International Journal of Religion
2024
Volume: 5| Number 12 | pp. 1379 – 1386
ISSN: 2633-352X (Print) | ISSN: 2633-3538 (Online)
ijor.co.uk
DOI: https://doi.org/10.61707/86g8gz14

Examining The Impact Of Problem-Based Learning On Students' Problem Solving Ability And Self-Efficacy

Rohantizani[1], Nuraina[2], Jaza Anil Husna Pasaribu[3], Fatimah[4]

Abstract

With effective problem-solving techniques and a strong sense of mathematical self-efficacy, students may effectively navigate challenges on a regular basis. This ability can be enhanced by using a problem-based learning integrated in classroom. Using an integrated problem-based learning in classroom can help students increase the capacity. This study was aimed to investigate the application of Problem-Based Learning (PBL) in improving students' problem-solving ability and mathematical self-efficacy. It was conducted at Sekolah Menengah Pertama Negeri 5 (State Junior High School), Lhokseumawe, involving students of class VIII as the research population. The students of class VIII 1 and VIII-5 were selected through purposive sampling technique a sample to be respectively assigned as an experimental and control group. The emerging data as a result to the treatment were analyzed quantitatively with two-way ANOVA using SPSS software. These findings indicated that the PBL increased students' mathematical ability more than conventional learning did in control group. At the same time, the ability of students' mathematical self-efficacy from PBL experimented-group showed no greater differences from those of control group.

Keywords: *Problem Solving Ability, Self Efficacy, Problem Based Learning Model*

INTRODUCTION

The problem solving ability is important in learning mathematics at school since it is thought as a means of increasing students' logical, critical, analytical, and creative reasoning. [5] states that the solving ability helps students in decision-making, information gathering, solution planning, information analysis, and reflecting on the outcomes.

To be proficient in problem solving is one of the objectives of mathematical education. In general, the goals of mathematics education at schools can be classified as material goals emphasizing on the ability to solve problems and the application of mathematics itself. Students of having problem solving ability are able to handle not only a daily standard issue set by their teacher, but also they are capable of dealing with a more complex problem calling for their higher level of thinking skills. In fact, this ability has not reached the level of learning completeness allowing students encountering difficulty in abstracting, generalizing, deducing and remembering the concepts and principles of mathematics [6]. Therefore, it is very essential to conduct a systematic study of the variables originating from students' inner side in which theoretically influences their mathematics learning outcomes.

Furthermore, in teaching and learning process, students' self efficacy is also viewed as important as the problem solving ability. [7] states that self-efficacy is an individual's ability to estimate his capacity pertains to self-

[1] Universitas Malikussaleh

[2] Universitas Malikussaleh

[3] Universitas Malikussaleh

[4] Universitas Malikussaleh

[5] S.A. Agustina, R., Salsabilah, D., Suci, F., Syahrani, "Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa Pada Materi Relasi Dan Fungsi Dengan Menggunakan Beberapa Model Pembelajaran Yang Efektif," *Jurnal Ilmiah Multidisiplin Indonesia*, no. 2(6) (2023): 1064.

[6] R. Hidayat, M.A., Sofia, "). Teknik Belajar Matematika Yang Menyenangkan Bagi Siswa Sekolah Menengah Atas (SMA)," *Jurnal Pema Tarbiyah* 1(1) (2022): 22.

[7] Oktariani, "Peranan Self Efficacy Dalam Meningkatkan Prestasi Belajar Siswa," *Jurnal Kognisi* 3(1) (2018): 46.

