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Problem Solving Analysis Through Tests in View Of Student Learning Achievement

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Abstract: *This research is motivated by the importance of problem solving abilities for students. The importance of having problem solving skills is one of the main tasks in learning mathematics, moreover the process of solving mathematical problems is the essence of mathematics. The purpose of writing this paper is to find out how problem-solving abilities through test questions are assessed from student achievement. Data collection was carried out in the Lamongan area with the subjects being grade VI elementary school students who were selected based on the results of student achievement which were then grouped into 3 categories, low, medium and high. The method used is descriptive qualitative with data collection techniques carried out by administering tests. Based on the results of the field trials, it was found that the ability to solve mathematical problems using test questions for students who are classified as having high learning achievement fulfills 3-4 indicators of problem solving. Students who are classified as having moderate learning achievement fulfill 3-2 indicators of problem solving. Meanwhile, students who are classified as having low learning achievement are unable to meet the indicators of solving mathematical problems.*

Keywords: *Problem Solving, Test Questions, Learning Achievement*

Introduction

Mathematics is a science that is highly expected by everyone, as a result mathematics is taught at every level of education (Darmayanti et al., 2023; Muhammad, Agus Triansyah, et al., 2023; Muhammad, Darmayanti, et al., 2023; Sugianto, 2023; Triansyah et al., 2023). Mathematics is also defined as a subject that helps develop thinking, such as ideas, processes, and reasoning related to opinions or facts (Marchy et al., 2022; Mayani et al., 2022; Muhammad et al., 2022; Muhammad, Elmawati, et al., 2023; Ramadhaniyati et al., 2023; Sanusi et al., 2023). According to Novita & Pd, (2015) mathematics is a related science and can be found in real life. A person's ability to deal with real world problems and problems related to mathematics is the result of mathematical efforts to be able to provide the ability to think systematically (Ahmed & Kumalasari, 2023; Arif et al., 2023; Mustakim & Ngaliyah, 2023; Nasiha et al., 2023; Pradana & Uthman, 2023; Segara et al., 2023).

Creative thinking is a mental activity that produces a new result from development (Amany & Puteri, 2023; Cahyadi & Ariansyah, 2023; Inganah et al., 2023; Jayanti et al., 2023; Lestari et al., 2023; Rachmawati et al., 2023; Santiago, 2023). Bachriani et al., (2021) says creative thinking in mathematics is a combination of logical and divergent thinking. There are 5 characteristics to measure the ability to think creatively, namely: (1) Fluency. Speed to bring

out ideas that do not yet exist. Fluency is a product measure of creative productivity. (2) Dexterity. Making something about what we think so that our thoughts are more visible. (3) detail. Outlining an object, an idea to become something more interesting. (4) Sensitivity. Using the left and right brain so that both work together to create new ideas. (5) Authenticity. Originality or originality to show the ability to generate ideas that we have that still do not exist, is literally unique. Broadly speaking, creative thinking means mental activity to find something that has not been found before. The ability to think creatively mathematically can be defined as the ability to solve a problem flexibly (easily) related to mathematics (Bernard et al., 2018). Meanwhile, according to Suardi et al., (2019), the ability to think creatively mathematically is defined as an ability that must be owned and developed by students in learning mathematics. So it can be concluded that creative thinking is an ability which must be possessed and developed by students during the learning process of mathematics so that it can produce something new from the results of the development of the learning process.

The problem-solving ability that students must have is how to overcome problems that are related to learning activities, for example solving problems in math problems (Hodiyanto, 2017). Problem solving can be referred to as a learning method (Vendiagrys et al., 2015). According to Novita & Pd, (2015) there are several indicators to measure mathematical ability in solving problems, namely: (1) understanding the problem, (2) developing solutions, (3) carrying out plans, (4) reviewing the work done. According to Bernard et al., (2018) solving mathematical problems includes solving word problems, proving, creating, and applying mathematics in life. Bachriani et al., (2021) the importance of having problem solving skills is one of the main tasks in learning mathematics, moreover the process of solving mathematical problems is the essence of mathematics. This means that problem solving skills need to be considered. Students practice solving a problem given by the teacher or from events related to life. Problem solving is able to develop children's creativity to identify and find alternatives or solutions (Dyah & Setiawati, 2019)

