The decision making criteria are

- If the significant value is < 0.05 , there is an influence of differentiated learning management in the field of mathematics study on students' creative thinking
- If the significant value is > 0.05 , there is no influence of differentiated learning management in the field of mathematics study on students' creative thinking

This is in accordance with the sound hypothesis in this research, namely:

Ha: there is an influence of differentiated learning management in the field of mathematics study on students' creative thinking

H₀: there is no influence of differentiated learning management in the field of mathematics study on students' creative thinking

3. FINDINGS AND DISCUSSION

Normality Test Results

The normality test aims to determine whether the sample data comes from a normally distributed population or not. Data that is good and suitable for use in this research is data that has a normal distribution. In this research, researchers used the Shapiro Wilk normality test assisted by the SPSS application (Scientists & Suryaningtyas, 2022). The Shapiro Wilk test was chosen because the number of samples in one class was < 50 . The basis for decision making used is

1. If in the (KS) test a significant Shapiro Wilk value is obtained above 0.05 then the residuals are normally distributed
2. If a value obtained below Shapiro Wilk significance is below 0.05 then the residual is not normally distributed

Tests of Normality							
		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Class	Statistics	Df	Sig.	Statistics	df	Sig.
Creative Thinking	Class A	.132	30	,193	,930	30	,050
	Class B	.131	30	,197	,962	30	,358

a. Lilliefors Significance Correction

Based on the test results, it is known that each variable data is declared to be normally distributed with a Shapiro Wilk score >0.05.

Homogeneity Test

The homogeneity test is used to determine whether data from research results in the experimental class and control class have the same variance value or not. It is said to have the same/not different (homogeneous) variant value if the significance level is ≥ 0.05 and if the significance level is < 0.05 then the data is concluded to not have the same/different (not homogeneous) variant value (Fahrurnisa et al., 2023). Below is a table of homogeneity test results

Test of Homogeneity of Variances					
		Levene Statistics	df1	df2	Sig.
Creative Thinking	Based on Mean	1,580	1	58	,214
	Based on Median	1,223	1	58	,273
	Based on Median and with adjusted df	1,223	1	51,808	,274
	Based on trimmed mean	1,614	1	58	,209

Hypothesis testing

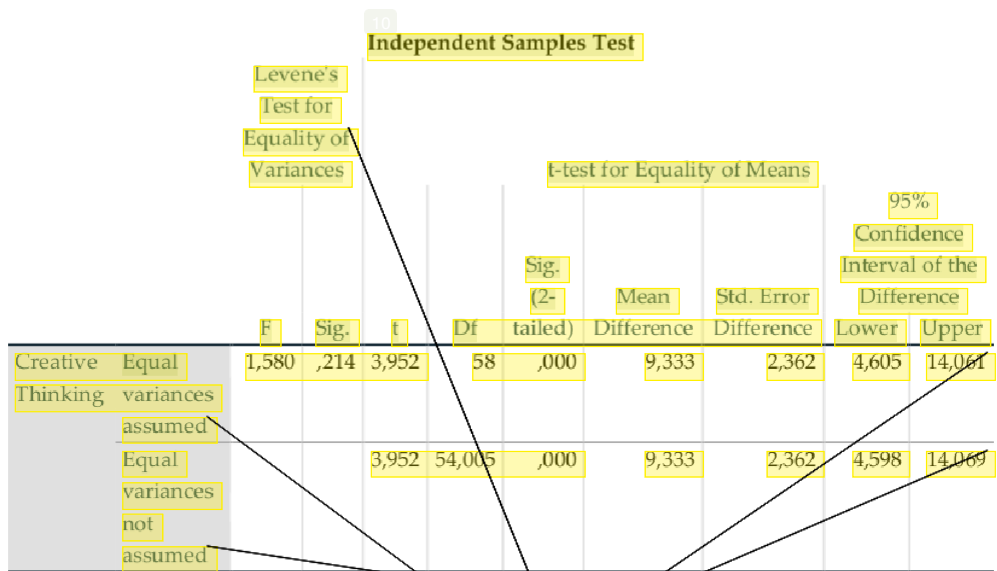
After the two classes are normally distributed and have homogeneous variances, a test of equality of two means is then carried out using a two-tailed t-test using the SPSS 23.0 for Windows program with a significance level of 0.05. The decision making criteria according to (Mufarrikh, 2019) are as follows:

- A. The probability value is > 0.05 then H_0 is accepted
- B. The probability value is < 0.05 then H_0 is rejected

Descriptive Statistics						
		Mean	N	Minimum	Std. Error Mean	Std. Deviation
Creative Thinkings	Class A PreTest	72,0000	30	55.00	1.58296	8.67020

Class A PostTest	81.6667	30	70.00	1.42501	7.80510
Class B PreTest	70.1667	30	45.00	2.02688	11.10167
Class B PostTest	72.3333	30	50.00	1.88359	10.31682

Figure ... presents a description of the pairs of creative thinking scores that were analyzed, which includes the average (mean) before being given treatment. Before treatment, the experimental group, namely class A, had an average of 72.0000 and the control group, namely class B, had a smaller average than the experimental group, namely 70.1667. After being given treatment, the experimental group showed better creative thinking with an average of 81.6667 and the control group had a lower increase than the experimental group with an average of 72.3333.



