The Effectiveness of the Discovery Learning Model Assisted by the Mathematics Learning Module on Mathematical Problem-Solving Skills

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A B S T R A K

Penelitian ini dilatarbelakangi oleh rendahnya keterampilan siswa dalam memecahkan masalah matematika, dimana keterampilan pemecahan masalah merupakan salah satu keterampilan penting abad ke-21. Penelitian ini bertujuan untuk menganalisis keefektifan model pembelajaran Discovery Learning berbantuan modul pembelajaran matematika terhadap kemampuan pemecahan masalah matematis siswa. Jenis penelitian ini adalah eksperimen semu. Desain penelitian yang digunakan adalah Non-equivalent Control Group Design. Penelitian ini dilakukan pada kelas lima di dua sekolah dasar. Instrumen yang digunakan dalam penelitian ini adalah instrumen tes yang terdiri dari 8 soal esai. Teknik analisis data menggunakan uji statistik parametrik. Hasil penelitian diperoleh: 1) rata-rata kemampuan pemecahan masalah matematis siswa pada kelompok eksperimen mencapai KKM; 2) proporsi siswa kelas eksperimen yang mencapai ketuntasan lebih dari 75%; 3) rata-rata kemampuan pemecahan masalah matematis eksperimen lebih tinggi dibandingkan kelompok kontrol; 4) kemampuan pemecahan masalah matematis siswa pada kelompok eksperimen mengalami peningkatan (n-gain) dengan kriteria "tinggi". Berdasarkan hasil penelitian dapat disimpulkan bahwa pembelajaran dengan menggunakan model Discovery Learning berbantuan modul pembelajaran matematika efektif dalam meningkatkan kemampuan pemecahan masalah matematis siswa.

A B S T R A C T

This research is motivated by the low skills of students in solving mathematical problems, where problem solving skills are one of the important skills of the 21st century. This research aims to analyze the effectiveness of the discovery learning model assisted by the mathematics learning module on students' mathematical problem-solving skills. This type of research is quasi-experimental. The research design used is Non-equivalent Control Group Design. The research was conducted in the fifth grade in two elementary schools. The instrument used in this research was a test instrument consisting of 8 essay questions. Data analysis techniques using parametric statistical tests. The research results obtained: 1) the average mathematical problem-solving skills of students in the experimental group reached the passing grade; 2) the proportion of experimental class students who achieved a passing grade was more than 75%; 3) the average experimental mathematical problem-solving skills is higher than the control group; 4) students' mathematical problem-solving skills in the experimental group have increased (n-gain) with the criteria of "high." Based on the results of the research, it can be concluded that learning using the discovery learning model assisted by the mathematics learning module is effective in improving students' mathematical problem-solving skill.

1. INTRODUCTION

One of the important subjects in the education unit is mathematics. Because mathematics is a provision for thinking mathematically and solving common problems related to everyday life (Gokbulut & Kus, 2019; Hikmasari et al., 2017; Patmaniar et al., 2021). Therefore mathematics is a compulsory subject from elementary to high school (Achsin et al., 2020; Naimnule et al., 2020; Safitri et al., 2021). This fact shows that mathematics lessons need to be a serious concern in the education curriculum.

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Efforts that can be made to improve the quality of education are to develop students' skills. The purpose of learning mathematics is not limited to the cognitive domain, but also to the affective domain which can support the ability to solve problems (Bakay, 2022; Ramadhani et al., 2020; Surya et al., 2017). Mathematics cannot be separated from problem-solving because problem-solving is an integral part of learning mathematics (Son & Fatimah, 2020; Winarti et al., 2019). It can make students more innovative, change the world and behavior, and improve skills in dealing with and solving phenomena in the surrounding environment (Rahmawati et al., 2019; Savitri et al., 2021; Wahyuni et al., 2017). In addition, problem-solving skills are one of the important 21st-century skills students have (Farikh & Haryani, 2022; ŽivkoviL·, 2016). Previous studies add that mathematical problem-solving skills are important skills to have in living a competitive life in this globalization era (Kaitera & Harmoinen, 2022; Kartono et al., 2020; Manurung & Panggabean, 2020). In line with that other studies adds that problem-solving skills are one of the main research domains in mathematics education today (Palanisamy & Nor, 2021; Suseelan et al., 2022). Thus, problem-solving skills in mathematics need to be a serious concern. Problem-solving is the process of applying previously acquired knowledge to new and unknown situations. Problem-solving skills can help students develop their analytical thinking, help students become critical and creative, and improve other math skills (Frerejean et al., 2016; Hendriana et al., 2018; Novita & Putra, 2016). According to previous study student problem-solving skills are student skills to understand problems, plan problem-solving strategies, implement the chosen settlement strategy, and re-examine problem-solving to then make solutions in other ways or develop problem-solving when students are dealing with mathematical problems (Simamora et al., 2018). Other study also added that problem-solving is a formula for finding truth and building a foundation of knowledge (Wicaksono & Korom, 2022). Based on several definitions of problem-solving skills, it can be concluded that mathematical problem-solving skills are students' skills to understand a problem related to mathematics, think of a way/solution that can be done to solve mathematical problems, carry out problem-solving activities based on the method chosen, and re-examine the results of the math problems that have been solved.

Previous studies state that the characteristics of problem-solving skills are: 1) students can understand problems, 2) students can plan completion of preparing hypotheses and designing experiments, 3) students can apply problem-solving skills based on planning which includes data collection, analysis, and conclusion, 4) students re-check the results obtained (Nurita et al., 2017; Sudarsono et al., 2022). Meanwhile, problem-solving indicators according to NCTM include: 1) Using problem-solving in building new knowledge; 2) Carrying out problem-solving activities in mathematics and other contexts; 3) Using a variety of appropriate ways to solve problems; 4) Observing and reflecting on the process of solving mathematical problems (Arifin et al., 2019; Ramadhani, Kartono, & Haryani, 2023). However, the reality on the ground shows that problem-solving skills have not been fully mastered by students. Based on a mini-research conducted at SD Negeri Ngijo 02, it was found that the value of students' problem-solving skills was in a low category. This can be seen from the average student test results in working on problem-solving questions which are still included in the low category, namely 54.76. This fact shows that students' skills in solving mathematical problems are still low. This shows that there is a gap between expectations and reality in the field regarding problem-solving skills. This opens up opportunities to research solutions that can be applied to improve problem-solving skills to meet the demands of 21st-century skills.