Looking at international results, Indonesia ranks 73rd in mathematics in the PIZA (Program for International Student Assessment) out of 79 participating countries. When viewed from the process of formulating the problem, Indonesia gets a score of 379. This result shows that the learning achievement of junior high school mathematics in Indonesia is very low (Hodiyanto, 2017). As a result, students in junior high school still experience mathematical problems in terms of creative thinking which still needs to be improved. So it is important to improve learning to improve PISA ranking and achieve the learning objectives. Experience in apprentice 2, there are still many junior high school students who do not have creative thinking mathematically when solving problems, seen from the results of their work in solving problems that are not fluent, flexible, detailed and many are still not able to be independent. This makes the reason the writer wants to look further at the creative thinking of junior high school students in solving a problem.

The results of previous research (Vendiagrys et al., 2015) examined the ability to solve mathematical problems using questions such as TIMSS in terms of cognitive style. It showed that through cognitive style, students could understand verbal questions from problems, but could not translate them into mathematical language, can determine the relationship between variables and draw effective conclusions, use planned steps to solve problems, but often do not get the right answer, and double-check the answer. Meanwhile, students' Field Independent (FI) cognitive style can translate it into mathematical language and also get the

right answers. The difference between this research and the previous one is that the variables come from students' cognitive styles. Another study was also conducted (Bernard et al., 2018) namely the analysis of mathematical problem solving abilities in terms of students' reasoning abilities whose research results showed that there were differences in students' problem solving abilities at high, medium, and low reasoning skills. In contrast to this research, the research conducted by the researcher looked more at student achievement and this study described more of the student's process of solving problems.

Based on the explanation above, the formulation of the research problem is how students' mathematical problem solving abilities through test questions are viewed from student achievement.

Methods

This research is a descriptive research with a qualitative approach. Qualitative descriptive research is intended to describe the strategies and stages used by students in solving problems. This research was conducted at SDN 1 Godog Lamongan. The subjects of this study were 3 students of grade VI Elementary School. The selection of this subject is based on considerations in terms of learning achievement and is categorized into 3 groups namely High, Medium, Low, which is then taken 1 student from each group. This research consists of two stages, namely the pre-research and research stages. The pre-research stage includes several activities, namely the researcher compiling research instruments. Meanwhile, the research phase includes several activities, namely giving directions to students regarding the stages of working on the questions, giving question texts to students, and analyzing student answer data. The instrument used is a problem with the type of problem solving. The data analysis technique of this research includes 3 stages, namely: 1) Data reduction in this analysis is the process of sorting student answers that are needed either in the form of answer questions. Unnecessary data will be removed. Presentation of data in this analysis is to present the results of student answers that have gone through the reduction stage. Then it is presented in the form of tables with the strategies used and grouped parts of student answers according to problem solving indicators. Drawing conclusions based on the data that has been collected which includes data on the answers to test questions.

Results and Discussion

This study aims to describe students' mathematical communication abilities through test questions based on student achievement. The first thing the researcher did was to obtain data on the mathematics learning outcomes of grade VI students. The results of learning mathematics are in table 1.

After obtaining the data, the researcher grouped students into high, medium and low categories based on student learning outcomes. The calculation of this category grouping is calculated using the formula:

Table 2. Criteria for grouping students

Grouping criteria	Criteria
Value ≥ Mean + SD	Tall
Mean - SD ≤ Value < Mean + SD	Currently
Value < Mean – SD	Low

(Arikunto, 2012, h. 299)

The formula used to find the average and standard deviation is:
Average (mean) = 1/2(highest score+lowest score)
Standard deviation(SD) = 1/6(highest-lowest score)

Table 1. Student Learning Outcomes

No	Name	Value
1.	CLM	74
2	DAS	75
3	FF	74
4	IFA	72
5	ISN	79
6	MWS	73
7	MAR	73
8	MNA	73
9	MSF	89
10	RAW	72
11	AZPI	88
12	ARDS	74
13	FA	73
14	MDAEP	84
15	MHH	73
16	MGAI	73
17	NAA	78
18	SR	73
19	VAND	78

Based on the calculation using the above formula, the grouping of students based on categories is obtained:

Table 3. Student grouping

Grouping criteria	Value
High Group (KT)	89
Medium Group (KS)	78
Low Group (KR)	75

Furthermore, these three categories were carried out by research by giving test questions to determine students' mathematical problem-solving abilities. The following are the results of research on the ability of students to write mathematical problem solving in the high group (KT), students in the medium group (KS), and students in the low group (KR).

