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THE ROLE OF PROBLEM SOLVING APPROACH ON IMPROVING STUDENT'S COMMUNICATION ABILITY AND SELF EFFICACY

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ABSTRACT

This study is a pretest-posttest experiment control group design having a goal to analyze the role of in problem-solving approach (PSA) on students' mathematical communication ability (MCA) and self-efficacy in mathematics (MSE). The study involves 66 eighth grade students, and MCA test, and an MSE scale. The study revealed that PSA took a better role than SA in obtaining MCA and MSE. Students getting treatment with PSA obtained MCA and MSE were at good grade quality, while students taught by SA attained MCA and MSE were at pretty good grade level. Besides that, the study found there was a very high association between MCA and MSE. Like that, students expressed a positive opinion on PSA, even if, students still realized a few difficulties in solving MCA.

Keywords: mathematical communication, self-efficacy, problem-solving approach

Abstrak

Penelitian ini adalah desain kelompok kontrol eksperimen pretest-posttest yang memiliki tujuan untuk menganalisis peran dalam pendekatan Problem Solving (PSA) pada kemampuan komunikasi matematika siswa (MCA) dan self-efficacy dalam matematika (MSE). Penelitian ini melibatkan 66 siswa kelas delapan, dan tes MCA, dan skala MSE. Studi ini mengungkapkan bahwa PSA mengambil peran yang lebih baik daripada SA dalam mendapatkan MCA dan MSE. Siswa yang mendapatkan pembelajaran dengan PSA yang diperoleh MCA dan MSE berada pada kualitas kelas baik, sementara siswa yang diajarkan oleh SA mencapai MCA dan MSE berada pada tingkat kelas yang cukup baik. Selain itu, penelitian ini menemukan ada hubungan yang sangat tinggi antara MCA dan MSE. Selain itu, siswa menyatakan pendapat positif tentang PSA, bahkan jika, siswa masih menyadari beberapa kesulitan dalam menyelesaikan MCA.

Kata kunci: komunikasi matematis, self-efficacy, pendekatan Problem Solving

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INTRODUCTION

Mathematical communication ability (MCA) is an important learning outcome that needs to be owned and developed in high school students. There are two reasons grounded on the statement. Firstly, MCA is enclosed in the goal of mathematics teaching (Nasional, 2013) and secondly it is in line with the expert's opinion. The goal and vision of teaching mathematics, among others, are: "To improve student's ability stating an idea using symbols, graphics, tables or other media to explain a situation and problem or presenting a mathematical model into the ordinary language (Nasional, 2013). Another reason is: mathematics is used in a variety of sciences and daily life. For example, mathematics as a language is used as a tool for thinking, finding principles and formulas, deriving conclusions, and confirming a thought precisely, thoroughly, and completely (Baroody & Lindquist, as cited in(Yonandi & Sumarmo, 2012)). Although MCA is important for High School students, the student's MCA was still at low to medium grade level. Several studies (Alamiah & Afriansyah, 2017; Alhaddad, Kusumah, Sabandar, & Dahlan, 2015; Hasibah, Rohaeti, & Aryan, 2018). Reported that students who received ordinary teaching achieved MCA at moderate grade qualification. Whereas students who get innovative teaching approaches obtained MCA at a fairly good grade level. These findings indicate that although some MCA assignments are difficult, teachers should continue to seek learning approaches that give students opportunities to achieve a better MCA grade level.

Nothing the importance of having MCA in students, teachers should try to select a learning approach and to practice mathematical tasks to improve student's MCA. For example, students practice to compile mathematical model of a problem situation or to compose a story problem from a given mathematical model. Such assignments characterized that MCA is a task classified as HOT in mathematics. To carry out these tasks, in addition to students needing to master mathematical concepts involved in the MCA tasks and students also need to have strong learning motives such as having the self-confidence that he or she was able to solve the MCA task. Such kind of learning motive behavior is mathematical self-efficacy (MSE). Canfields & Watkins (as cited in Miliyawati, 2012) proposes that self-efficacy is a kind of behavior which is accompanied by discipline and effort wisely and intelligently.