One of the causes of students' difficulties in solving problems is the inability of students to understand statements or information resulting in misconceptions about understanding mathematical material (Kurniadi & Purwaningrum, 2018; Pratiwi et al., 2020; Saja'ah, 2018). Mathematical problem-solving is often considered difficult by students (Arikan & Ünal, 2015; Dowker et al., 2016). Based on the results of the preliminary studies, show that more than 70% of students do not like mathematics. Other Active participation is only dominated by certain students, due to the lack of opportunity for students to express student ideas. The learning method that is often used is the lecture method, memorizing formulas and steps for working on problems. In some situations, learning mathematics in fifth grade is also carried out using discussion and demonstration methods. However, this has not fully facilitated students in developing mathematical problem-solving skills. According to previous study, mathematical problem-solving skills require good cognitive processes and analytical skills, so students need ongoing practice and a meaningful learning environment to practice these skills (Retnowati et al., 2018; Yapatang & Polyiem, 2022). That is, the learning methods used in developing mathematical problem-solving abilities must also be supportive in letting students learn mathematics with the opportunity to practice solving problems. The solution that can be achieved is through mastering the problem-solving process using the right method or model to support students' ability to solve problems (Durak, 2020; Saygılı, 2017; Sutama et al., 2022). This is because solving problems in mathematics requires a high-level thinking process and requires the right steps. Previous study added that in improving problem-solving skills, the process factor

is one of the most important elements to pay attention to, namely by helping them understand each step of determining a solution and then linking it to real-life situations (Sun et al., 2022). Based on some of these statements, there is a need for interactive learning that is oriented toward improving mathematical problem-solving skills. Various types of learning methods and models can be used as solutions to learning problems. However, researchers are interested in studying the discovery learning model as a solution to improve students' problem-solving skills. The application of discovery learning can facilitate students in the process of discovering concepts because discovery learning emphasizes discovering concepts and principles that students do not yet have (Bahtiar et al., 2022; Gunawan et al., 2021; Ritonga, 2021). In line with that, according to previous studies, this model is a learning model that makes students active in learning so as to create an effective class (Permatasari et al., 2019; Serevina & Luthfi, 2021). Based on other study the advantages of the discovery learning model include: increasing free-thinking abilities and training students' cognitive skills to find, investigate, and solve problems (Dina et al., 2019; Ertikanto et al., 2018). Previous study add that the discovery learning model can motivate students to improve their learning outcomes, as well as being able to solve problems for students (Usman et al., 2022). Another reason researchers are interested in using the discovery learning model is that there are differences in the results of previous research. Based on research conducted showed that the discovery learning model was not effective in improving students' mathematical problem-solving skills (Diana et al., 2016; Putri et al., 2017; Septiani et al., 2018). However, research conducted by other researchs shows that the discovery learning model is effective in improving students' mathematical problem-solving skills (Anggreini et al., 2018; Hanum et al., 2019; Jana & Fahmawati, 2020). Based on the facts from the research results, it can be concluded that there are gaps in some of the previous research results .

Researchers believe that in researching the impact of discovery learning models on mathematical problem-solving skills, supporting teaching materials are needed. Supporting teaching materials can be in the form of media, learning modules, student worksheets, or others. The use of supporting teaching materials in the application of the discovery learning model is necessary. Of the various existing learning media, modules can be an option to support learning activities (Sulistiyanti et al., 2021; Wahyuni et al., 2020). Based on previous research showing that learning modules are effective in improving mathematical problem-solving skills (As'ari, 2019; Dewi, 2017; Jannah et al., 2021). So, researchers are interested in using the mathematics learning module as teaching material to support the implementation of the discovery learning model. Based on studies on several previous research on the application of discovery learning and module of mathematics learning, there has been no research using integrated mathematics learning modules with discovery learning models in testing their effect on mathematical problem-solving skills. This provides an opportunity for researchers to use mathematics learning modules in assessing the effectiveness of discovery learning models on mathematical problem-solving skills. The module used is a mathematics learning module that integrates the syntax of the discovery learning model. The syntax of the discovery learning model includes stimulation, problem statement, data collection, data processing, verification, and generalization (Khabibah et al., 2017; Purwaningsih et al., 2020; Sulistyo & Kartono, 2021). Based on some of these explanations, the purpose of this research was to analyze the effectiveness of the discovery learning model assisted by the mathematics learning module on mathematical problem-solving skills. This research is important because problem solving skills are needed in learning mathematics, in fact it is a mandatory skill for the 21st century. This research is expected to be able to answer the gaps in some of the results of previous research regarding the effectiveness of the discovery learning model on mathematical problem-solving skills. This research is also expected to be a reference for further research, especially regarding the use of learning modules in the application of discovery learning models to improve students' mathematical problem-solving skills.

2. METHOD

This type of research is quasi-experimental. The research design used is the Nonequivalent Control Group Design (Sugiyono, 2016). This research used an experimental class and a control class, each of which was held in 5 meetings. The research activity begins with a pretest meeting and ends with a posttest. The data were analyzed to determine the effectiveness of the discovery learning model assisted by the learning module on mathematical problem-solving skills. Learning activities were carried out three times, and each meeting lasted 70 minutes. The subject matter being studied is geometric volume material (cubes and blocks). The experimental class was carried out by learning the discovery learning model assisted by the mathematics learning module. While the control class carries out conventional learning. The experimental class uses a mathematics learning module which is arranged based on the subject matter of geometric volume (cubes and blocks). The mathematics learning module is integrated with the syntax of the discovery learning model, hereinafter referred to as the mathematics learning module based

on discovery learning. This is to support the application of the discovery learning model. The research flow design can be seen in Figure 1.
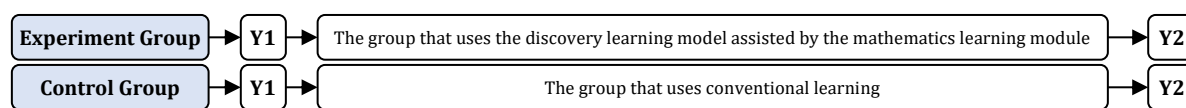

Figure 1. Nonequivalent Control Group Design

The population of this research was the fifth grade of elementary school in Gunungpati District, Semarang City for the 2022-2023 academic year. This research took 2 samples using purposive sampling from 39 schools. This was done by considering the school's accreditation and the similarity of the average daily test results for fifth-grade students. The first sample selected was grade V at SDN Ngijo 02, Gunungpati District. This is because based on previous research showing that fifth-grade students at SDN Ngijo 02 have problem-solving skills in the low category (Ramadhani, Kartono, & Haryani, 2023). The selection of the following sample is SDN accredited B which consists of 14 schools. Of the 14 schools, schools that were close to Ngijo 02 Elementary School were chosen, leaving 4 schools. Based on these schools, it was found that 1 school had an average daily test score equivalent to SDN Ngijo 02, namely SDN Nongkosawit 01, Gunungpati District. Thus the sample used was class V at SDN Ngijo 02 and SDN Nongkosawit 01 Gunungpati District, Semarang City. The experimental group was class V at SDN Ngijo 02 consisting of 28 students, while the control group was class V at SDN Nongkosawit 01 consisting of 22 students. Data collection techniques were carried out using problem-solving skills tests given during the pre-test and post-test. While the materials needed during research are learning modules and lesson plans. Before conducting the research, the validation of lesson plans, learning modules, and test instruments was carried out through content validation. The mathematics learning module based on discovery learning has been declared valid by mathematicians, linguists, and design experts (Ramadhani, Kartono, Haryani, et al., 2023). The recapitulation of the results of the validator's assessment can be seen in Table 1.