confidence, adaptability, cognitive capacity, intelligence and strength to act in an under pressure situations. [8] confirms that self-efficacy is an influencing mental factor which determines students' learning achievement.
The success of learning in a way of achieving the competency standard is very dependent on teachers' ability in managing their teaching and learning. Appropriate teaching and learning methodology, is regarded as starting point for the successful learning in creating situations that allow students to learn. According to [9], learning management is emphasized on planning, implementation, evaluation and follow-up activities in learning. Based on this issue, this study has been carried out to determine the increase of students' problem solving ability and mathematical self-efficacy.
In this regard, through the problem-based learning model, the learning activities will be more meaningful. [10] states that problem based learning (PBL) can help students develop thinking and problem solving skills, learning adult roles and becoming independent learners. One of the main characteristics of the problem-based learning model is that it focuses on the interrelationships between scientific disciplines. Through learning, the teaching and learning process begins by exposing students to real world problems, in this case, the problems of Acehnese culture where they live. With problems and questions related to culture, students will know the benefits of studying mathematics A problem can be defined as a situation, where a person is asked to solve a difficulty that he has never been done before without having an understanding toward its solution. [11] recognizes the problem solving as a process, it is an activity that prioritizes the importance of procedures, strategic steps taken by students in solving problems. A question remains a problem if there are no specific rules or regulation that can be used immediately to solve. Problem solving is a process of applying previously acquired knowledge to a new situation. [12] state that mathematical problem solving is a high level of thinking process that requires more complex thinking, whereas problem solving ability in the learning process will enable students to think critically in investigating and making them better at responding and solving a problem.

Self-efficacy is an ability to produce a level of performance that can ensure someone is successful in doing an activity. According to [13], the dimensions that form self-efficacy are level, strength and generality dimension. [14] note that a person's self-efficacy can be influenced by four types of factors, namely experience of success, experience of other people, verbal persuasion and the person's physical condition. Each individual's view of self-efficacy will show how much effort is made and how long the individual will persist when they encounter obstacles [15].

The problem-based learning model, which is a translation of the words Problem-Based Learning (PBL), is a learning model that helps teachers create a learning environment beginning with problems and it allows students to gain more real learning experiences. [16] states that problem based learning is a learning method that is triggered by problems, which encourages students to learn and work cooperatively in group to find solutions.

---

[8] P. Sudwiarrum, D.A., Nuryana, Ratna, "Pengaruh Self Efficacy Terhadap Prestasi Belajar IPS Siswa Kelas VIII SMP," *Jurnal Edueksos* 10(2) (2021): 296.

[9] S. Muyasaroh, "Pengelolaan Kelas Dalam Melaksanakan Pembelajaran Aktif," *Jurnal Kependidikan Dasar Islam Berbasis Sains* 3(2) (2019): 3.

[10] N. Hasanah, E., Darmawan, D., & Nanang, "Pengaruh Penggunaan Media Pembelajaran Articulate Dalam Metode Problem Based Learning (PBL) Terhadap Peningkatan Kemampuan Berpikir Kreatif Peserta Didik," *Jurnal Teknologi Pembelajaran* 4(2) (2019).

[11] Suryani

[12] Layali & Masri

[13] H. Mahsunah, A., Musbikhin., Muhimmatul, "Pengaruh Self Efficacy Terhadap Kepercayaan Diri Pada Siswa," *Jurnal Bimbingan Dan Konseling Islam* 2(2) (2023): 39.

[14] S. Agumuharram, F.N., Slamet, "Self-Efficacy Dan Kemampuan Pemecahan Masalah Siswa Kelas X SMA," *Jurnal Pendidikan Matematika* 5(3) (2021): 2353.

[15] Oktariani, "Peranan Self Efficacy Dalam Meningkatkan Prestasi Belajar Siswa."

[16] H. Hotimah, "Penerapan Metode Pembelajaran Problem Based Learning Dalam Meningkatkan Kemampuan Bercerita Pada Siswa Sekolah Dasar," *Jurnal Edukasi* 7(3) (2020): 5.

The problem-based learning (PBL) model consists of presenting students with authentic and meaningful problem and this learning can make students easier to carry out investigations and inquiries.

METHODS

This study employed quantitative research methodology based on descriptive model. It was designed in a quasi experimental research using the pretest-posttest control group design.

