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The Effect Of Applying The Constructivism Approach To Concept Understanding And Mathematical Problem Solving Ability Of Class VIII Mtsn IV Angkat Candung Students

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Abstract – This study aims to determine the effect of applying the constructivism approach to concept understanding and mathematical problem solving ability when viewed from the initial ability of students. This type of research is a quasy experiment with a randomized posttest only control group design. The study population were students of class VIII MTsN IV Angkat Candung. The samples in this study were taken randomly, namely students of class VIII.4 as an experimental class and class VIII.5 as a control class. The instruments used are tests of concept understanding and mathematical problem solving ability. Data were analyzed with the t-test and the Mann-Whitney U test. The results showed that (1) Concept understanding and mathematical problem solving ability of students who follow constructivism-based learning are better than students' concept understanding and mathematical problem solving ability in conventional learning, (2) Concept understanding and mathematical problem solving ability of students with high initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with high initial ability in conventional learning, (3) Concept understanding and mathematical problem solving ability of students with moderate initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with moderate initial ability in conventional learning, and (4) Concept understanding and mathematical problem solving ability of students with low initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with low initial ability in conventional learning.

Keywords – constructivism approach; concept understanding; mathematical problem solving ability; initial ability

I. INTRODUCTION

Mathematics as one of the basic sciences in the world of education has an important role in efforts to master science and technology [1]. Strong mastery of mathematics from an early age is indispensable for mastering and creating technology in the future [2]. The government has always placed mathematics as one of the subjects that must be studied from elementary school to college level.

Learning mathematics at all levels of education has very clear goals [3]. These objectives are stated in the Regulation of the Minister of Education and Culture of the Republic of Indonesia No. 58 of 2014, namely (1) concept understanding, is competence in explaining the relationship between concepts and applying concepts and algorithms flexibly, accurately, efficiently and precisely in problem solving, (2) using patterns as guesses in solving problems and being able to make generalizations based on existing data, (3) using reasoning on properties, performing mathematical manipulations both in simplification, and analyzing components present in problem solving in mathematical contexts and outside of mathematics, (4) communicate ideas, reasoning, and be able to compile mathematical evidence using symbols, tables, or diagrams, (5) have curiosity, attention and interest in studying mathematics as well as a tenacious and confident attitude in problem solving, (6) have attitudes and behaviors that are in accordance with the values in mathematics and learning, such as obeying principles, being consistent, upholding agreements, tolerance, respect the opinions of others, polite, creative, cooperative, honest and conscientious, (7) carry out motor activities that use mathematical knowledge, and (8) use simple props and technology to carry out mathematical activities [2].

Concept understanding and mathematical problem solving ability are very necessary as a foundation in solving mathematical problems, because when students are faced with problems that require an understanding of concepts, the student can directly solve the problem with the concepts that already exist in him [3], [4]. However, in reality the results of learning mathematics have not been in line with expectations, as in Table I below.

TABLE I. AVERAGE MATHEMATICS SCORES OF CLASS VIII MTSN IV ANGKAT CANDUNG STUDENTS

Class	**Number of Students**	**Average Mathematics Scores**
VIII.1	35	54.28
VIII.2	36	50.56
VIII.3	35	65.62
VIII.4	36	57.42
VIII.5	33	55.70

Based on Table I, it can be seen that students' mastery of understanding concepts and mathematical problem solving is not optimal. The questions given in the first semester exam include 67.5% of the questions testing concept understanding, 17.5% of the questions testing problem solving, and the rest testing other mathematical ability. Test results of concept understanding and mathematical problem solving ability can be seen in Table II.

TABLE II. TEST RESULTS OF CONCEPT UNDERSTANDING AND MATHEMATICAL PROBLEM SOLVING ABILITY OF CLASS VIII MTSN IV ANGKAT CANDUNG STUDENTS

Class	**Number of Students**	**Average Test Results**	
		Concept Understanding	**Problem Solving Ability**
Experiment	36	9.39	
Control	33		
Ideal Score		**24**	

Based on Table II, the average test of concept understanding and mathematical problem solving ability of students is 9.39 which still needs to be improved. So far, the teacher starts learning by explaining the material, giving examples of questions and exercises, then the practice questions are discussed together. As a results, knowledge gained by students will not last long and in developing mathematical ideas, students will be less than optimal [5]. Efforts to renew the world of education are not only the responsibility of the government, teachers as implementers of learning also play a big role in advancing education. The most dominant role of the teacher is the responsibility of the teacher in the learning process to stimulate and motivate students, providing experiences to cultivate understanding, diagnose and overcome student difficulties.