Table 1. Eligibility Level of Instruments

Instrument	Validator	Percentage of Rating	Eligibility Criteria
Learning Modules	Mathematicians	90%	Very Good
	Linguist	91%	Very Good
	Design expert	82%	Very Good
Lesson Plan	Learning Practitioner (Teacher)	98%	Very Good
Test Instrument	Mathematicians	91%	Very Good

Furthermore, the test instrument used is a mathematical problem-solving skills test instrument. The test instrument will be given at the pretest and posttest. The material tested is the volume of geometric shapes (cubes and blocks). Test instruments that have been declared feasible by mathematicians, then test the items to obtain empirically valid test instruments, namely through 1) testing the validity of the items using the product moment correlation formula; 2) reliability test with Alpha Cronbach formula; 3) discriminating power test; and 4) difficulty level test. After testing the 13 test instruments, 8 test instruments were obtained that met the requirements, namely valid, reliable, good discriminatory, and had a proportional level of difficulty. Recapitulation of the analysis of the items that have been declared valid can be seen in Table 2, while the indicators of problem-solving skills used in the test instrument are shown in Table 3.

Table 2. Recapitulation of The Validity, Reliability, Discriminatory Power, and Level of Difficulty

Question Items of	Validity		Reliability		Discriminating Power		Level of Difficulty	
	r_{xy}	Criteria	r_{11}	Criteria	DP	Criteria	LD	Criteria
1	0.73	High			0.22	Medium	0.70	Medium
2	0.77	High	0.93		0.36	Medium	0.82	Easy
3	0.88	High	Very High		0.39	Medium	0.70	Medium
4	0.89	High			0.33	Medium	0.66	Medium
5	0.83	High			0.33	Medium	0.50	Medium
6	0.88	High	0.93		0.39	Medium	0.70	Medium
7	0.85	High	Very High		0.58	Good	0.36	Medium
8	0.85	High			0.58	Good	0.36	Medium

Table 3. Indicators of Problem Solving Skills

	Indicators	Number of questions
1.	Build new mathematical knowledge through problem-solving	1, 2
2.	Solve problems that arise in mathematics and other contexts	3, 4, 5
3.	Implement and use various appropriate strategies to solve problems	6, 7, 8
4.	Observe and reflect on the process of solving mathematical problems	

The data analysis technique is quantitative analysis, namely inferential statistics consisting of prerequisite tests and hypothesis tests. The prerequisite test consists of a normality test and a homogeneity test. The effectiveness of the discovery learning model assisted by the mathematics learning module on problem-solving skills can be seen from several tests, namely: 1) the actual passing average value using the One Sample T-Test statistic in SPSS 25; 2) the classical completeness test using the Z-Test formula; 3) the mean difference test uses the Independent Sample T-Test statistical test on SPSS 25. The significance level used is α = 0.05. After testing the hypothesis, then the N-Gain test was carried out to measure the level of effectiveness of the discovery learning model assisted by the mathematics learning module on students' mathematical problem-solving skills. The results of calculating the average N-Gain are then interpreted using the criteria shown in Table 4.

Table 4. Criteria for N-Gain Value Data on Mathematical Problem-Solving Skills

N-Gain Average Value	Criteria
0.70 - 1	High
0.31 – 0.69	Medium
0 – 0.30	Low

3. RESULT AND DISCUSSION

Result

The data analyzed were taken from students' mathematical problem-solving skills data, both from the pretest and posttest of students. Posttest data is used to determine the average mastery and classical proportion of students in solving math problem-solving questions. Posttest data is also used to find out the average difference in the mathematical problem-solving skills of students whose learning uses the discovery learning model assisted by the mathematics learning module with students who use conventional learning. The results of the post-test data statistical analysis are shown in Table 5.

Table 5. Actual Passing Average Test of Post-test

Statistic Test	Passing Grade	Sig. (P-Value)	Information	Decision
Normality		0.083	*Sig* > 0.05	The data are normal
One-Sample Test	65	0.002	*Sig* < 0.05	The average of data passed passing grade

Based on Table 5, it can be seen that the post-test data analysis was carried out using a parametric test because the data are normal. The One-Sample Test was carried out using the SPSS 25 application which showed that the significant value or P-value was 0.002. That is, the posttest results of the experimental class have a significant value or P-value < α and H_0 is rejected. Thus, it can be concluded that the average mathematical problem-solving skills of students who are taught using the discovery learning model assisted by the mathematics learning module reaches the actual completion limit of 65.

Table 6. Classical Pass Proportion Test of Post-test

Statistic Test	Passing Grade	Proportion	Z_{score}	Z_{table}	Information	Decision
Z-Test	65	75%	1.746	1.65	$Z_{score} > Z_{table}$	75% of the data passed passing grade

Based on Table 6, the posttest data analysis which was carried out using the Z-test shows that the $Z_{score} > Z_{table}$, which means H_0 is rejected. Based on this decision, it can be said that the proportion of students who meet the actual passing limit has exceeded 75% of the many students who are taught using the discovery learning model assisted by the mathematics learning module.

Table 7. Differences in Average of the Post-test Data

Statistic Test		Sig. (P-Value)	Information	Decision
Normality	Experiment	0.083	*Sig* > 0,05	The data are normal
	Control	0.078	*Sig* > 0,05	The data are normal
Homogeneity		0.443	*Sig* > 0,05	The data are homogeneous
T-test		0.018	*Sig* < 0,05	There are the significant average difference

Based on Table 7, it can be seen that the post-test data analysis was carried out using a parametric test because the data are normal and homogeneous. Based on the Independent Sample Test using the SPSS 25 application, it shows that the significant value or P-value is 0.018. Because of the significant value or P-value < α (0,05), then H_0 is rejected. Thus, it can be concluded that the average mathematical problem-solving skills of students who are taught using the discovery learning model assisted by the mathematics learning module is higher than students who are taught using conventional learning.