Tabel 1. Research design

Group	Pretest	Dependent Variable	Posttest
Experiment	O_1	X	O_2
Control	O_1	-	O_2

The table 2 above indicates that the variables that were used in this study was characterized by X variable meaning a group that underwent the treatment of Problem Based Learning (PBL). The O_1 was referred as the pretest of problem solving ability and mathematical self-efficacy. The O2 was the posttest problem solving ability and mathematical self-efficacy. The population of this research was class VIII students of *SMPN* (State Junior High School) 5 Lhokseumawe. The samples were selected by using purposive sampling, class VIII-1 as an experimental class and VIII-5 as control.

The data collection technique used was a test of mathematical problem solving ability; in this case it was designed in question based on the value of Acehnese culture with 3 questions, as well as a non-test technique, namely a mathematical self-efficacy questionnaire consisting of 25 statements. The analysis of pretest and posttest scores was to determine the normalized-gain. This stage helped identified the increase of students's problem-solving ability and mathematical self-efficacy during problem-based and conventional learning was taken into account. To calculate the normalized gain, the following formula was used:

$$g=\frac{Posttestscore-pretestscore}{ideal\ maximum\ socre-pretest\ score} \quad (1)$$

After obtaining the value of the normalized gain, it was necessary to perform a normality and a homogeneity test. This statistical investigation was carried out by using a two-way ANOVA test which described the interaction of two factors, one was the dependent variable of interval or ratio type and the other were several independent variables of nominal or ordinal type. To analyze the hypothesis, the two-way Anova statistical test was used with the aid of SPSS software. The testing criterion is to reject H_0 if the sig value < 0.05. The next stage in the analysis was a description of students' problem solving patterns. This description noted how the solution patterns of students were taught through problem-based learning compared to ordinary learning.

RESULTS AND DISCUSSION

The main objective of this quantitative research was to investigate the increase of students' problem-solving ability and mathematical self-efficacy in a two-variable of linear equation systems that was done with different learning. The experimental class was taught with problem-based learning, while the control class was with conventional learning. Additionally, the impact of learning model variables on improving students' problem-solving ability and mathematical self-efficacy was examined in conjunction with their baseline mathematical ability factors. It also investigated students' solving problem process and mathematical efficacy which was done with conventional teaching i.e. the scientific teaching and learning with the use of teaching resource that have been used by the school.

The two tests of problem-solving ability and mathematical self-efficacy were carried out two times, namely pretest and posttest with the same questions form, only having difference in terms of its numbers. The pretest and posttest were given to 29 students of the experimental class and the other 27 students were in control class. Students in the control and the experimental class, in particular, took an initial math ability test of social arithmetic material consisting of questions before beginning their learning treatment.

Performing this study, at an earlier stage of coming across the effect of Problem based-learning (PBL) in increasing students' solving problem and mathematical efficacy, it was very central to validate teaching instruments so that it could be used as a yardstick for subsequent stages of research.

Table 2. Teaching instrument validation

No.	Examined-objects	scores	Validation level
1.	Lesson plan	0.99	High
2.	Students' worksheet	1.0	High

Table 2 notes the results of teaching instruments validation including the lesson plan and students' worksheet. It shows that the two objects revealed a significant score making the instruments were worthwhile to be used in further investigation toward students' solving ability and their mathematical self-efficacy.

Table 3. Students' solving problem and self efficacy test result

No.	Examined-objects	Validator average scores	Validation level
1.	Students' solving problem	0.98	High
2.	Self-efficacy	1.0	High

Based on the validators' test on the examined-objects as can be seen from table 3, the results of students' solving problem test was as high as their efficacy result making 0.98 and 1.0. The instruments were regarded valid and it was employed as an important part of research at *SMPN* (Junior High School) 5 Lhokseumawe. In addition, students' initial mathematics ability was also investigated. This process was done to encounter students pre-mathematical ability prior to the treatment was conducted. Before doing actual study, the test results of the students' initial ability were used to estimate their level of learning. It was anticipated that following treatment, the academic performance of the students would change.