One approach that can be applied to improve students' concept understanding and mathematical problem solving ability is the constructivism approach [6], [7]. The constructivism approach is a process of knowledge formation [8], [9], [10]. This formation is carried out by students, they must actively carry out activities, actively think, compile concepts and give meaning about the things being studied [11]. Silva [12] suggests that there are several abilities needed in the process of constructing knowledge, namely (1) the ability to remember and re-express experiences, (2) the ability to compare and make decisions about similarities and differences, and (3) the ability to prefer one experience over another.

The constructivism approach places students in the main role in the learning process and the teacher plays the role of facilitator in learning [13]. The principles of the constructivism approach according to Siregar [14] include (1) students are not seen as passive, but have goals and can respond to learning situations, (2) learning to consider as optimally as possible the process of student involvement in constructing knowledge, (3) knowledge is not something that comes from outside but optimal construction, (4) learning is not the transmission of knowledge, but involves knowledge of class situations, and (5) the curriculum is not just learned, but a set of learning, materials, and resources.

In its implementation, constructivism-based learning consists of several stages, namely (1) invitation, necessary to identify the initial conception of students before learning is carried out, (2) exploration, the stage of implementing learning by involving students actively exploring new information, (3) submission of explanations and solutions, the stage of discussion carried out by students, both individually and in groups, and (4) taking action, namely the final stage of learning. The results of previous studies have shown that the use of constructivism approaches in mathematics learning has a positive effect on concept understanding and interest in learning [15], [16], problem solving ability [14], [17], mathematical communication [6], [18], and student confidence [19].

One of the properties of mathematics is systematic, where to learn a new concept in mathematics requires mastery of material in previous learning [20]. The students' mathematical knowledge before receiving this new material is what is said to be the initial ability [21]. To develop concept understanding and mathematical problem solving ability, it is necessary to pay attention to students' initial ability [15], [22]. This is useful to know the extent to which students already know the material to be given, so that teachers can design learning better [23]. Thus the constructivism approach is expected to be one of the alternatives to improve students' concept understanding and mathematical problem solving ability.

II. Methods

This type of research is quasy exsperiment with randomized posttest only control group design. This design is used for each class with regard to the initial ability of the students, as shown in Table III.

TABLE III. RESEARCH DESIGN

	Constructivism Learning (B_1)	Conventional Learning (B_2)
High Initial Ability (A_1)	A_1B_1	A_1B_2
Moderate Initial Ability (A_2)	A_2B_1	A_2B_2
Low Initial Ability (A_3)	A_3B_1	A_3B_2

Information:

A_1B_1 : Concept understanding and mathematical problem solving ability of students with high initial ability who follow constructivism-based learning.

A_1B_2 : Concept understanding and mathematical problem solving ability of students with high initial ability who follow conventional learning.

A_2B_1 : Concept understanding and mathematical problem solving ability of students with moderate initial ability who follow constructivism-based learning.

A_2B_2 : Concept understanding and mathematical problem solving ability of students with moderate initial ability who follow conventional learning.

A_3B_1 : Concept understanding and mathematical problem solving ability of students with low initial ability who follow constructivism-based learning.

A_3B_2 : Concept understanding and mathematical problem solving ability of students with low initial ability who follow conventional learning.

The study population were students of class VIII MTsN IV Angkat Candung. The samples in this study were taken randomly, namely students of class VIII.4 as an experimental class and class VIII.5 as a control class. The instruments used are tests of concept understanding and mathematical problem solving ability. Data on students' concept understanding and mathematical problem solving ability that are normally distributed and homogeneous will be analyzed by t-test. On the other hand, if the student's concept understanding and mathematical problem solving ability data are not normally distributed, then the Mann-Whitney U test is continued so that there is no need for a homogeneity test.