In contrast to the findings in the MCA, several studies (Aziz, Rochmad, & Wijayanti, 2015; Hidayat, Sabandar, & Syaban, 2018; Hasibah, Rohaeti, & Aryan, 2018) by implementing different teaching approaches students obtained MSE at medium-fairly good grade level. It seems that MCA assignments were more difficult for students to complete than students performing good MSE behavior.

Refer to teacher's task, (Polya, 2004), Glasersfeld and Nickson (as cited in Suparno, 1997) express that teacher's task is not only to deliver mathematics content but the more important things are: to behave suitable attitude with student's need, to esteem student's feeling, to motivate the student to invent new cognizance, to enhance student's thinking ability, to support student's reasoning, and to support the student to learn well. Besides that, in mathematics teaching-learning, Kurikulum Matematika 2013 proposes that mathematical hard-skill and soft-skill such as MCA and MSE should be improved accordingly and proportionally. Those arguments encourage researchers to select mathematics teaching proper to those aforementioned suggestions. Based on its teaching-learning steps, researchers estimate that the problem-solving approach (PSA) will suitable for Polya's and mathematics curriculum's wishes. Problem-solving approach (PSA) is an approach which centralized its activities in improving problem-solving ability and then by using strategy, ways, or certain technique, students are unafraid to confront new problem or situation so that they succeed to

complete the problem. Two studies (Mulyasari, Rohaeti, & Sugandi, 2018) reported the superiority of PSA than ordinary teaching on improving student's MCA.

Those aforementioned arguments stimulate researchers to execute a study to analyze the role of PSA on obtaining student's MCA, MSE and then we compile research questions as follows.

1. Are MCA grade and its normalized gain, and MSE grade of students getting treatment with PSA better than the grades of students taught by SA?
2. Is there any association between MCA and MSE?
3. What are the student's activities during the PSA lesson?

Aside from the explanation of the MCA that was reported in the previous section, Asikin, (as cited in Hulukati, 2005) summarizes in detail the importance of owning MCA among others are a. Support students to confirm their thinking, and as a tool for assessing students' understanding; b. Help students to regulate and develop their skills; c. Increase student's problem solving and reasoning abilities; d. Raise student's self-efficacy; e. Improve student's social skills, namely mathematical speaking ability which is useful in mathematics society. Further, Baroody and Lindquist (as cited in Yonandi & Sumarmo, 2012) add reasons for the importance of MCA for students, namely: Mathematics communication is the heart of social activities such as interaction among students, teacher, and teaching material.

Besides that, Elliot and Kenney (as cited in Sumarmo, 2010) bring up that MCA encloses some processes such as a. To express a mathematical situation or problem, or daily life situation into the mathematical model; b. To explain a mathematical content or argument in his language written or orally; c. To compile a story from a given mathematical model; d. To pose questions about presented mathematical content. There are some suggestions for improving student's mathematical communication ability among others are a. Promote students' habits for explaining their answers, and responding to other answers (Pugalle, 2001, as cited in Indiana, Rohaeti, & Sumarmo, 2017); b. Motivate students to discuss, to propose, to explain, to illustrate, to listen, to ask, and to work together in a small group (Within, as cited in Shadiq, 2004).

Some writers explain the notion of self-efficacy term in different expression, however, those definitions contain a similar sense that is a self-perception on his or her capabilities, as follow: a. Self-efficacy is personal confidence in its ability to organize himself and solve problems to get the wished results (Bandura, 1997); b. Self-efficacy is a personal belief on something that can be done (Schunk as cited in Moma, Kusumah, Sabandar, & Dahlan, 2013); c. Self-efficacy is self-confidence in something he can do for achieving his goals (Maddux, 2000); c. Self-efficacy is personal believe that something is good or bad, precise or false, able or unable to be done (Alwisol, 2004); d) Self-efficacy is the assessment of his ability in the face a problem.To measure the degree of self-efficacy, then Bandura (1997) put forward several indicators of self-efficacy, namely: a) Able to overcome the problem at hand; b) Believe that he will succeed; c) Not afraid to face challenges; d) Dare to face the risk of his decision; e) Understand the strengths and weaknesses of himself; f) Able to interact with their peers; g) Tough and don't give up easily. Further, Bandura (1997) explains that there are four main information resources for improving self-efficacy namely: a) Experience your successes and failures; b) Experience the successes and failures of other (vicarious experience); c) Verbal persuasion*;* d) Psychological state. About the improvement of self-efficacy, Sauri (2010) argues that self-efficacy similar to other affective aspects, couldn't be taught as a mathematics content directly, but it could be improved in some ways such as: Convince, perform, and

familiarize students and teacher to behave self-efficacy attitude, and carry out integrated and continuous mathematics teaching-learning process.