Table 4. Students' mathematical ability pre-treatment condition

No.	Undergoing test	Experimental class	Control class	Remark
1.	Calculation of mean and standard deviation	9.975	6.616	Descriptive statistics
2.	Normality test	.000	.007	Shapiro-Wilk
3.	Non Parametric	222.000		Mann-Whitney U-Test
		600.000		Wilcoxon W
		-2.783		Z
		.005		Asmp.Sig. (2-tailed)

In this study, the mathematics ability test was utilized to establish the class equality of the research sample and to ascertain the students' pre-learning ability. The average and standard deviation, as can be seen in table 4, were computed to provide a general idea of the ability. This process considered several tests from the calculation of mean and standard deviation to the test normality and non parametric.

Tabel 5. Grouping students' mathematical pre-treatment test

Sample	Ability level		
	High	Medium	Low
Experimental class (VIII-1)	2	24	3
Control class (VIII-5)	4	18	5
Total	**6**	**42**	**8**

Based on the scores of students' initial mathematics ability, their levels were grouped into the level of high, medium and low (see table 5). The students with grades between less than X + SD and more than X – SD were placed in moderate mathematics ability, while students with KAM $\leq X$ – SD were grouped in low ability. Students with a score $\geq X$ + SD were classified as having excellent mathematical ability**.**

The following table presents an overview of the hypothesis testing findings of students' problem-solving ability based on statistical testing on N-gain scores.

Table 6. Hypothesis testing summary

No	Hypothesis	Testing results (H_a)	Conclusion
1	The increase in mathematical problem solving ability of students who took part in problem-based learning were higher than those who received conventional learning	Accepted	The increase in problem solving ability of students who underwent problem-based learning (PBL) was higher than those of the conventional class.
2	There was an interaction between learning and initial ability towards increasing students' problem solving ability	Rejected	There was no interaction between learning and students' initial mathematical ability (high, medium and low) on increasing students' mathematical problem solving ability.

The study's statistical testing results corroborated the findings of research by [17], which showed that students taught using the Problem Based Instruction learning model made a greater significant progress in comparison to those that taught using the conventional learning model. Likewise, constructivist learning theory states that problem-based learning begins by providing problems at the beginning of learning that direct students to be able to construct their own knowledge. Additionally, Piaget's developmental theory is a representation of constructivism which sees cognitive development as an active process of creating a system of meaning and comprehension of reality via experiences and their interaction. The influence of social elements and the surrounding environment is crucial to problem-based learning.

According to Vygotsky, learning will be successful if studied learning materials are integrated into their environment. Additionally, he claims that students are at the vanguard of learning progress through the process of scaffolding, which involves having teachers, friends, or other individuals with greater talents help students overcome specific difficulties. Vygotsky states that learning involves providing students with a range of assistance early on in their education, gradually diminishing those supports, and allowing them the chance to assume greater responsibility until they are able to do the task on their own [18].

The interaction discussed in this study was the relationship between the variables of students' initial learning and ability and the enhanced problem-solving capacity in mathematics. Furthermore, improving a student's capacity to solve mathematical problems is unaffected by their learning and mathematical ability. This was evident from the study's findings, which demonstrated that there was no relationship between instruction and students' innate mathematical ability for increasing their capacity to solve mathematical problems. Theoretically, the interaction occurred because students' progress was influenced by the way of learning used by their teacher in exploring their mathematic skills. These results are consistent with those of Rahma et al. [19] that found no correlation between learning and mathematics initial ability in terms of improving students' mathematical skills. This result also stand in contrast with a study by Marsaulina et al. [20] stated that there was no interaction between the learning model and students' initial ability in increasing mathematical problem solving ability.

The capacity to create circumstances and performance levels that can persuade someone to succeed in a task is known as self-efficacy. Self-efficacy, according to Fauziana [21], is a person's belief in his own capacity to complete a task. The perception that one can exercise personal influence over motivation, intellect, and affection in the social environment is correlated with self-efficacy. [22] ; explained that Bandura's four types of elements can affect an individual's self-efficacy such as successful experiences, other people's experiences, verbal persuasion, and the individual's physical state. Every person's perception of their own self-efficacy reveals how much work they

[17] N. K. Layali, "Kemampuan Pemecahan Masalah Matematis Melalui Model Treffinger Di SMA," *Jurnal Pendidikan Matematika Raflesia* 05(02) (2020): 137–144.