III. Results And Discussion

3.1. Data Description

3.1.1. Concept Understanding Test Results

The results of the concept understanding test obtained are described according to the number of students, average, standard deviation, highest and lowest scores. A description of the data can be seen in Table IV.

TABLE IV. DISTRIBUTION OF CONCEPT UNDERSTANDING TEST RESULTS OF EXPERIMENTAL CLASS AND CONTROL CLASS STUDENTS

Class	Initial Ability	N	$\bar{x}$	s	X_{Max}	X_{Min}
Experiment	High	5	18.00	2.24	21	15
	Moderate	24	17.75	1.88	21	15
	Low	7	17.86	1.81	20	10
	Total	36	17.75	1.74	21	15
Control	High	7	12.57	2.57	16	9
	Moderate	24	11.52	2.08	15	9
	Low	5	11.40	3.78	15	7
	Total	33	11.52	2.77	16	6

Based on Table IV, it can be seen that the average concept understanding of experimental class students is higher than the average concept understanding of control class students. The standard deviation of the concept understanding of the experimental class students is smaller than the control class. It shows that the understanding of the concept of control class students is more diffuse compared to experimental class students.

For students with high initial ability, the average concept understanding of the experimental class students is higher than the control class. The maximum and minimum scores of the experimental class students' concept understanding are higher than the maximum and minimum scores in the control class. The understanding of the concept of students with high initial ability in the control class is more diffuse than the experimental class, because the standard deviation of the control class is higher than the experimental class.

For students with moderate initial ability, the average concept understanding of experimental class students is higher than the control class. The maximum and minimum scores of the concept understanding of the experimental class students are higher than the control class. Based on standard deviations, students' concept understanding of moderate initial ability in the control class is more diffuse compared to the experimental class.

Furthermore, for students with low initial ability, the average concept understanding of the experimental class students is higher than the control class. The maximum and minimum scores of the concept understanding of the experimental class students are higher than the control class. The concept understanding of students with low initial ability in the control class is more diffuse compared to the experimental class.

3.1.2. Mathematical Problem Solving Ability Test Results

The results of the mathematical problem solving ability test obtained are described according to the number of students, average, standard deviation, highest and lowest scores. A description of the data can be seen in Table V.

TABLE V. DISTRIBUTION OF MATHEMATICAL PROBLEM SOLVING ABILITY TEST RESULTS OF EXPERIMENTAL CLASS AND CONTROL CLASS STUDENTS

Class	**Initial Ability**	**N**	$\bar{x}$	s	X_{Max}	X_{Min}
Experiment	High	5	9.20	1.92	12	7
	Moderate	24	8.75	1.57	12	6
	Low	7	7.71	0.76	9	7
	Total	36	8.64	1.57	12	6
Control	High	7	6.00	1.63	9	4
	Moderate	24	4.48	1.63	8	2
	Low	5	3.20	0.84	4	2
	Total	33	4.67	1.74	9	2

Based on Table V, it can be seen that the average mathematical problem solving ability of experimental class students is higher than the average mathematical problem solving ability of control class students. The standard deviation of the mathematical problem solving ability of the experimental class students is smaller than the control class. It means that the mathematical problem solving ability of control class students is more diffuse compared to experimental classes.

For students with high initial ability, the average mathematical problem solving ability of experimental class students is higher than the control class. The maximum and minimum scores of mathematical problem solving ability of experimental class students are higher than the maximum and minimum scores in the control class. The mathematical problem solving ability of students with high initial ability in the experimental class is more diffuse than the control class, because the standard deviation of the experimental class is higher than the control class.

For students with moderate initial ability, the average mathematical problem solving ability of experimental class students is higher than the control class. The maximum and minimum scores of mathematical problem solving ability of experimental class students are higher than the control class. Based on standard deviation, the mathematical problem solving ability of students with moderate initial ability in the control class is more diffuse compared to the experimental class.

Furthermore, for students with low initial ability, the average mathematical problem solving ability of the experimental class students is higher than the control class. The maximum and minimum scores of mathematical problem solving ability of experimental class students are higher than the control class. The mathematical problem solving ability of students with low initial ability in the control class is more diffuse compared to the experimental class.