High Group Category
Test Question Results

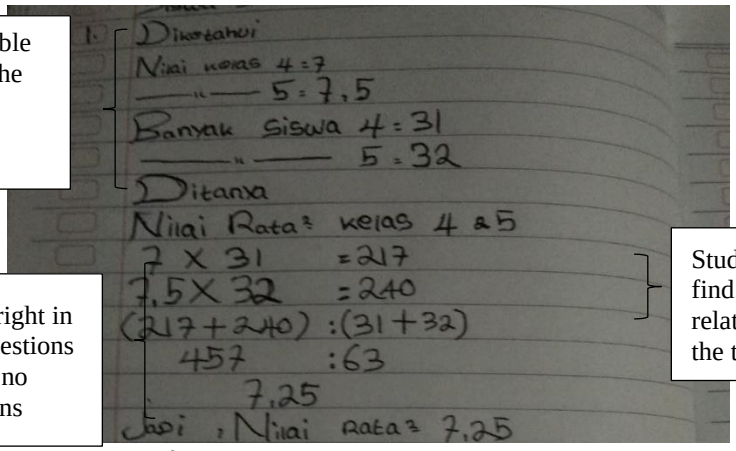

Figure 1. Answers to KT Question No. 1

Based on the results of student tests and by comparing the answer keys, it can be seen that students can understand the problem in question number 1. It can be seen that students are able to write down what is known and what is asked in the questions as a necessary condition. Students can also determine the suitability of the conditions needed in the questions so that they can answer the questions given.

In the planning step for solving this problem, it can be seen that students can plan a solution because students use all the information needed and can also find out the relationship between the required conditions. In solving the problem, the student's work is adjusted to the answer key with the final calculation results obtained an average of 7.25. This stage is located at the end, namely checking and re-examining the results that students are working on. This stage is also if there is no miscalculation, so it is possible for students to check student answers again.

High Group Category
Test Question Results

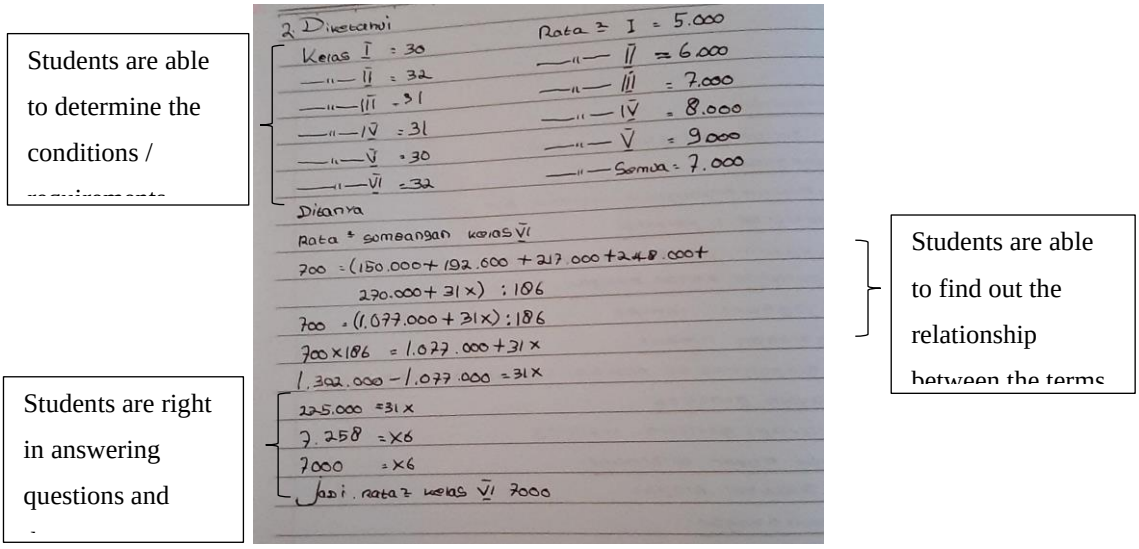

Figure 2. Answers to KT Question No. 2

Based on the results of student tests and by comparing the answer keys, it can be seen that students can understand the problem in question number 2. It can be seen that students are able to write down what is known and what is asked in the questions as a necessary condition. Students can also determine the suitability of the conditions needed in the questions so that they can answer the questions given.