[18] S. Anisah, "Efektivitas Metode Scaffolding Dalam Meningkatkan Computational Thinking Siswa SMP Pada Pembelajaran Matematika," 2023.

[19] D.I. Ritonga, "Peningkatan Kemampuan Pemecahan Masalah Matematik Dan Self Efficacy Siswa Kelas VIII SMP Negeri 1 Percut Sei Tuan Melalui Model Pembelajaran Berbasis Masalah," 2020, 1–239.

[20] & Marhami. Ningsih, A.R, Rohantizani, "Peningkatan Kemampuan Komunikasi Matematis Siswa Melalui Pembelajaran Problem Based Learning (PBL) Pada Materi Sistem Persamaan Linier Dua Variabel Di Kelas X SMK Negeri 1 Dewantara," *Ar-Riyadhiyyat: Journal of Mathematics Education* 2(1) (2021): 19–26.

[21] Fauziana, "Pengaruh Self Efficacy Terhadap Kemampuan Memecahkan Masalah IPA," *Jurnal Pendidikan* 11(2) (2022): 154.

[22] Agumuharram, F.N., Slamet, "Self-Efficacy Dan Kemampuan Pemecahan Masalah Siswa Kelas X SMA."

put in and how long they will persevere in the face of difficulties [23]. These findings indicated that students in the control group had higher levels of self-efficacy than those in the experimental group [24]. This disproves the theory that was laid in the previous section. Therefore, more investigation is required to determine the reasons for the negligible results. These results were consistent with a study by [25] which found no relationship between students' baseline mathematical ability and their learning methodology in relation to their mathematical self-efficacy ability. Similar to Bruner's constructivism learning theory, it emphasizes the need of assisting students in comprehending the fundamental concepts or structure of a discipline as well as the necessity of their active participation in the learning process as learning is built via discovery. According to Bruner's additional assertion, teaching mathematics should focus on the concepts and structures inherent in the material being covered, as well as the connections between those concepts and structures.

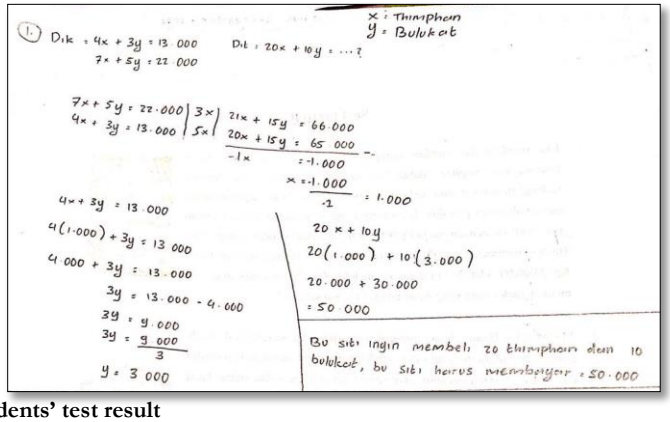
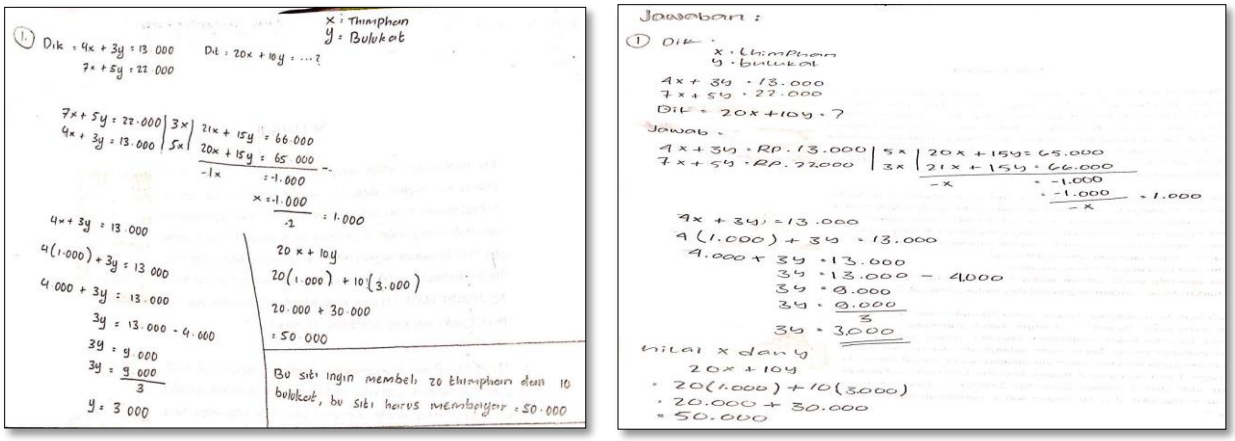