Problem Solving Approach is learning that focuses its activities on problem-solving skills, which are then followed by strengthening problem-solving skills or choosing and developing responses. The almost similar notion, the problem-solving strategy is a process of using certain strategies, methods, or techniques to deal with a new situation or problem, so that the problem can be resolved and the objectives can be achieved. The problem-solving approach is not designed to provide as much information as possible to students but emphasizes helping students develop and practice their thinking skills, solve problems, and other skills so that they become independent students. In other words, the problem-solving approach directs the ability, willingness, feelings, enthusiasm, and thinking of students, to solve problems, and then encourages students to think systematically.

There are seven-steps for an effective problem-solving process: a) Identify the issues, and be clear about what the problem is; b. Understand everyone's interests; c. List the possible solutions; d. Assess the options; e. Select an option or options; f. Document the agreement; e. Agree on contingencies, monitoring, and evaluation.

Killen (as cited in proposes the benefits the problem-solving approach among others are: a) Develop students' thinking abilities and increase student knowledge, and other skills; b) Developing a curious attitude and independent critical analytical way of thinking, both individually and in groups;c) Helping students deal with problems in their surroundings and encourage students to try to exert all abilities to be able to find solutions to problems. Apart from that, based on the opinion of some expert's conception, Killen (as cited in Sukasno, 2002) summarized the advantages and disadvantages of the PSA as follows. The advantages of PSA include:a) Developing meaningful answers to a problem will lead students to a deeper understanding of the material (Mc Allister, 1997 as cited in Sukasno, 2002); b) Problem solving gives challenges to students so they can get satisfaction and find new knowledge for themselves (Cobb, Yackel, 1998, as cited in Sukasno, 2002); c) Problem solving makes students active in learning (Moelewald, 1993, as cited in Sukasno, 2002), d) Problem solving helps students learn how to transfer their knowledge into the real world (Gallagher, Stepien & Rosenthal, 1992 and Coin 1994, as cited in Sukasno, 2002); e) Problem solving helps students be more responsible for their own learning process, also encourages them to evaluate their own learning process; f) Problem solving can show students that mathematics is a way of thinking and solving problems is a challenge for students; g) Problem solving can be an interesting learning experience and can reward students as well as fun and stimulate students to learn; (Barrows & Tamblyn, 1980, as cited in Sukasno, 2002).

Besides having advantages, the PSA also has disadvantages, among them, are (Killen in Sukasno, 2002): a) When the questions do not motivate students to learn, they feel the problem are just busy; b) When students are not interested they will be reluctant to try; c) Solving problems requires a lot of preparation; d) When students do not understand the usefulness of solving a problem they will leave the task; e) When students have to work independently, they feel to be failed;f) In group work the smart students will dominate the weak students; g) Students who are familiar with teacher's information, students feel inconvenient to learn on their own; h) Student learning styles may not be suitable for PSA.

Apart from the study findings reported in the previous section, the following study findings are presented below. The advantages of PSA than ordinary teaching approach was reported in Eftafiyana, Nurjanah, Armania, Sugandi, & Fitriani (2018) on improving student's creative

thinking ability and learning motive, and Mulyana, Sumarmo, & Kurniawan (2018) on improving student's mathematical critical thinking ability and disposition.