3.2. Testing Analysis Requirements

3.2.1. Normality Test

The results of the normality test of concept understanding data of experimental class and control class students can be seen in Table VI.

TABLE VI. THE RESULTS OF THE NORMALITY TEST OF CONCEPT UNDERSTANDING DATA OF EXPERIMENTAL CLASS AND CONTROL CLASS STUDENTS

Class	**Initial Ability**	**Sig**	**Information**
Experiment	High	1.000	Normal
	Moderate	0.690	Normal
	Low	0.873	Normal
	Total	0.059	Normal
Control	High	0.366	Normal
	Moderate	0.025	Abnormal
	Low	0.222	Normal

	Total	0.086	Normal

Based on Table VI, sig values = 0.059 > 0.05 for the experimental class and sig values = 0.086 > 0.05 for the control class were obtained. It means that the concept comprehension data of experimental class students and control classes are normally distributed. When viewed from the high initial ability, a sig value = 1,000 > 0.05 was obtained for the experiment class and a sig value = 0.366 > 0.05 for the control class. It shows that the concept understanding data of students with high initial ability in the experimental class and the control class are normally distributed. At the initial ability being obtained sig values = 0.690 > 0.05 for the experimental class and sig values = 0.025 < 0.05 for the control class. Only the concept understanding data of students with moderate initial ability in the experimental class are normally distributed. While at low initial ability obtained sig values = 0.873 > 0.05 for experimental classes and sig values = 0.222 > 0.05 for control classes. That is, the concept understanding data of students with low initial ability in experimental classes and normally distributed control classes.

The results of the normality test of mathematical problem solving ability data of experimental class and control class students can also be seen in Table VII.

TABLE VII. THE RESULTS OF THE NORMALITY TEST OF MATHEMATICAL PROBLEM SOLVING ABILITY DATA OF EXPERIMENTAL CLASS AND CONTROL CLASS STUDENTS

Class	Initial Ability	Sig	Information
Experiment	High	0.928	Normal
	Moderate	0.297	Normal
	Low	0.086	Normal
	Total	0.055	Normal
Control	High	0.573	Normal
	Moderate	0.018	Abnormal
	Low	0.314	Normal
	Total	0.030	Abnormal

Based on Table VII, sig values = 0.055 > 0.05 for the experimental class and sig values = 0.030 < 0.05 for the control class were obtained. Only the mathematical problem solving ability data of the experimental class students are normally distributed. When viewed from the high initial ability, a sig value = 0.928 > 0.05 for the experiment class and a sig value = 0.573 > 0.05 for the control class were obtained. It shows that the mathematical problem solving ability data of students with high initial ability in experimental classes and control classes are normally distributed. At the initial ability is being obtained sig value = 0.297 > 0.05 for the experimental class and sig value = 0.018 < 0.05 for the control class. Only the mathematical problem solving ability data of students with moderate initial ability in the experimental class are normally distributed. While at low initial ability obtained sig value = 0.086 > 0.05 for experimental class and sig value = 0.314 > 0.05 for control class. That is, the mathematical problem solving ability data of students with low initial ability in the experimental class and control class are normally distributed.

3.2.2. Homogeneity Test

The results of the homogeneity test of concept understanding data of students with high and low initial ability in the experimental class and control class can be seen in Table VIII.

TABLE VIII. THE RESULTS OF THE HOMOGENEITY TEST OF STUDENTS' CONCEPT UNDERSTANDING DATA

No	Test Results	Sig	Information
1	Overall (Experiment and Control)	0.398	Homogeneous
2	High Initial Ability (Experiment and Control)	0.289	Homogeneous

3	Low Initial Ability (Experiment and Control)	0.653	Homogeneous

Based on Table VIII, sig values = 0.398 > 0.05 were obtained for the experimental class and the control class. It means that the concept understanding data of experimental class and control class students have homogeneous variance. Concept understanding of students with high initial ability in experimental and control classes showed a score of 0.289 > 0.05. That is, the concept understanding data of students with high initial ability in the experimental and control classes have homogeneous variance. Likewise, concept understanding of students with low initial ability, a sig score = 0.653 > 0.05 was obtained. It shows that the concept understanding data of students with low initial ability have homogeneous variance.