Table 8. N-Gain Test of Pretest and Post-test Data

Group	N	Average of N-Gain	Criteria
Experiment	28	0.84	High
Control	22	0.54	Medium

Based on Table 8, it can be seen that the data on students' mathematical problem-solving skills in the experimental class has increased with the criteria of "high." While the increase in the control class the improvement criterion is in the "medium" category. This shows that students' mathematical problem-solving skills have increased after using the discovery learning model assisted by the mathematics learning module.

Discussion

The application of discovery learning assisted by learning modules can improve mathematical problem-solving skills. This research is important to carry out to improve mathematical problem-solving skills, as an effort to fulfill one of the important skills of the 21st century. Discovery learning integrated modules can support the implementation of discovery learning in improving mathematical problem-solving (Septiani et al., 2018; Septiyan et al., 2020). Based on the results of the research, it shows that the discovery learning model assisted by the mathematics learning module can improve students' mathematical problem-solving skills. This can be shown from the results of the statistical test analysis on the posttest data of the experimental class students which showed that the average mathematical problem-solving skills of students who were taught with the mathematics learning module assisted discovery learning model reached the passing grade of 65. Furthermore, the results of the analysis also showed that the proportion of students who met the passing grade had exceeded 75% of the number of students taught with the mathematics learning module-assisted discovery learning model. The results of this research are different from some previous research results which show that the discovery learning model is not effective in improving students' mathematical problem-solving skills. This can be seen from the proportion of students who fulfill passing grade 70 no more than 60 (Diana et al., 2016; Panjaitan et al., 2018; Putri et al., 2017). However, from the standard test, the proportion used in this research is different, namely using passing grade 70 and a minimum completeness proportion of 60%. In contrast, this research used passing grade 65 and a proportion of 75%. This is because the research subjects are different from the researchers used, namely in elementary schools. Another reason researchers use the passing grade at the elementary school level is 65 because problem-solving skills require high thinking skills (Kurniadi & Purwaningrum, 2018; Pratiwi et al., 2020; Saja'ah, 2018). However, even though there are differences in research results, previous research has shown that students' mathematical problem-solving skills tend to increase over time (Diana et al., 2016).

The effectiveness of the discovery learning model assisted by the mathematics learning module in improving students' mathematical problem-solving skills is also shown through the results of the analysis of the average difference through the t-test. The results of the analysis show that the significance value is 0.018 or less than 0.05, which means that the average problem-solving skills of students whose learning uses the mathematics learning module are higher than students who use conventional learning. The results of this research are in line with some previous research which shows that the discovery learning model is effective in improving students' mathematical problem-solving skills (Anggreini et al., 2018; Hanum et al., 2019; Jana & Fahmawati, 2020).

However, there are differences in characteristics between research conducted by several previous researchers and those conducted by other researchers. The difference lies in the supporting materials used, the previous research did not use discovery learning-based mathematics learning modules. While researchers use learning modules in research. The use of modules is an effort that can be made to support the implementation of learning and help solve problems completely (Laisnima & Siregar, 2020; Wahyuni et al., 2020). The next difference lies in the research subjects used. The researchers conducted research at the elementary school level, whereas some previous research did not conduct research at the elementary school level (Kusumaningrum & Indarini, 2020). The results of this research indicate that the discovery learning model is more effective in increasing students' problem-solving skills than problem solving learning model. The difference between this research and research conducted by researchers is the learning used in the control class. This research used problem-solving learning in the control class. While researchers use conventional learning in the control class, it aims as a comparison to see how far discovery learning can have an impact. Although there are differences in the characteristics of the research, the results of these researches strengthen the results of this research regarding the effectiveness of the discovery learning model assisted by the mathematics learning module in improving mathematical problem-solving skills.

The findings in the field show that students are quite enthusiastic when learning takes place using the discovery learning model assisted by the mathematics learning module. This is shown when students feel challenged to solve problems contained in the "stimulus" stage. Students can follow the discovery learning syntax by using the instructions in the learning modules that have been developed. Student's difficulties in carrying out the syntax of the discovery learning model occurred in stage 2 "problem identification" at meeting 1. Students had difficulty compiling questions and hypotheses. This is because discovery learning activities at the first meeting are the discovery of a formula concept. This becomes an obstacle for students in developing hypotheses on new material. Researchers realized that the activity of developing hypotheses in learning was quite difficult to do at the elementary school level. This is in line which states that children at the elementary school level who are in the age range of 7-12 years are at the concrete operational stage based on Piaget's theory (Hayati et al., 2021). Previous study added that in this age range children are generally able to solve problems logically, but cannot think abstractly or hypothetically (Agustyaningrum & Pradanti, 2022). Therefore, researchers pay more attention to and guide students to overcome these obstacles. This weakness was also found by previous researchers, that the application of discovery learning requires recognition and habituation (Diana et al., 2016; Panjaitan et al., 2018; Putri et al., 2017).

At the second and third meetings, students began to be able to follow the lesson well. This is because the problems presented at the second and third meetings were not new material, but material for expanding the material at the first meeting. That is, the discovery that is the goal is the discovery of problem-solving concepts based on material that has been studied in the previous meeting. Thus, the results of these discoveries are no longer about formulas, but a way of thinking or problem-solving concepts. This is in line with one of the characteristics of learning mathematics at the elementary level stated by previous study, which is a form of spiral learning that emphasizes repetition and use of material (Tampubolon, 2016). Discovery learning activities at meetings two and three can run better even though at the "problem identification" stage it still requires guidance from the teacher. But the activity of "data processing" runs quite effectively . This can be seen from the enthusiasm of students who are passionate about solving problems. Students feel proud when they can solve the given problems. There were even some students who asked to be given a new problem to solve. Because these students feel happy with the results of solving the problems that have been found. This is in line with previous research which states that learning mathematics in elementary schools must facilitate students to reach their potential through challenging mathematical activities (Abidin et al., 2020). In this case, the use of learning modules also helps in carrying out the learning process. This is in line with some previous research which shows that the use of modules can facilitate learning activities and make learning more productive so that it can help students solve each math problem given (Anisah & Lastuti, 2018; Sarkawi & Permana, 2022).