Besides that, a lot of studies (Barnas, Sumarmo, & Syaban, 2018; Isnaeni & Maya, 2014; Kartiwi, Sumarmo, & Sugandi, 2018; Nadia, Rohaeti, & Kustiana, 2018; Qodariyah & Hendriana, 2015; U Sumarmo, Mulyani, & Hidayat, 2018) by using different teaching approaches reported that students obtained MCA at good grade qualification. As well as, other studies (U Sumarmo et al., 2018; Isnaeni & Maya, 2014; Kartiwi et al., 2018; Mulyasari et al., 2018; Qodariyah & Hendriana, 2015; Yonandi & Sumarmo, 2012). found that students attained MSE at a fairly good grade level.

METHOD

This study was a pretest-postest experiment control group design having a goal to analyze the role of PSA on students' MCA and MSE. The study involves 66 seventh grade students, and MCA test, and an MSE scale. The MCA test consisted of .. items, and by using Hendriana & Soemarmo (2014) and Utari Sumarmo (2016) as references it is obtained characteristic of the instruments as attached in Table 1.

Table 1. Description of Instruments of This Research

Test and Scale	n Subyect	n Item Test & Scale	Discrimin at power	Difficulty index	Item Validity ($t_{table} = 2$)	Relia-bility
MCTA test	59	5	.39 - .45	.29 - .60	.69 - .94	.73
MSE Scale	59	35	-	-	2.59 - 15.55	.88

In the following we attached some sample of instruments of this study.

1. **Sample of Communication Test**

   A tennis ball is dropped to floor from a position of 3 meter height. In each rebound the ball reachs $\frac{2}{3}$ times previous height. Skech path that passed by the ball up to the ball stopped and compile mathematical model for determining distance taken on, and then solve it accompnied with concept or rule used in each step your calculation.

2. **Sample Communication Test**

   In a show-night for collecting fund to help victim of natural occurence, an audience room is arranged a number of seats in some rows. Each row consists of 200 seats. Ticket price of first row is Rp. 150.000,00 per seat and ticket price of the last row is Rp. 50.000,00 per seat. Difference price ticket between a row and the next row is equal. All tickets are sold and the committee obtains fund as much as Rp. 120.000.000,00. Compile mathematical model for calculating ticket price per seat. Then solve it together with concept and or rules that used in each step of computation.

Tabel 2. 3 Sample items of Self Efficacy Scale

No.	Statement	SA	A	DA	SDA
1.	I avoid to discuss difficult linier equation system of two variabels problems				
2.	I believe I can complete difficult linier equation system of two variables problems				
3.	I persisted in solving m difficult linier equation system of two variables problems even though it took a long time				
4.	I deliberately chose difficult linier equation system of two variables problems to improve my understanding				
5.	I am afraid to express different opinions in a group discussion forum about line equations through two points				
6.	I gave up learning straight-line equations with various positions				
7.	I am confused to determine which straight line equation content I should study in more depth				
8.	I avoid discussing solving difficult problems of linier equation system of two variables with smart friends				

Note: SA: strongly agree ; A: agree; DA: disagree; SDA: strongly disagree

RESULTS AND DISCUSSION

Results

The attaiment of student's MCA and its gain (N-G), and student's MSE are attached in Table 3

Table 3. Student's MCA and Its Gain (N-G), and Student's MSE In Both Teaching Approaches

Variables	$\bar{x}$ and s	PBL-RME Pretes (%)	PBL-RME Postes (%)	$\langle g \rangle$	n	PBL alone Pretes (%)	PBL alone Postes (%)	$\langle g \rangle$	n
MC	$\bar{x}$	8.64	27.55	.72	33	8.30	21.33	.48	33
	%	2.51	78.70			2.32	60.95	.24	
	s	24.68	5.51	.22		23.72	6.15		
MSE	$\bar{x}$		131.79		33		107.30		33
	%		79.87				65.03		
	s		17.88				9.18		

Note:

MCA: mathematical communication ability Ideal Score: 35

MSE : mathematical self efficacy Ideal scoe : 165

In the pre-test, there were no different students' grades of MCA of both class teaching approaches, and the grades were at a very low level. But after teaching approaches, the study found that PSA took a better role than SA on obtaining MC, its N-Gain, and MSE.

Student getting treatment with PSA obtained the grade of MCA and MSE were at good grade level. Even though, students accepting treatment with SA attained MCA and MSE were at medium grade level Testing hypothesis of those means of MCA and MSE on both teaching approaches were attached in Table 4.