In the planning step for solving this problem, it can be seen that students can plan a solution because students use all the information needed and can also find out the relationship between the required conditions. In solving the problem, the student's work is adjusted to the answer key with the final calculation results obtained - an average contribution of 7,000. This stage is located at the end, namely checking and re-examining the results that students are working on. This stage is also if there is no miscalculation, so it is possible for students to check student answers again. This result is supported by the results of interviews with students who said that they re-examined their answers.

Medium Group Category
Test Question Results

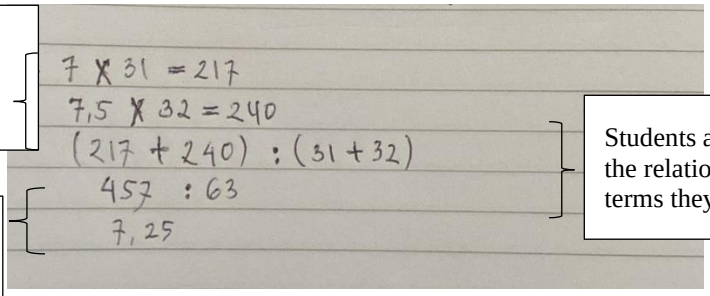

Figure 3. Answers to KS Question No. 1

Based on the results of student tests and by comparing the answer keys, it can be seen that students can understand the problem in question number 1. It can be seen that students are able to write down what is known and what is asked in the questions as a necessary condition. Students can also determine the suitability of the conditions needed in the questions so that they can answer the questions given. In the planning step for solving this problem, it can be seen that students can plan a solution because students use all the information needed and can also find out the relationship between the required conditions.

In solving the problem, the student's work is adjusted to the answer key with the final calculation results obtained - the average grade 4 & 5 is 7.5. This stage is located at the end, namely checking and re-examining the results that students are working on. This stage is also if there is no miscalculation, so it is possible for students to check student answers again.

Medium Group Category
Test Question Results

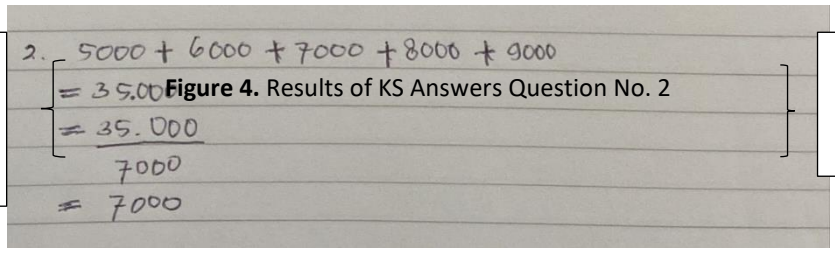

Figure 4. Results of KS Answers Question No. 2

Based on the results of the student's work above and by comparing the answer keys the student was unable to understand problem number 2. The student did not write down what he knew in the problem nor did he write down what was asked of the problem as a necessary condition.

The next stage is planning problem solving. In this step it can be seen that students do not know the relationship between the required conditions.Completion of questions completed by students is not in accordance with the appropriate answer key. The final step is to re-check the answers that have been obtained. At this stage there is no miscalculation, so it is possible for students to re-check the answers obtained.

Low Group Category
Test Question Results

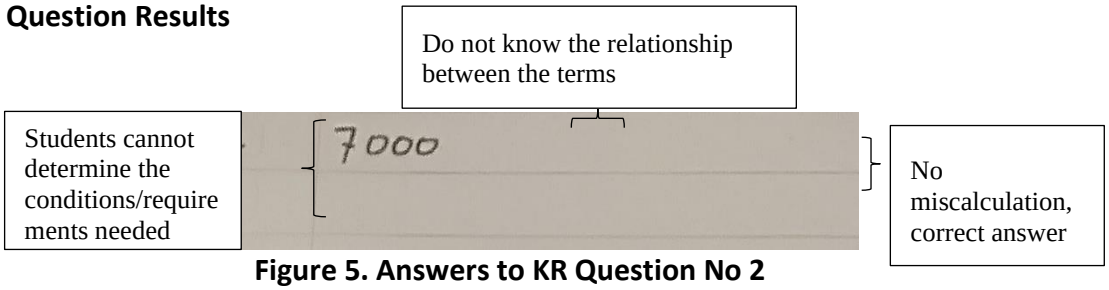

Figure 5. Answers to KR Question No 2

Based on the results of the student's work above and by comparing the answer keys the student was unable to understand problem number 2. The student did not write down what he knew in the problem nor did he write down what was asked of the problem as a necessary condition.