The results of the homogeneity test of mathematical problem solving ability data of students with high and low initial ability in experimental and control classes are outlined in Table IX.

TABLE IX. THE RESULTS OF THE HOMOGENEITY TEST OF STUDENTS' MATHEMATICAL PROBLEM SOLVING ABILITY DATA

No	Test Results	Sig	Information
1	High Initial Ability (Experiment and Control)	0.643	Homogeneous
2	Low Initial Ability (Experiment and Control)	0.578	Homogeneous

Based on Table IX, it can be seen that the mathematical problem solving ability of students with high initial ability in the experimental and control classes showed a value of 0.643 > 0.05. That is, the mathematical problem solving ability data of students with high initial ability in the experimental and control classes have homogeneous variance. Likewise, the mathematical problem solving ability of students with low initial ability obtained a sig value = 0.578 > 0.05. It shows that the mathematical problem solving ability data of students with low initial ability have homogeneous variance.

3.3. Hypothesis Test

Based on the results of the normality and homogeneity test, it is known that the students' concept understanding and mathematical problem solving ability data are normally distributed and have homogeneous variance. So the hypothesis test is continued with the t-test. Meanwhile, concept understanding and mathematical problem solving ability data are not normally distributed then continued with the Mann-Whitney U test so that there is no need for a homogeneity test.

3.3.1. First Hypothesis

This hypothesis test is carried out to find out whether students' concept understanding and mathematical problem solving ability who follow constructivism-based learning are better than students' concept understanding and mathematical problem solving ability in conventional learning. This hypothesis testing was performed with a t-test for normally distributed and variance data and a Mann-Whitney U test for data not normally distributed. The results of the calculation of the first hypothesis test showed that the value of sig = 0.000 < 0.05 was H_0 rejected. In other words, concept understanding and mathematical problem solving ability of students who follow constructivism-based learning are better than students' concept understanding and mathematical problem solving ability in conventional learning.

The results of this study are in accordance with Silva's findings [12] that student learning outcomes increase after participating in constructivism-based learning assisted by android-based e-book media. This is because constructivism-based learning provides more opportunities for students to discuss finding their own concepts, understanding and doing the questions given [24]. Supardi [13] states that the knowledge gained through discovery from the results of cooperation will be more permanent value in the understanding of each student. Jatisunda [17] and Yuni [25] found that constructivism-based learning makes students more active in learning and faster in doing practice questions. So that students' mathematical problem solving ability increases. This statement is supported by Hidayati's [26] opinion that in the constructivism approach, the role of a teacher is not to give the final answer to students' questions but rather to direct them to form mathematical knowledge.

While in conventional learning, the teacher directly explains the subject matter, gives examples of questions and then students do the questions in LKS in groups based on their seating position. During learning, it can be seen that students are still embarrassed to ask their groupmates, they are more likely to do the questions individually. Even if they want to ask, they will directly ask the teacher.

3.3.2. Second Hypothesis

This hypothesis test is carried out to find out whether the concept understanding and mathematical problem solving ability of students with high initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with high initial ability in conventional learning. This hypothesis testing is carried out with a t-test because the data are normally distributed and have homogeneous variance. Based on the calculation results of the second hypothesis test, the value of sig = $0.039 < 0.05$ for concept understanding data was obtained and the value of sig = $0.019 < 0.05$ for mathematical problem solving ability data was H_0 rejected. So it can be concluded that the concept understanding and mathematical problem solving ability of students with high initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with high initial ability in conventional learning.

This result is because in constructivism-based learning, students with high initial ability will become tutors for their other friends in understanding the material so that the knowledge they have is more closely related to their memory. This is in accordance with the opinion of Rumapea [22] which states that students with high initial ability can improve their academic abilities because they provide services as tutors to peers who need deeper thinking about the relationship of ideas contained in certain materials. Dhani [18] asserts that it will be easier for a person to learn something if the learning is based on what the person already knows. The learning experience that students gain to solve problems in their groups makes students with high initial abilities more skilled and creative. By answering questions at LKS and presenting group work, they are trained to think critically and come up with ideas in solving problems. It is supported by Sari's opinion [27] that in discussions cooperation between group members is needed to achieve maximum learning outcomes. Nurhusain [28] stated that group discussions are very useful for students in improving mathematics learning outcomes.