Table 4. Testing Hypotesis of Mean Difference of Mathematical Communication. Its N-Gain, and Mathematical Self Efficacy on the Both Teaching Approcahes

Variable	Teaching approach	$\bar{x}$	s	n	Sig.	Interpretation
MCA	PSA	27.55	27.55	33	.00 < .05	$MCA_{PSA} > MCA_{SA}$
	SA	21.33	6.15	33		
N-Gain of	PSA	.72	.22	33	.00 < .05	N-Gain MCA_{PSA} >
MC	SA	.48	. 24	33		N-Gain MCA_{SA}
	PSA	131.79	17.88	33		
MSE	SA	107.30	9.18	33	.00 < .05	$MSE_{PSA} > MSE_{SAL}$

Note: MCA : mathematical communication ability Ideal score MCA: 35

MSE : mathematical self efficacy Ideal score MSE:135

Further analysis was about student's difficulties in completing MCA tasks that were attached in Table 5.

Table 5. Mean Score Of Each Item Of Mathematical Communication on Both Teaching Approaches

Teaching approach	Stat.Desc	No.1	No 2.	No.3	No.4	No.5
	Ideal score	6	8	8	8	5
PSA	$\bar{\bar{x}}$	5.55	8.36	4.94	4.27	4.42
	% out of IS	92.42	92.93	82.32	53.41	73.74
SA	$\bar{x}$	3.91	7.27	4.97	2.42	2.76
	% out of IS	65.15	80.81	82.83	30.30	45.96

The study found that many students of PSA attained high grades of MCA (more than 60% out of ideal score) except on item No 4 students attained rather low (53.41 % out of ideal score) it was about to compose story problem from a mathematical model. However, students taught by SA obtained low grade (less than 60% out of ideal score) of MCA on no 4. and no.5.

In further analysis, by using the contingency table and statistic Pearson-Chi Square (c2) the study found that c2 = 66.000a, C= .816, and sig = .000 < .05 It meant that there was a very high association between MCA and MSE. (Table 6 and Table 7)

Table 6. Contigency Table of Mathematical Communication Ability and Mathematical Self Efficacy

MCA \ MSE	High	Medium	Low	Total
High	26	0	0	26
Medium	0	4	0	4
Low	0	0	3	3
Total	26	4	3	33

Table 7. Test of Pearson-Chi Square and Contigency Coefficient between Mathematical Communication Ability and Mathematical Self Effcacy

Pearson-Chi Square (χ^2)	DF	Contigency Cofficient (C)	Sig.(2-tailed)
66.000[a]	4	.816	.000 <.05

Besides those findings, this study also found that students demonstrated more active learning during PSA lessons compared to student's activities during SA lessons. They discussed actively in a small group, to identify the problem on the students' worksheet (Figure 1) and (Figure 2), and presented their work in front of the class (Figure 3)

While, in the SA lessons even though students sit in small groups, they tend to work independently. (Figure 4 and Figure 5)

Figure 1. Students are used to learning in small group

Figure 2. Students discuss and solve problems in small groups actively

Figure 3. Students presented their work infront of the class voluntary

Figure 4 and Figure 5. Even though students sit in small groups, they tend to study individually

Discussion

The finding of the grades of MCA at the good level was higher to the findings of previous studies that students getting treatment with various innovative teaching that attained MCA grades at a fairly good level(Alamiah & Afriansyah, 2017; Alhaddad et al., 2015; Hasibah et al., 2018; Isnaeni & Maya, 2014; Kartiwi et al., 2018; Mulyasari et al., 2018; Qodariyah & Hendriana, 2015; Yonandi & Sumarmo, 2012). Findings of this study that student obtained MSE at good grade level was similar to findings of prior studies which implementing innovative approaches (Aziz et al., 2015; Hasibah et al., 2018; Hidayat et al., 2018; Nadia et al., 2018) that they found students' MSE were at pretty good grade level.