The use of learning modules in the implementation of discovery learning can encourage students to improve mathematical problem-solving skills. This is supported by the results of previous research which showed that the learning modules used in learning can help students solve problems (Anisah & Lastuti, 2018; As'ari, 2019). The results of the N-Gain test in this research indicate that the increase in students' mathematical problem-solving skills after using the discovery learning model assisted by the mathematics learning module is included in the "high" category. While the control class showed an increase in the moderate category. This shows that theoretically, an increase in learning outcomes occurs when the data being compared is pretest and posttest data. This happened because during the pretest students had not studied solid volume material (cubes and blocks). Thus, this proves that the increase in

"moderate" category math problem-solving skills in the control class is nothing special. This is the same as the result of previous research which obtained N-Gain in the "moderate" category, so it cannot be said to be significantly effective (Septiani et al., 2018). Based on some of the facts that have been mentioned, the application of the discovery learning model assisted by the mathematics learning module can improve students' mathematical problem-solving skills. This research will be very useful for teachers in choosing the right learning model to improve mathematical problem-solving skills. This research is also new knowledge regarding the effectiveness of the discovery learning model assisted by the mathematics learning module on mathematical problem solving abilities. However, this research is still very limited. The research subject involved only elementary school students and the material taught was the volume of geometric shapes (cubes and blocks). Therefore, it is hoped that further research can further deepen and broaden the scope of research related to the discovery learning model and the development of a learning module.

4. CONCLUSION

Based on the results of the research and discussion, it can be concluded that learning using the discovery learning model assisted by the mathematics learning module is effective in improving students' mathematical problem-solving skills. This is indicated by the achievement of indicators: 1) the average mathematical problem-solving skills of students who are taught using the discovery learning model assisted by the mathematics learning module reach the actual completion limit; 2) the proportion of students who meet the actual completion limit of the number of students who are taught using the discovery learning model assisted by the mathematics learning module; 3) the average mathematical problem-solving skills of students who were taught using the discovery learning model assisted by the mathematics learning module were higher than students who were taught using conventional learning; 4) the mathematical problem-solving skills of students who are taught using the discovery learning model assisted by the mathematics learning module have increased (n-gain) with the criterion "high."

5. REFERENCES

Abidin, Z., Utomo, A. C., Pratiwi, V., & Farokhah, L. (2020). Project-based learning-literacy in improving students' mathematical reasoning abilities in elementary schools. *JMIE (Journal of Madrasah Ibtidaiyah Education)*, *4*(1), 39. https://doi.org/10.32934/jmie.v4i1.170.

Achsin, M. A., Kartono, K., & Wibawanto, H. (2020). Analysis of Problem Solving Capabilities in Problem Based Learning Contextual Approaches Based on Metacognitive Awareness. *Unnes Journal of Mathematics Education Research*, *9*(2), 147–155. https://journal.unnes.ac.id/sju/index.php/ujmer/article/view/32979.

Agustyaningrum, N., & Pradanti, P. (2022). Teori Perkembangan Piaget dan Vygotsky: Bagaimana Implikasinya dalam Pembelajaran Matematika Sekolah Dasar? *Jurnal Absis: Jurnal Pendidikan Matematika Dan Matematika*, *5*(1), 568–582. https://doi.org/10.30606/absis.v5i1.1440.

Anggreini, R. D., Asnawati, R., & Koestoro, B. (2018). Pengaruh Discovery Learning Terhadap Kemampuan Pemecahan Masalah Matematis Siswa. *Jurnal Pendidikan Matematika Universitas Lampung*, *6*(3), 186–197. http://jurnal.fkip.unila.ac.id/index.php/MTK/article/view/15319.

Anisah, & Lastuti, S. (2018). Pengembangan Bahan Ajar berbasis HOTS untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Mahasiswa. *Kreano: Jurnal Matematika Kreatif-Inovatif*, *9*(2), 191–197. https://doi.org/10.15294/kreano.v9i2.16341.

Arifin, S., Kartono, & Hidayah, I. (2019). Analisis Kemampuan Pemecahan Masalah pada Model Problem Based Learning Disertai Remedial Teaching. *Eduma: Mathematics Education Learning and Teaching*, *8*(1), 85–97. https://doi.org/10.24235/eduma.v8i1.3355.

Arikan, E. E., & Ünal, H. (2015). Investigation of Problem-Solving and Problem-Posing Abilities of Seventh-Grade Students. *Educational Sciences: Theory and Practice*, *15*(5), 1403–1416. https://doi.org/10.12738/estp.2015.5.2678.

As'ari, H. (2019). Pengembangan Modul Pembelajaran Matematika Berbasis Masalah Untuk Meningkatkan Kemampuan Pemecahan Masalah. *Delta: Jurnal Ilmiah Pendidikan Matematika*, *7*(1), 19–26. https://doi.org/10.31941/delta.v7i1.920.

Bahtiar, B., Ibrahim, I., & Maimun, M. (2022). Analysis of Students' Scientific Literacy Skill in terms of Gender Using Science Teaching Materials Discovery Model Assisted by PhET Simulation. *Jurnal Pendidikan IPA Indonesia*, *11*(3), 371–386. https://doi.org/10.15294/jpii.v11i3.37279.

Bakay, M. E. (2022). 21st Century Skills for Higher Education Students in EU Countries: Perception of Academicians and HR Managers. *International Education Studies*, *15*(2), 14–24.

https://doi.org/10.5539/ies.v15n2p14.

Dewi, M. (2017). Pengembangan Modul Matematika Menggunakan Model Thiagarajan untuk Meningkatkan Kemampuan Pemecahan Masalah melalui Pendekatan Pembelajaran Matematika Realistik di MTs Pesantren Daar Al Uluum Kisaran. *Jurnal Paradikma*, *10*(2), 193–203. https://doi.org/https://jurnal.unimed.ac.id/2012/index.php/paradikma/article/view/8699

Diana, L., Noer, S. H., & Gunowibowo, P. (2016). Efektivitas Pembelajaran Discovery Ditinjau dari Kemampuan Pemecahan masalah Matematis dan Self Confidence. *Jurnal Pendidikan Matematika Universitas Lampung*, *4*(1). https://doi.org/http://jurnal.fkip.unila.ac.id/index.php/MTK/article/view/10600.

Dina, Z. H., Ikhsan, M., & Hajidin. (2019). The Improvement of Communication and Mathematical Disposition Abilities through Discovery Learning Model in Junior High School. *Journal of Research and Advances in Mathematics Education*, *4*(1), 11–22. https://doi.org/10.23917/jramathedu.v4i1.6824.

Dowker, A., Sarkar, A., & Looi, C. Y. (2016). Mathematics anxiety: What have we learned in 60 years? *Frontiers in Psychology*, *7*(APR), 508. https://doi.org/10.3389/fpsyg.2016.00508.