The next stage is planning problem solving. In this step it can be seen that students do not know the relationship between the required conditions because what is used in student answers is the equation symbol. Completion of questions completed by students is not in accordance with the answer key because it should be. The final step is to re-check the answers that have been obtained. At this stage there is no miscalculation, so it is possible for students to re-check the answers obtained.

From the presentation of the data above, it can be seen that the high learning achievement group is able to fulfill 3-4 problem solving indicators. It can be concluded that the high group tends to have a fairly high problem-solving ability. In the moderate learning achievement group, they are able to fulfill 2 problem solving indicators. It can be concluded that the medium group tends to have a relatively low solving ability. In the low learning achievement group unable to meet problem solving indicators, so it can be concluded that the low group has very low problem solving abilities. These results are supported by Novita's previous research (2015) which showed that there was a high correlation between problem-solving abilities in mathematics learning and student achievement. This is also in line with Hodiyanto's research (2017) which shows that the ability to solve math problems is positively correlated with academic achievement.

Based on the presentation of the data above, it can be concluded that the high learning achievement group has relatively high problem solving abilities. This is consistent with Novita's research (2015) which found a high correlation between problem solving skills in learning mathematics and student achievement. The findings confirm that strong problem-solving abilities can contribute significantly to good academic achievement. Furthermore, research conducted by Hodiyanto (2017) also

strengthens the positive relationship between the ability to solve mathematical problems and academic achievement. In his research, Hodiyanto found that students who have better problem-solving skills tend to achieve higher academic achievement. This shows that problem solving ability is not only relevant in the context of mathematics, but also has a significant impact on achievement in general.

Thus, it can be concluded that there is a close relationship between problem solving abilities and student achievement. Groups with high academic achievement have better problem-solving abilities, while medium and low learning achievement groups tend to have lower problem-solving abilities. Therefore, it is important for educators and students to pay adequate attention to developing problem-solving skills, because this can contribute positively to achieving better academic achievement.

Conclusions

Based on the explanation and discussion above, the researchers concluded: The ability to solve mathematical problems using test questions on students who are classified as having high academic achievement, namely: 1) Students with high learning achievement are able to determine the terms or conditions needed to solve problem solving; 2) Students with high learning achievement can use all the information needed and can find out the relationship between the required conditions; 3) Students with high learning achievement are able to solve problems with appropriate and appropriate steps to solve them; 4) Students with high academic achievement can re-examine the answers they have obtained. The ability to solve mathematical problems using test questions on students who are classified as having moderate learning achievement, namely: 1) Students with moderate learning achievement are able to determine the terms or conditions needed to complete problem solving; 2) Students with moderate learning achievement are still lacking in knowing the interrelationships between known conditions and not using all the information needed; 3) Students with moderate learning achievement are not precise in using steps to solve problems; 4) Students with moderate learning achievement can re-examine the answers they have obtained. The ability to solve mathematical problems using test questions on students who are classified as having low learning achievement, namely: 1) Students with low learning achievement are unable to determine the terms or conditions needed to complete problem solving; 2) Students with low learning achievement cannot know the relationship between the required conditions; 3) Students with low learning achievement cannot solve problems with appropriate and appropriate steps to solve them; 4) Students with low learning achievement are unable to re-examine the answers they have obtained.

As for suggestions for further research, namely investigation of the factors that influence the level of understanding and ability of students in determining the requirements or conditions needed to solve mathematical problems. This research can involve factors such as educational background, motivation, or student learning styles.

References

Ahmed, M. A., & Kumalasari, N. (2023). ANDIN-MU : Development of Android-Based Descriptive Text Interactive Multimedia Materials in High School English Subjects. *ALJ: Assyfa Learning Journal*, *1*(1), 49–59.