Moreover, students expressed a positive opinion on PSA. Students tended to be comfortable with the new accepted teaching approach (PSA), despite at first they were confused to solve new kind mathematics problems. In this study, sometimes teachers faced obstruction in conducting PSA, such as limited allocated time whereas it needed a long time for students to construct their knowledge, to discuss in their group, and to present their solution in front of the class. Even though, in further sessions, the obstruction could be handled by offering more interesting mathematics tasks and guidance during students working together in each small group.

CONCLUSION

Based on the findings of the study and discussion, it derived some conclusion as follows. Students getting treatment with PSA obtained higher grades on MCA and MSE than students taught by SA. The first group students obtained MCA and MSE was at good grade level, while the second group students attained MCA and MSE at fairly-good grade level. Besides, students in both teaching approaches realized few difficulties in solving MCA tasks. The other conclusion was there was a very high association between MCA and MSE and students getting treatment with PSA performed more active learning than students taught by SA. Like that, students posed positive opinions on PSA.

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REFERENCES

Alamiah, U. S., & Afriansyah, E. A. (2017). Perbandingan kemampuan komunikasi matematis siswa antara yang mendapatkan model pembelajaran problem based learning dengan pendekatan realistic mathematics education dan open-ended. *Mosharafa: Jurnal*

Pendidikan Matematika, *6*(2), 207–216.

Alhaddad, I., Kusumah, Y. S., Sabandar, J., & Dahlan, J. A. (2015). Enhancing Students' Communication Skills through Treffinger Teaching Model. *Indonesian Mathematical Society Journal on Mathematics Education*, *6*(1), 31–39.

Alwisol, A. (2004). Psikologi kepribadian. *Malang: Universitas Muhammyadiah Malang*.

Aziz, M. A., Rochmad, R., & Wijayanti, K. (2015). Kemampuan Berpikir Kreatif Dan Self-Efficacy Siswa Kelas X Smk Teuku Umar Semarang Dengan Model Pembelajaran Osborn. *Unnes Journal of Mathematics Education*, *4*(3).

Bandura, A. (1997). *Self-efficacy: The exercise of control*. wH Freeman New York.

Barnas, B., Sumarmo, U., & Syaban, M. (2018). The role of SQ3R strategy on mathematical communication ability and self regulated learning of seventh grade student. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *1*(3), 153–160.

Eftafiyana, S., Nurjanah, S. A., Armania, M., Sugandi, A. I., & Fitriani, N. (2018). Hubungan antara kemampuan berpikir kreatif matematis dan motivasi belajar siswa SMP yang menggunakan pendekatan creative problem solving. *Teorema: Teori Dan Riset Matematika*, *2*(2), 85–92.

Hasibah, B., Rohaeti, E. E., & Aryan, B. (2018). APPLICATION OF INDUCTIVE-DEDUCTIVE APPROACH TO IMPROVE THE ABILITY OF MATHEMATICAL COMMUNICATION AND SELF EFFICACY OF JUNIOR HIGH SCHOOL STUDENT. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *1*(1), 18–23.

Hendriana, H., Rohaeti, E. E., & Sumarmo, U. (2017). Hard skills dan soft skills matematik siswa. *Bandung: Refika Aditama*.

Hendriana, H., & Soemarmo, U. (2014). Penilaian pembelajaran matematika. *Bandung: Refika Aditama*.

Hidayat, T. I. A., Sabandar, J., & Syaban, M. (2018). INDUCTIVE-DEDUCTIVE LEARNING APPROACH TO DEVELOP STUDENTS'MATHEMATICAL PROBLEM SOLVING SKILLS AND SELF EFFICACY. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *1*(1), 24–33.

Hulukati, E. (2005). Mengembangkan kemampuan komunikasi dan pemecahan masalah matematika siswa SMP melalui model pembelajaran generatif. Universitas Pendidikan Indonesia.

Isnaeni, I., & Maya, R. (2014). Meningkatkan kemampuan komunikasi dan disposisi matematik siswa sekolah menengah atas melalui pembelajaran generatif. *Jurnal Pengajaran MIPA*, *19*(2), 159–165.