Durak, H. Y. (2020). The Effects of Using Different Tools in Programming Teaching of Secondary School Students on Engagement, Computational Thinking and Reflective Thinking Skills for Problem Solving. *Technology, Knowledge and Learning*, *25*, 179–195. https://doi.org/10.1007/s10758-018-9391-y.

Ertikanto, C., Rosidin, U., Distrik, I. W., Yuberti, Y., & Rahayu, T. S. (2018). Comparison of Mathematical Representation Skill and Science Learning Result in Classes With Problem-Based and Discovery Learning Model. *Jurnal Pendidikan IPA Indonesia*, *7*(1), 106–113. https://doi.org/10.15294/jpii.v6i2.9512.

Farikh, N. I., & Haryani, S. (2022). Pengembangan Instrumen Tes Berbasis Pemecahan Masalah Pada Materi Redoks. *Chemistry in Education*, *11*(1), 79–85. https://doi.org/http://journal.unnes.ac.id/sju/index.php/chemined.

Frerejean, J., Strien, J. L. H., Kirschner, P. A., & Brand-Gruwel, S. (2016). Completion Strategy or Emphasis Manipulation? Task Support for Teaching Information Problem Solving. *Computers in Human Behavior*, *62*, 90–104. https://doi.org/10.1016/j.chb.2016.03.048.

Gokbulut, Y., & Kus, S. (2019). Cartoon to Solve Teaching Problem on Mathematics. *International Journal of Evaluation and Research in Education*, *8*(1), 145–150. https://doi.org/10.11591/ijere.v8i1.17609.

Gunawan, G., Kosim, K., Ibrahim, I., Susilawati, S., & Syukur, A. (2021). The Effectiveness of Physics Learning Tools Based on Discovery Model with Cognitive Conflict Approach Toward Student's Conceptual Mastery. *Journal of Physics: Conference Series*, *1747*(1), 1–7. https://doi.org/10.1088/1742-6596/1747/1/012035.

Hanum, L., Istikomah, D. A., & Jana, P. (2019). Perbandingan Keefektifan Model Pembelajaran Problem Based Learning (PBL) Dan Discovery Learning (Dl) Ditinjau Dari Kemampuan Pemecahan Masalah. *Eduma: Mathematics Education Learning and Teaching*, *8*(1), 67–74. https://doi.org/10.24235/eduma.v8i1.3203.

Hayati, F., Neviyarni, N., & Irdamurni, I. (2021). Karakteristik Perkembangan Siswa Sekolah Dasar: Sebuah Kajian Literatur. *Jurnal Pendidikan Tambusai*, *5*(1), 1809–1815. https://www.jptam.org/index.php/jptam/article/download/1181/1056.

Hendriana, H., Johanto, T., & Sumarmo, U. (2018). The role of problem-based learning to improve students' mathematical problem-solving ability and self confidence. *Journal on Mathematics Education*, *9*(2), 291–299. https://doi.org/10.22342/jme.9.2.5394.291-300.

Hikmasari, P., Kartono, & Mariani, S. (2017). Analyze of Diagnostic Assessment and Remedial Teaching Result of Mathematics Problem Solving Achievement by Problem Based Learning Mode. *Unnes Journal of Mathematics Education*, *6*(1), 215–222. https://journal.unnes.ac.id/sju/index.php/ujme/article/view/15576/8697.

Jana, P., & Fahmawati, A. A. N. (2020). Model Discovery Learning untuk Meningkatkan Kemampuan Pemecahan Masalah. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *9*(1), 213–220. https://doi.org/10.24127/ajpm.v9i1.2157.

Jannah, M., Supratman, M., & Rahmawati, H. (2021). Efektivitas Penggunaan Modul Terhadap Kemampuan Pemecahan Masalah Matematika pada Materi Sistem Persamaan Linear Tiga Variabel. *TIRAI EDUKASI: Jurnal Pendidikan*, *4*(1), 59–64. https://www.jkqh.uniqhba.ac.id/index.php/tirai_edukasi/article/view/313/196.

Kaitera, S., & Harmoinen, S. (2022). Developing Mathematical Problem-Solving Skills in Primary School by Using Visual Representations on Heuristics. *LUMAT: International Journal on Math, Science and Technology Education*, *10*(2), 111–146. https://doi.org/10.31129/LUMAT.10.2.1696.

Kartono, M., K., U., & Dwidayati, N. K. (2020). An Analysis of Student Error Types in Solving Mathematics Problem on the Implementation of Osborn Simple Feedback Learning Model. *Journal of Physics: Conference Series*, *1567*(3), 1–6. https://doi.org/10.1088/1742-6596/1567/3/032018.

Khabibah, E. N., Masykuri, M., & Maridi, M. (2017). The Effectiveness of Module Based on Discovery Learning to Increase Generic Science Skills. *Journal of Education and Learning (EduLearn*, *11*(2), 146–153. https://doi.org/10.11591/edulearn.v11i2.6076.

Kurniadi, G., & Purwaningrum, J. P. (2018). Kesalahan Siswa pada Kategori Kemampuan Awal Matematis Rendah dalam Penyelesaian Tes Kemampuan Pemecahan Masalah Matematis. *JPPM (Jurnal Penelitian Dan Pembelajaran Matematika*, *11*(2), 55–66. https://doi.org/10.30870/jppm.v11i2.3754.

Kusumaningrum, Y., & Indarini, E. (2020). The Effectiveness Of Discovery Learning and Problem Solving Learning Model on Mathematical Problem Solving Skills of Class IV Primary School. *Jurnal PAJAR*, *4*(2), 435–444. https://doi.org/10.33578/pjr.v4i2.7969.

Laisnima, L., & Siregar, T. (2020). Modul Pembelajaran Berbasis Science, Technology, Engineering and Mathematics (STEM) untuk Meningkatkan Hasil Belajar dan Keterampilan Proses Peserta Didik pada Materi Redoks dan Sel Elektrolisis. *Jurnal Ilmu Pendidikan Indonesia*, *8*(2), 84–90. https://doi.org/10.31957/jipi.v8i2.1237.

Manurung, S. R., & Panggabean, D. D. (2020). Improving Students' Thinking Ability In Physics Using Interactive Multimedia Based Problem Solving. *Jurnal Cakrawala Pendidikan*, *39*(2), 460–470. https://doi.org/10.21831/cp.v39i2.28205.

Naimnule, M., Kartono, K., & Asikin, M. (2020). Mathematics Problem Solving Ability in Terms of Adversity Quotient in Problem Based Learning Model With Peer Feedback. *Unnes Journal of Mathematics Education Research*, *9*(2), 222–228. https://journal.unnes.ac.id/sju/index.php/ujmer/article/view/33859.