Based on the test results, it is known that the sig. The result obtained was <0.05, so it can be concluded that the creative thinking posttest scores for the two groups were significantly different.

DISCUSSION

In the world of education, the differentiation approach has been recognized as an effective way to accommodate students' individual learning needs. Especially in the field of mathematics studies, this approach can facilitate various learning styles and different student understanding (Rahmah et al., 2022). In a study conducted to evaluate the effect of differentiated learning management on students' creative thinking, the results showed significant differences between the experimental group and the control group.

Before being given treatment or differentiation approach treatment, the experimental group had an average creative thinking score of 72.0000. Meanwhile, the control group showed a slightly lower average, namely 70.1667. However, after the treatment was implemented, there was a significant increase in the performance of the experimental group. Their average creative thinking score increased to 81.6667. On the other hand, the control group also experienced an increase, but at a lower level, reaching an average of 72.3333. This shows that the application of a differentiation approach in

mathematics learning can have a greater positive impact on students' creative thinking compared to conventional methods.

Other research that supports these findings was conducted by (Rahmah et al., 2022) (Manggalastawa, 2023) (Kusuma et al., 2023), which found that students who studied with a differentiation approach had better problem solving abilities and were more able to think creatively compared to those who studied with a conventional approach. These findings emphasize the importance of adapting learning approaches according to students' needs and characteristics to increase students' creative potential.

Differentiated learning management recognizes that each student has different learning styles, backgrounds and needs. In the study of mathematics, differentiation allows teachers to adapt teaching methods, materials, and resources to suit student characteristics and needs. In this way, students who may have difficulty understanding certain concepts can be given additional help or alternative teaching methods that better suit their learning style (Istikomah & Haryanto, 2021).

The importance of this adequate approach lies in the fact that mathematical understanding is not only based on one's numerical strength, but also on one's ability to think critically, analyze, and relate those concepts to real-world situations. Therefore, with a differentiation approach, students are not only given the opportunity to understand the material in depth but also to develop their creative thinking.

In the long term, students who have strong creative thinking will be better able to face future challenges, both in academic and professional environments. The ability to think creatively allows them to find innovative solutions to problems, adapt to change, and have a broader view of the world around them. Thus, differentiated learning management in the field of mathematics study not only improves students' academic understanding but also equips them with the skills and competencies necessary for success in the future.

Apart from that, the differentiation approach in mathematics learning also creates an inclusive environment in the classroom. By accommodating diverse learning needs, teachers recognize each student as an individual with unique potential. This can increase students' motivation and self-confidence because they feel valued and supported in their learning process.

Furthermore, with a differentiation approach, students are invited to become lifelong learners. They are trained to become more independent, learn how to learn best for themselves, and value diversity in thought and approach. It's not just about understanding mathematics, but also about preparing students to face a rapidly changing world, where adaptation skills and creative thinking are becoming increasingly important.

The benefits of the differentiation approach are not only felt by students who may have difficulty understanding mathematical concepts. Even students who already have a strong understanding can be given additional challenges or more in-depth material according to their needs, so that they remain motivated and driven to reach their peak potential.

Finally, it is important to note that implementing a differentiation approach requires appropriate support and training for teachers. By ensuring that teachers have the tools, resources, and understanding necessary to implement this approach effectively, the positive potential of differentiated learning management in the mathematics subject area can be fully realized.

Overall, differentiated learning management in the field of mathematics studies plays a crucial role in improving students' creative thinking. By providing an approach that is adequate and appropriate to students' learning needs, their creative potential can be optimized, which will ultimately make a positive contribution to their future development.

4. CONCLUSION

Differentiated learning management in the field of mathematics studies shows a significant positive impact on students' creative thinking. In one study, a group of students given a differentiation approach experienced greater improvements in creative thinking compared to a group using conventional methods. This confirms that adapting learning approaches according to students' needs and characteristics can increase their creative potential. Therefore, implementing a differentiation approach in mathematics learning is highly recommended to maximize students' creative development.

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