Kartiwi, W., Sumarmo, U., & Sugandi, A. I. (2018). INCREASING COMMUNICATION AND CAPABILITY MATHEMATIC DISPOSITION OF SMA STUDENTS THROUGH EXPLORATION APPROACH. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *1*(3), 227–233.

Maddux, J. (2000). Self-efficacy: the power of believing you can. George Mason University.(in press). Snyder, CR, & Lopez, SJ. *Handbook of Positive Psychology*.

Miliyawati, B. (2012). Peningkatan Kemampuan Berpikir Kritis dan Self-Eficacy Matematis Siswa SMA dengan Menggunakan Pendekatan Investigasi. Universitas Pendidikan

Indonesia.

Moma, L., Kusumah, Y. S., Sabandar, J., & Dahlan, J. A. (2013). The enhancement of junior high school students mathematical creative thinking abilities through Generative learning. *Mathematical Theory and Modeling*, *3*(8), 146–157.

Mulyana, A., Sumarmo, U., & Kurniawan, R. (2018). The Role of Problem Solving Approach on Student's Mathematical Critical Thinking Ability and Disposition. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *1*(3), 161–172.

Mulyasari, I., Rohaeti, E. E., & Sugandi, A. I. (2018). THE APPLICATION OF PROBLEM SOLVING APPROACH IN IMPROVING JUNIOR HIGH SCHOOL STUDENTS'MATHEMATICAL COMMUNICATION AND DISPOSITION SKILL. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *1*(3), 200–206.

Nadia, R., Rohaeti, E. E., & Kustiana, K. (2018). APPLICATION OF INDUCTIVE APPROACH TO IMPROVE MATHEMATICAL COMMUNICATION CAPABILITIES AND STUDENT SELF EFFICACY JUNIOR HIGH SCHOOL. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *1*(1), 1–7.

Nasional, D. P. (2013). Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 81 A Tahun 2013 Tentang Implementasi Kurikulum. *Jakarta: Departemen Pendidikan Nasional*.

Polya, G. (2004). *How to solve it: A new aspect of mathematical method* (Vol. 85). Princeton university press.

Qodariyah, L., & Hendriana, H. (2015). Mengembangkan Kemampuan Komunikasi dan Disposisi Matematik Siswa SMP melalui Discovery Learning. *Edusentris*, *2*(3), 241–252.

Sauri, S. (2010). Membangun karakter bangsa melalui pembinaan profesionalisme guru berbasis pendidikan nilai. *Jurnal Pendidikan Karakter*, *2*(2), 1–15.

Shadiq, F. (2004). Pemecahan masalah, penalaran dan komunikasi. *Yogyakarta: PPPG Matematika*.

Sukasno. (2002). *Model Pembelajaran Pemecahan Masalah dalam Pembelajaran Trigonometri*. Unpublished Tesis at PPS-UPI Bandung

Sumarmo, U, Mulyani, E., & Hidayat, W. (2018). Mathematical Communication Ability and Self Confidence Experiment with Eleventh Grade Students Using Scientific Approach. *JIML-Journal of Innovative Mathematics Learning*, *1*(1), 19–30.

Sumarmo, Utari. (2010). Berpikir Dan Disposisi Matematik: Apa, Mengapa, dan bagaimana dikembangkan pada peserta didik. *Bandung: FPMIPA UPI*.

Sumarmo, Utari. (2016). Pedoman pemberian skor pada beragam tes kemampuan matematik. *Kelengkapan Bahan Ajar Mata Kuliah Evaluasi Pembelajaran Matematika Pada Program Magister Pendidikan Matematika STKIP Siliwangi: Tidak Diterbitkan*.

Suparno, P. (1997). Filsafat konstruktivisme dalam pendidikan. *Yogyakarta: Kanisius*, 12–16.

Taufiqurrohman, E. Sabandar, Y.Tapilouw, M. (2018). Mathematical Communication And Connections Students' Ability Through Problem-Based Learning. JPMI. Volume 1 Number 2, June 2018, pp. 95-108

Yonandi, M., & Sumarmo, U. (2012). Mathematical Communication Ability and Disposition

(Experiment with Grade-11 students Using Contextual Teaching with Computer Assissted). *Jurnal Pengajaran MIPA*, *17*(2), 142–156.