Unlike the experimental class, in the control class students with high initial ability the opportunity to solve problems in collaboration with their friends is very limited because learning is dominated by teachers. This statement is supported by the opinion of Jatisunda [17] that conventional learning tends to make students slower in solving problems.

3.3.3. Third Hypothesis

This hypothesis test is carried out to find out whether the concept understanding and mathematical problem solving ability of students with moderate initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with moderate initial ability in conventional learning. This hypothesis testing was carried out with the Mann-Whitney U test because the data were not normally distributed. The calculation results of the third hypothesis test showed that the sig value = $0.000 < 0.05$ was H_0 rejected. That is, concept understanding and mathematical problem solving ability of students with moderate initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with moderate initial ability in conventional learning.

Through constructivism-based learning, students with moderate initial ability are more motivated in learning. Those who are a little more understanding can help their friends from a low initial ability in understanding the material and solving problems. If there is anything they don't understand, they can ask friends with high initial ability. Hidayati [26] revealed that early knowledge plays an important role in any information processing. As Siregar [14] argues that in one's mind there is an initial knowledge structure called schemata, which acts as a filter and facilitator for new ideas and experiences. Schemata serves to organize, coordinate and intensify basic principles. Schemata can be developed and changed by the process of assimilation and accommodation through contact with new experiences, if the new experience still corresponds to the schemata that a person has, then the schemata is developed through the process of assimilation. Likewise, if the new experience is different from the existing experience, so the old schemata is no longer suitable for dealing with new experiences. The old schemata was changed until there was another balance.

In conventional learning, students with moderate initial ability have limited opportunities to understand concepts and their mathematical problem solving ability are no better. This is because they learn on their own so that their confidence level does not grow and their interest in learning mathematics is also lacking.

3.3.4. Fourth Hypothesis

This hypothesis test is carried out to find out whether the concept understanding and mathematical problem solving ability of students with low initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with low initial ability in conventional learning. This hypothesis testing is carried out with t-test because the data are normally distributed and have homogeneous variance. Based on the calculation results of the fourth hypothesis test, the value of sig = 0.001 < 0.05 for concept understanding data and sig value = 0.000 < 0.05 for mathematical problem-solving ability data was H_0 rejected. Thus, the concept understanding and mathematical problem solving ability of students with low initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with low initial ability in conventional learning.

This is because students with low initial ability become confident and interested in learning mathematics [29]. They can ask questions with their friends who have high and moderate initial ability so that good relations are established between group members [19]. In accordance with the findings of Suryani [20] that students with low initial ability are more enthusiastic when discussing solving a problem. By paying attention to the maximum academic ability of students, group discussions in constructivism-based learning will run optimally and have a positive impact on student learning outcomes [30].

IV. CONCLUSIONS

Based on the results of the study, several conclusions were obtained, namely:

1. Concept understanding and mathematical problem solving ability of students who follow constructivism-based learning are better than students' concept understanding and mathematical problem solving ability in conventional learning.
2. Concept understanding and mathematical problem solving ability of students with high initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with high initial ability in conventional learning.
3. Concept understanding and mathematical problem solving ability of students with moderate initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with moderate initial ability in conventional learning.
4. Concept understanding and mathematical problem solving ability of students with low initial ability who follow constructivism-based learning are better than the concept understanding and mathematical problem solving ability of students with low initial ability in conventional learning.

REFERENCES

[1] S. H. Nasution, "Pentingnya Literasi Teknologi Bagi Mahasiswa Calon Guru Matematika", Jurnal Kajian Pembelajaran Matematika, 2(1), pp. 14-18, 2018.

[2] N. A. Rusyda and D. S. Sari, "Pengaruh Penerapan Model Contextual Teaching and Learning Terhadap Kemampuan Pemahaman Konsep Matematis Siswa SMP pada Materi Garis dan Sudut", Jurnal Nasional Pendidikan Matematika, 1(1), pp. 150-162, 2017.

[3] L. Khofifah, N. Supriadi, and M. Syazali, "Model Flipped Classroom dan Discovery Learning terhadap Kemampuan Pemahaman Konsep dan Pemecahan Masalah Matematis", PRISMA, 10(1), pp. 17-29, 2021.