Novita, R., & Putra, M. (2016). Using Task Like PISA's Problem to Support Student's Creativity in Mathematics. *Journal on Mathematics Education*, *7*(1), 31–42. https://doi.org/10.22342/jme.7.1.2815.31-42.

Nurita, T., Hastuti, P. W., & Sari, D. A. P. (2017). Problem-Solving Ability of Science Students in Optical Wave Courses. *Jurnal Pendidikan IPA Indonesia*, *6*(2), 341–345. https://doi.org/10.15294/jpii.v6i2.8184.

Palanisamy, S., & Nor, N. B. M. (2021). Effectiveness of Mayer's Problem Solving Model with Visual Representation Teaching Strategy in Enhancing Year Four Pupils' Mathematical Problem Solving Ability. *Malaysian Online Journal of Educational Sciences*, *9*(2), 41–52. http://ojie.um.edu.my/index.php/MOJES/article/view/29378.

Panjaitan, V., Bharata, H., & Gunowibowo, P. (2018). Efektivitas Model Discovery Learning Ditinjau dari Kemampuan Pemecahan. *Jurnal Pendidikan Matematika Universitas Lampung*, *6*(3), 163–174. http://jurnal.fkip.unila.ac.id/index.php/MTK/article/view/15227.

Patmaniar, A., M., S., & Sulaiman, R. (2021). Students' Growing Understanding in Solving Mathematics Problems Based on Gender: Elaborating Folding Back. *Journal on Mathematics Education*, *12*(3), 507–530. https://doi.org/10.22342/jme.12.3.14267.507-530.

Permatasari, D. R., Soegiyanto, H., & Usodo, B. (2019). The Use of Discovery Learning Model with RME Approach Viewed from Interpersonal Intelligence. *Journal of Education and Learning (EduLearn*, *13*(1), 87–92. https://doi.org/10.11591/edulearn.v13i1.8414.

Pratiwi, E., Nusantara, T., Susiwo, S., & Muksar, M. (2020). Textual and Contextual Commognitive Conflict Students in Solving An Improper Fraction. *Journal for the Education of Gifted Young Scientists*, *8*(2), 731–742. https://doi.org/10.17478/jegys.678528.

Purwaningsih, E., Sari, S. P., Sari, A. M., & Suryadi, A. (2020). The Effect Of Stem-Pjbl And Discovery Learning On Improving Students ' Problem-Solving Skills Of The Impulse And Momentum Topic. *Jurnal Pendidikan IPA Indonesia*, *9*(4), 465–476. https://doi.org/10.15294/jpii.v9i4.26432.

Putri, D. A., Gunowibowo, P., & Coesamin, M. (2017). Efektivitas Metode Discovery Learning Ditinjau dari Kemampuan Pemecahan Masalah Matematis Siswa. *Jurnal Pendidikan Matematika Universitas Lampung*, *5*(3), 1–13. http://jurnal.fkip.unila.ac.id/index.php/MTK/article/view/12457/0.

Rahmawati, D., Sajidan, A., Afandi, & Prasetyanti, N. M. (2019). The Implementation of Stim HOTs Model to Improve Student's Problem solving Skill of Metabolism Learning in Senior High School. *Journal of Physics: Conference Series*, *1241*(1), 1–9. https://doi.org/10.1088/1742-6596/1241/1/012045.

Ramadhani, M. H., Caswita, C., & Haenilah, E. Y. (2020). Efektivitas Model Problem Based Learning Bersasis Metakognitif Terhadap Kemampuan Berpikir Kritis Matematis. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *4*(2), 1064–1071. https://doi.org/10.31004/cendekia.v4i2.323.

Ramadhani, M. H., Kartono, K., & Haryani, S. (2023). Pengembangan Modul Pembelajaran Matematika

Kelas V Berbasis Discovery Learning untuk Memfasilitasi Kemampuan Pemecahan Masalah Matematis. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(3), 2726–2739. https://ojs.fkip.ummetro.ac.id/index.php/matematika/article/view/7574.

Ramadhani, M. H., Kartono, K., Haryani, S., Marwoto, P., & Mulyono, S. E. (2023). Analisis Kemampuan Pemecahan Masalah Matematis Siswa SD Negeri Ngijo 02 Gunungpati. *Jurnal Educatio FKIP UNMA*, *9*(1), 168–176. https://doi.org/10.31949/educatio.v9i1.4518.

Retnowati, E., Fathoni, Y., & Chen, O. (2018). Mathematics Problem Solving Skill Acquisition: Learning by Problem Posing or by Problem Solving? *Jurnal Cakrawala Pendidikan*, *37*(1), 1–10. https://doi.org/10.21831/cp.v37i1.18787.

Ritonga, S. (2021). The Implementation of STEM-Based Discovery Learning Model in Motion Systems Concept to Improve Learning Outcomes. *Asian Journal of Science Education*, *3*(2), 120–125. https://jurnal.usk.ac.id/AJSE/article/view/19724.

Safitri, F., Kartono, K., & Mastur, Z. (2021). Mathematics Problem Solving Skill Reviewed from Cognitive Style on Problem Based Learning with Aceh Custom Nuances with Descriptive Feedback. *Unnes Journal of Mathematics Education Research*, *10*(A), 1–7. https://journal.unnes.ac.id/sju/index.php/ujmer/article/view/37694.

Saja'ah, U. F. (2018). Analisis Kesulitan Siswa Kelas IV Sekolah Dasar dalam Menyelesaikan Soal Pemecahan Masalah. *Eduhumaniora: Jurnal Pendidikan Dasar*, *10*(2), 98–104. https://doi.org/10.17509/eh.v10i2.10866.

Sarkawi, M. R., & Permana, D. (2022). Efektivitas Penggunaan Modul Matematika yang Bernuansa Islami untuk Memfasilitasi Kemampuan Pemecahan Masalah Matematis. *JEMS: Jurnal Edukasi Matematika Dan Sains*, *10*(2), 164–172. http://e-journal.unipma.ac.id/index.php/JEMS/article/view/12268.

Savitri, E. N., Amalia, A. V, Prabowo, S. A., Rahmadani, O. E. P., & Kholidah, A. (2021). The Effectiveness of Real Science Mask with QR Code on Students' Problem-Solving Skills and Scientific Literacy. *Jurnal Pendidikan IPA Indonesia*, *10*(2), 209–219. https://doi.org/10.15294/jpii.v10i2.29918.