Figure1. Low category of Students' test result

The students' response to the first question as depicted in Figure 1 above noted that they had style of completing the task. It showed that the student grasped the purpose of the test. They also came up with a smart strategy for arriving at the right response. They took a necessary action to solve it accurately and achieve the solution, as well as to double-check their work.



(a) (b)

Figure 2. Testing results of (a) medium category (b) high category

Figure 2 (a) demonstrated that student has already been able to formulate what he has been understood and asked about in a clear and comprehensive manner. He was able to create a clear, comprehensive plan for the

[23] Fauziana, "Pengaruh Self Efficacy Terhadap Kemampuan Memecahkan Masalah IPA."

[24] B Mulyono, M., & Sinaga, "Pengaruh Model Pembelajaran Kooperatife Tipe Think-Pair-Share Berbantuan Media Software Autograph Terhdap Kemampuan Self-Efficacy Siswa Di SMA Negeri Unggul Subulussalam," *Paradikma: Jurnal Pendidikan Matematika* 14(2) (2021): 22–29.

[25] Mulyono & Sinaga

study and applied it to a true, clear, and concise way. Moreover, he formulated a series of clear, concise, and true steps for the study and completed it with clear, concise, and accurate results. The student's response demonstrated that he could build on what he already known of and that he fully and accurately understood the question regarding the problem. Along with creating a thorough plan of action, the student also arrived at the right response. He followed the right procedures to solve it and provided the right answers. Nevertheless, the students neglected to double-check the responses that had been provided, specifically by noting the problem's solution in the question (see figure 2 (b)).

CONCLUSION

Based on the results of data analysis and research findings during learning through the application of problem-based learning model regarding students' problem solving ability and mathematical self-efficacy, it can be concluded that students who were taught using a problem-based learning approach (the experimental group) had an increase in their problem-solving skills compared to those who were taught conventionally (the control group). Students in the experimental group learned using a problem-based learning approach and their gain in mathematical self-efficacy was less than those of the control group who received conventional instruction. It was found that there was an interaction between learning model and mathematical initial ability toward the increase of students' mathematical problem solving ability. However, there was no interaction between learning model and initial ability toward increasing the ability of students' mathematical self-efficacy. This study is a stepping stone for improving teachers' competence in teaching as well as student competence in learning. Thus, it is crucial to take a leading step forward to conduct an in depth analysis in developing and improving the quality of teaching and learning.

REFERENCES

Agumuharram, F.N., Slamet, S. "Self-Efficacy Dan Kemampuan Pemecahan Masalah Siswa Kelas X SMA." *Jurnal Pendidikan Matematika* 5(3) (2021): 2353.

Agustina, R., Salsabilah, D., Suci, F., Syahrani, S.A. "Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa Pada Materi Relasi Dan Fungsi Dengan Menggunakan Beberapa Model Pembelajaran Yang Efektif." *Jurnal Ilmiah Multidisiplin Indonesia*, no. 2(6) (2023): 1064.