Amany, D. A. L., & Puteri, A. A. I. (2023). Analysis of The Relationship Between Student Interest and Written Communication in Solving Realistic Mathematics Problems. *Delta-Phi: Jurnal Pendidikan Matematika*, *1*(1), 31–42.

Arif, V. R., Afnan, M., & Usmiyatun. (2023). Development of Social Studies Animation Video (S2AV) Teaching Materials on the Material " Plurality of Indonesian Society " for Junior High School Students. *ALJ: Assyfa Learning Journal*, *1*(1), 1–11.

Bachriani, E. N., Sukoriyanto, S., & Muksar, M. (2021). Kemampuan Komunikasi Matematis Tulis Siswa dalam Mengerjakan Soal Cerita Statistika. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *9*(2), 85. https://doi.org/10.25273/jipm.v9i2.8324

Bernard, M., Nurmala, N., Mariam, S., & Rustyani, N. (2018). Analisis Kemampuan Pemecahan Masalah Matematis Siswa SMP Kelas IX Pada Materi Bangun Datar. *SJME (Supremum Journal of Mathematics Education)*, *2*(2), 77–83. https://doi.org/10.35706/sjme.v2i2.1317

Cahyadi, M. R., & Ariansyah, F. (2023). Analysis of Skills Using Pattern Finding Strategies in Solving Mathematical Problems in View of Gender Differences. *Delta-Phi : Jurnal Pendidikan Matematika*, *1*(1), 12–22.

Darmayanti, R., Nguyen, T., & Serpe, A. (2023). Gema Cow-Pu: Development of Mathematical Crossword Puzzle Learning Media on Geometry Material on Middle School Students' Critical Thinking Ability. *Assyfa Learning Journal*, *1*(1), 37–48.

Dyah, A. D. M., & Setiawati, F. A. (2019). Pemerolehan Bahasa Pertama pada Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *3*(1), 265. https://doi.org/10.31004/obsesi.v3i1.160

Hodiyanto. (2017). Hubungan Kemampuan Pemecahan Masalah Matematis Dan Kemampuan Koneksi Matematis Dengan Prestasi Belajar Mahasiswa. *Jurnal Pendidikan Informatika Dan Sains*, *6*(2), 208–218.

Inganah, S., Choirudin, & Rizki, N. (2023). Integration of Islamic Values , Mathematics , and Career Readiness Competencies of Prospective Teachers in Islamic Universities. *Delta-Phi : Jurnal Pendidikan Matematika*, *1*(1), 23–30.

Jayanti, E. F., Choirudin, & Anwar, M. S. (2023). Application of the Mind Mapping Learning Model to Improve Understanding of Mathematics Concepts in Building Space Materials. *Delta-Phi : Jurnal Pendidikan Matematika*, *1*(1), 43–56.

Lestari, A. S. B., Wahyono, A., Purwanto, Anas, K., Nurmalasari, Y., Bibi, R., & Yunus, M. (2023). Plan – Do – See : Lesson Study-Based Differentiated Learning. *Delta-Phi : Jurnal Pendidikan Matematika*, *1*(1), 85–92.

Marchy, F., Murni, A., Kartini, & Muhammad, I. (2022). The Effectiveness of Using Problem Based Learning (PBL) in Mathematics Problem Solving Ability for Junior High School Students. *AlphaMath Journal of Mathematics Education*, *8*(2), 185–198. https://doi.org/10.30595/alphamath.v8i2.15047

Mayani, I., Suripah, & Muhammad, I. (2022). Analysis of Students' Errors in Solving Statistical Problems: A Case of 8th Grade Students at SMPN 4 Siak Hulu, Indonesia.

Jurnal Pendidikan Mipa, *23*(4), 1826–1838. https://doi.org/10.23960/jpmipa/v23i2.pp1827-1838

Muhammad, I., Agus Triansyah, F., Fahri, A., & Lizein, B. (2023). Analisis Bibliometrik: Penelitian Self-Efficacy Pada Sekolah Menengah Atas (1987-2023). *Edukatif : Jurnal Ilmu Pendidikan*, *5*(1), 519–532. https://www.edukatif.org/index.php/edukatif/article/view/4713

Muhammad, I., Darmayanti, R., & Arif, V. R. (2023). Discovery Learning Research in Mathematics Learning : A. *Delta-Phi : Jurnal Pendidikan Matematika*, *1*(1), 72–84.