Saygılı, S. (2017). Examining The Problem Solving Skills and The Strategies Used by High School Students in Solving Non-routine Problems. *E-International Journal of Educational Research*, *8*(2), 91–114. http://www.e-ijer.com/en/download/article-file/338828.

Septiani, R. D., Djalil, A., & Coesamin, M. (2018). Efektivitas Model Pembelajaran Discovery Learning Ditinjau dari Kemampuan Pemecahan Masalah Matematis Siswa. *Jurnal Pendidikan Matematika Universitas Lampung*, *6*(1), 14–25. http://jurnal.fkip.unila.ac.id/index.php/MTK/article/view/14786/pdf.

Septiyan, I., Anriani, N., & Hendrayana, A. (2020). Perbandingan Model Discovery Learning dan Blended Learning Terhadap Kemampuan Pemecahan Masalah Matematis. *Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang*, *4*(2), 359–374. https://www.e-journal.ivet.ac.id/index.php/matematika/article/view/1019.

Serevina, V., & Luthfi, K. (2021). Development of Discovery Learning-Based on Online Learning Tools on Momentum and Impulse. *Journal of Physics: Conference Series*, *1876*(1), 1–9. https://doi.org/10.1088/1742-6596/1876/1/012076.

Simamora, R. E., Saragih, S., & Hasratuddin, H. (2018). Improving students' mathematical problem solving ability and self-efficacy through guided discovery learning in local culture context. *International Electronic Journal of Mathematics Education*, *14*(1), 61–72. https://doi.org/10.12973/iejme/3966.

Son, A. L., & Fatimah, S. (2020). Students' Mathematical Problem-Solving Ability Based on Teaching Models Intervention and Cognitive Style. *Journal on Mathematics Education*, *11*(2), 209–222. https://doi.org/10.22342/jme.11.2.10744.209-222.

Sudarsono, K., Mulyono, & Mariani, S. (2022). The Effect of STEM Model Based on Bima's Local Cultural on Problem Solving Ability. *International Journal of Instruction*, *15*(2), 83–96. https://doi.org/10.29333/iji.2022.1525a.

Sugiyono, H. (2016). Metode kualitatif dan kuantitatif. *Cetakan Ke-23. Alfabeta, Bandung*.

Sulistiyanti, I., Haryani, S., & Cahyono, E. (2021). Developing Problem Based Learning Module Containing Multiple Levels of Representation of Ksp Material to Improve Students' Problem Solving Ability. *International Journal of Active Learning*, *6*(1), 27–33. https://journal.unnes.ac.id/nju/index.php/ijal/article/view/28587.

Sulistyo, L., & Kartono. (2021). Guided Discovery Learning Model with The Teacher-Student Active Learning Approach, Assisted by The Whatsapp Solution Alternative Application on The COVID-19 Pandemic. *Journal of Physics: Conference Series*, *1918*(4), 1–4. https://doi.org/10.1088/1742-6596/1918/4/042052.

Sun, Y., Chang, C.-H., & Chiang, F.-K. (2022). When Life Science Meets Educational Robotics. *Educational Technology & Society*, *25*(1), 166–178. https://www.jstor.org/stable/48647038.

Surya, E., Putri, F. A., & Mukhtar. (2017). Improving Mathematical Problem-Solving Ability And Self-Confidence Of High School Students Through Contextual Learning Model. *Journal on Mathematics Education*, *8*(1), 85–94. https://eric.ed.gov/?id=EJ1173627.

Suseelan, M., Chew, C. M., & Chin, H. (2022). Research on Mathematics Problem Solving in Elementary Education Conducted from 1969 to 2021: A Bibliometric Review. *International Journal of Education in Mathematics, Science and Technology*, *10*(4), 1003–1029. https://doi.org/10.46328/ijemst.2198.

Sutama, S., Fuadi, D., Narimo, S., Hafida, S. H. N., Novitasari, M., Anif, S., Prayitno, H. J., Sunanih, S., & Adnan, M. (2022). Collaborative Mathematics Learning Management: Critical Thinking Skills in Problem Solving. *International Journal of Evaluation and Research in Education*, *11*(3), 1015–1027. https://doi.org/10.11591/ijere.v11i3.22193.

Tampubolon, P. T. (2016). Penerapan Model Pembelajaran Matematika Realistik Indonesia Untuk Meningkatkan Aktivitas Dan Hasil Belajar Siswa Kelas IV SD. *Jurnal Pendidikan Guru Sekolah Dasar*, *1*(1), 190–198. https://ejournal.upi.edu/index.php/jpgsd/article/view/9072.

Usman, M., Degeng, I. N. S., Utaya, S., & Kuswandi, D. (2022). The Influence of JIGSAW Learning Model and Discovery Learning on Learning Discipline and Learning Outcomes. *Pegem Journal of Education and Instruction*, *12*(2), 166–178. https://doi.org/10.47750/pegegog.12.02.17.

Wahyuni, S., Indrawati, I., Sudarti, S., & Suana, W. (2017). Developing Science Process Skills and Problemsolving Abilities Based on Outdoor Learning in Junior High School. *Jurnal Pendidikan IPA Indonesia*, *6*(1), 158–162. https://doi.org/10.15294/jpii.v6i1.6849.

Wahyuni, S., Yati, M., & Fadila, A. (2020). Pengembangan Modul Matematika Berbasis REACT terhadap Kemampuan Komunikasi Matematis Peserta Didik. *Jambura Journal of Mathematics Education*, *1*(1), 1–12. https://doi.org/10.34312/jmathedu.v1i1.4542.

Wicaksono, A. G. C., & Korom, E. (2022). Review of Problem-Solving Measurement: An Assessment Developed in The Indonesian Context. *Participatory Educational Research*, *9*(1), 116–136. https://doi.org/10.17275/per.22.7.9.1.

Winarti, E. R., Waluya, S. B., Rochmad, & Kartono. (2019). The Impact of Problem Based Learning Using Performance Assessment on Student's Mathematical Problem Solving Ability. *Journal of Physics: Conference Series*, *1321*(3), 1–4. https://doi.org/10.1088/1742-6596/1321/3/032090.

Yapatang, L., & Polyiem, T. (2022). Development of the Mathematical Problem-Solving Ability Using Applied Cooperative Learning and Polya's Problem-Solving Process for Grade 9 Students. *Journal of Education and Learning*, *11*(3), 40–46. https://doi.org/10.5539/jel.v11n3p40.

ŽivkoviĿ·, S. (2016). A Model of Critical Thinking as an Important Attribute for Success in the 21st Century. Procedia. *Social and Behavioral Sciences*, *232*, 102–108. https://doi.org/10.1016/j.sbspro.2016.10.034.