[4] Suraji, Maimunah, and S. Saragih, "Analisis Kemampuan Pemahaman Konsep Matematis dan Kemampuan Pemecahan Masalah Matematis Siswa SMP pada Materi Sistem Persamaan Linear Dua Variabel (SPLDV)", Suska Journal of Mathematics Education, 4(1), pp. 9-16, 2018.

[5] S. Wahyuningsih, "Pembelajaran Berbasis Konstruktivisme untuk Meningkatkan Aktivitas dan Prestasi Belajar Siswa pada Materi Pokok Himpunan", Jurnal Pendidikan dan Pembelajaran Indonesia, 1(1), pp. 10-21, 2021.

[6] A. A. Yati, J. Marzal, and Yantoro, "Pengaruh Pendekatan Pembelajaran Konstruktivisme dan Self-efficacy Siswa terhadap Kemampuan Komunikasi Matematis Siswa", Jurnal Didaktik Matematika, 5(2), pp. 20-29, 2018.

[7] P. Hendikawati, K. Wijayanti, Sunarmi, R. B. Veronika, and S. B. Waluya, "Pelatihan Pembelajaran Matematika Kreatif dengan Pendekatan Konstruktivisme bagi Guru-Guru Sekolah Dasar YPII", Jurnal Pengabdian kepada Masyarakat, 23(1), pp. 1-7, 2019.

[8] G. Bozkurt, "Social Constructivism: Does it Succeed in Reconciling Individual Cognition with Social Teaching and Learning Practices in Mathematics?", Journal of Education and Practice, 8(3), pp. 210-218, 2017.

[9] C. Kosnik, L. Menna, P. Dharamshi, and C. Beck, "Constructivism as a Framework for Literacy Teacher Education Courses: The Cases of Six Literacy Teacher Educators", European Journal of Teacher Education, pp. 1-15, 2017.

[10] Suparlan, "Teori Konstruktivisme dalam Pembelajaran", Islamika: Jurnal Keislaman dan Ilmu Pendidikan, 1(2), pp. 79-88, 2019.

[11] C. Tan, "Constructivism and Pedagogical Reform in China: Issues and Challenges", Globalization, Societies and Education, 15(2), pp. 238-247, 2016.

[12] I. P. Silva, D. Purnomo, and M. S. Zuhri, "Efektivitas Pendekatan Konstruktivisme Berbantu Media E-Book Berbasis Android terhadap Hasil Belajar Ditinjau dari Gaya Belajar pada Siswa Kelas X di SMKN 11 Semarang", Imajiner: Jurnal Matematika dan Pendidikan Matematika, 1(6), pp. 310-316, 2019.

[13] A. A. Supardi, Y. Gusmania, and F. Amelia, "Pengembangan Modul Pembelajaran Matematika Berbasis Pendekatan Konstruktivisme pada Materi Logaritma", Aksioma: Jurnal Matematika dan Pendidikan Matematika, 10(1), pp. 80-92, 2019.

[14] A. M. Siregar, "Efektifitas Pendekatan Konstruktivisme Terhadap Kemampuan Pemecahan Masalah Matematis Siswa di SMP Negeri 5 Sipirok", Mathematic Education Journal, 1(3), pp. 1-10, 2018.

[15] N. Cintang and A. M. Nurkhasanah, "Peningkatan Pemahaman Konsep Bangun Datar Melalui Pendekatan Konstruktivisme Berbasis Teori Van Hiele", Jurnal Pendidikan Dasar dan Pembelajaran, 7(1), pp. 1-8, 2017.

[16] N. Ulya, A. Aziz, and L. D. Pratama, "Pengaruh Penggunaan Program CABRI 3D dengan Pendekatan Konstruktivisme Terhadap Pemahaman Konsep dan Minat Belajar Siswa", Jurnal Pendidikan dan Konseling, 4(4), pp. 413-417, 2022.