Anisah, S. "Efektivitas Metode Scaffolding Dalam Meningkatkan Computational Thinking Siswa SMP Pada Pembelajaran Matematika," 2023.

Fauziana. "Pengaruh Self Efficacy Terhadap Kemampuan Memecahkan Masalah IPA." *Jurnal Pendidikan* 11(2) (2022): 154.

Hasanah, E., Darmawan, D., & Nanang, N. "Pengaruh Penggunaan Media Pembelajaran Articulate Dalam Metode Problem Based Learning (PBL) Terhadap Peningkatan Kemampuan Berpikir Kreatif Peserta Didik." *Jurnal Teknologi Pembelajaran* 4(2) (2019).

Hidayat, M.A., Sofia, R. "). Teknik Belajar Matematika Yang Menyenangkan Bagi Siswa Sekolah Menengah Atas (SMA)." *Jurnal Pema Tarbiyah* 1(1) (2022): 22.

Hotimah, H. "Penerapan Metode Pembelajaran Problem Based Learning Dalam Meningkatkan Kemampuan Bercerita Pada Siswa Sekolah Dasar." *Jurnal Edukasi* 7(3) (2020): 5.

Layali, N. K., & Masri, M. "Kemampuan Pemecahan Masalah Matematis Melalui Treffinger Di SMA." *Jurnal Pendidikan Matematika Raflesia* 5(2) (2020): 137–44.

Layali, N. K. "Kemampuan Pemecahan Masalah Matematis Melalui Model Treffinger Di SMA." *Jurnal Pendidikan Matematika Raflesia* 05(02) (2020): 137–144.

Mahsunah, A., Musbikhin., Muhimmatul, H. "Pengaruh Self Efficacy Terhadap Kepercayaan Diri Pada Siswa." *Jurnal Bimbingan Dan Konseling Islam* 2(2) (2023): 39.

Mulyono, M., & Sinaga, B. "Pengaruh Model Pembelajaran Kooperatife Tipe Think-Pair-Share Berbantuan Media Software Autograph Terhdap Kemampuan Self-Efficacy Siswa Di SMA Negeri Unggul Subulussalam." *Paradikma: Jurnal Pendidikan Matematika* 14(2) (2021): 22–29.

Muyasaroh, S. "Pengelolaan Kelas Dalam Melaksanakan Pembelajaran Aktif." *Jurnal Kependidikan Dasar Islam Berbasis Sains* 3(2) (2019): 3.

Ningsih, A.R, Rohantizani, & Marhami. "Peningkatan Kemampuan Komunikasi Matematis Siswa Melalui Pembelajaran Problem Based Learning (PBL) Pada Materi Sistem Persamaan Linier Dua Variabel Di Kelas X SMK Negeri 1 Dewantara." *Ar-Riyadhiyyat: Journal of Mathematics Education* 2(1) (2021): 19–26.

Oktariani. "Peranan Self Efficacy Dalam Meningkatkan Prestasi Belajar Siswa." *Jurnal Kognisi* 3(1) (2018): 46.

Ritonga, D.I. "Peningkatan Kemampuan Pemecahan Masalah Matematik Dan Self Efficacy Siswa Kelas VIII SMP Negeri 1 Percut Sei Tuan Melalui Model Pembelajaran Berbasis Masalah," 2020, 1–239.

Sudwiarrum, D.A., Nuryana, Ratna, P. "Pengaruh Self Efficacy Terhadap Prestasi Belajar IPS Siswa Kelas VIII SMP." *Jurnal Edueksos* 10(2) (2021): 296.

Suryani, M., Jufri, L. H., & Putri, T. A. "Analisis Kemampuan Pemecahan Masalah Siswa Berdasarkan Kemampuan Awal Matematis,"

2020, 119–30. https://doi.org/https://doi.org/10.31980/mosharafa.v9i1.605.