Muhammad, I., Elmawati, Samosir, C. M., & Marchy, F. (2023). Bibliometric Analysis: Research on Articulate Storylines in Mathematics Learning. *EduMa: Mathematics Education Learning And Teaching*, *12*(1), 77–87. https://doi.org/10.24235/eduma.v12i1.12607

Muhammad, I., Mukhibin, A., Naser, A. do muhammad, & Dasari, D. (2022). Bibliometric Analysis: Research Trend of Interactive Learning Media in Mathematics Learning in Indonesia. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *11*(1), 10–22. https://doi.org/10.26737/jpmi.v8i1.4005

Mustakim, A., & Ngaliyah, J. (2023). Quantum Teaching Model : Untuk Meningkatkan Hasil Belajar Matematika Siswa MTs. *JPTK: Jurnal Penelitian Tindakan Kelas*, *1*(1), 21–29.

Nasiha, W., Afifah, N., & Amir, A. N. (2023). Design of a Website-Based Arabic Typing Application for Students of Arabic Language Education Program at University. *ALJ: Assyfa Learning Journal*, *1*(1), 12–24.

Novita, R., & Pd, M. (2015). Jurnal Pendidikan Matematika TERHADAP PRESTASI BELAJAR SISWA SMP NEGERI 4 BANDA ACEH Jurnal Pendidikan Matematika Matematika pelajaran merupakan yang menarik mata untuk siswa dalam berhitung pemikiran sangat siswa mempengaruhi dalam dibahas dan selalu men. *Jurnal Pendidikan Matematika*, *2*(X), 86–96.

Pradana, M. D., & Uthman, Y. O. O. (2023). Development of Aqidah Akhlak Learning Media " Board Game Based on Education Fun on the Theme of Commendable Morals (E-Fun A2M)" for High School Students. *ALJ: Assyfa Learning Journal*, *1*(1), 25–35.

Rachmawati, L. N., Sah, R. W. A., & Hasanah, S. N. (2023). Newman and Scaffolding Stages in Analyzing Student Errors in Solving Algebraic Problems. *Delta-Phi : Jurnal Pendidikan Matematika*, *1*(1), 1–11.

Ramadhaniyati, R., Dwi, K., Siregar, P., Muhammad, I., & Triansyah, F. A. (2023). Guide Discovery Learning (GDL) in Education : A Bibliometric Analysis. *Journal on Education*, *05*(04), 11473–11484.

Santiago, P. V. da S. (2023). Didactic Engineering Supporting the Use of Gamification Applied to the Teaching of Arithmetic Operations. *Delta-Phi : Jurnal Pendidikan Matematika*, *1*(1), 57–71.

Sanusi, N., Triansyah, F. A., Muhammad, I., & Susanti, S. (2023). Analisis Bibliometrik: Penelitian Communication Skills Pada Pendidikan Tinggi. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, *6*(3), 1694–1701. https://doi.org/10.54371/jiip.v6i3.1763

Segara, B., Setiawan, A., & Anwar, M. S. (2023). Metode Inquiry : Meningkatkan Hasil Belajar Matematika Siswa SMP Pada Materi Luas Bangun Datar. *JPTK: Jurnal Penelitian Tindakan Kelas*, *1*(1), 30–38.

Sugianto, R. (2023). Penerapan Video YouTube " Pak Rahmad " sebagai Sumber Belajar Matematika Untuk Meningkatkan Hasil Belajar Siswa SMA. *JPTK: Jurnal Penelitian Tindakan Kelas*, *1*(1), 1–9.

Triansyah, F. A., Muhammad, I., Rabuandika, A., Pratiwi, K. D., Teapon, N., & Assabana, M. S. (2023). Bibliometric Analysis : Artificial Intelligence (AI) in High School Education. *Jurnal Imiah Pendidikan Dan Pembelajaran*, *7*(1), 112–123.

Vendiagrys, L., Junaedi, I., & Masrukan. (2015). Analisis Kemampuan Pemecahan Masalah Matematika Soal Setipe TIMSS Berdasarkan Gaya Kognitif Siswa Pada Pembelajaran Model Problem Based Learning. *Unnes Journal of Mathematics Education Research*, *4*(1), 34–41. http://journal.unnes.ac.id/sju/index.php/ujmer