[17] M. G. Jatisunda, "Pengaruh Pendekatan Konstruktivisme terhadap Pemecahan Masalah Matematis Peserta Didik (Studi Quasi Eksperimen terhadap Peserta Didik Kelas VIII SMP Negeri 1 Talaga Tahun Pelajaran 2015/2016)", Jurnal THEOREMS, 2(1), pp. 57-66, 2017.

[18] M. I. Dhani, T. A. Aziz, and L. E. Hakim, "Pembelajaran Matematika Melalui Pendekatan Konstruktivisme", Jurnal Pendidikan MIPA, 12(4), pp. 1236-1241, 2022.

[19] A. Mutiarawati, "Pengaruh Pendekatan Konstruktivisme Terhadap Karakter Kepercayaan Diri Siswa dalam Pembelajaran Matematika di SMPN 15 Kota Bekasi", Jurnal Pendidikan MIPA, 9(2), pp. 116-122, 2019.

[20] M. Suryani, L. H. Jufri, and T. A. Putri, "Analisis Kemampuan Pemecahan Masalah Siswa Berdasarkan Kemampuan Awal Matematika", Mosharafa: Jurnal Pendidikan Matematika, 9(1), pp. 119-130, 2020.

[21] M. Fitriadi, Marzuki, and T. Sabri, "Pengaruh Pendekatan Konstruktivisme Terhadap Perolehan Belajar Tematik Peserta Didik Kelas IV Sekolah Dasar", Jurnal Pendidikan dan Pembelajaran Khatulistiwa, 7(9), pp. 1-8, 2018.

[22] R. Rumapea, "Pengaruh Model Pembelajaran Kooperatif Tipe STAD dan Pemberian Soal Open-ended Terhadap Kemampuan Pemecahan Masalah Matematis Siswa Ditinjau dari Kemampuan Awal Matematika", Journal Pendidikan Matematika, 12(1), pp. 1-14, 2018.

[23] L. Astriani, "Pengaruh Pembelajaran Reciprocal Teaching Terhadap Kemampuan Pemahaman Konsep Matematika Ditinjau dari Kemampuan Awal Matematika Siswa", Fibonacci: Jurnal Pendidikan Matematika dan Matematika, 3(1), pp. 77-85, 2017.

[24] D. Sarah, Risnawati, and Z. Amir MZ, "Pengembangan Modul Berbasis Pendekatan Konstruktivisme untuk Memfasilitasi Pemahaman Konsep Matematis Siswa Sekolah Menengah Atas di Pekanbaru", Juring: Journal for Research in Mathematics Learning, 1(3), pp. 199-206, 2018.

[25] U. W. Yuni, E. Z. Djamaan, E. Musdi, and Suherman, "Pengembangan Perangkat Pembelajaran Berbasis Pendekatan Konstruktivisme Berupa e-Modul untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Peserta Didik", Vox Edukasi: Jurnal Ilmiah Ilmu Pendidikan, 13(2), pp. 209-218, 2022.

[26] F. Hidayati, I. M. Arnawa, and S. Bahri, "Development of Constructivism-Based Mathematics Learning Tools for Eleventh Graders", Journal of Physics: Conference Series, 1742(1), pp. 1-6, 2021.

[27] A. N. Sari, Subanji, and Sisworo, "Analisis Interaksi Siswa pada Aktivitas Diskusi Kelompok dalam Pembelajaran Matematika Secara Daring", Jurnal Cendekia: Jurnal Pendidikan Matematika, 5(3), pp. 2636-2651, 2021.

[28] M. Nurhusain and M. Hasby, "Komunikasi Matematis Siswa SMP: Studi Membangun Diskusi Kelompok yang Efektif Melalui Strategi Student Team Heroic Leadership", Kognitif: Jurnal Riset HOTS Pendidikan Matematika, 1(1), pp. 53-65, 2021.

[29] A. Asmar and H. Delyana, "Improved Problem Solving Skills Slow Learner Students in Elementary School Through the Use of Constructivism Learning Model", Aksioma: Jurnal Program Studi Pendidikan Matematika, 11(2), pp. 1411-1422, 2022.

[30] B. Erdal, B. Mehmet, and D. Bülent, "The Reasons for Gaining and Losing the Popularity of a Paradigm in Constructivism: Why? and How?", Psycho-Educational Research Reviews, 10(1), pp. 8-24, 2021.