

## MATHEMATICS CONNECTION ABILITY AND SELF REGULATED LEARNING OF JUNIOR HIGH SCHOOL STUDENTS TROUGH PROBLEM-BASED LEARNING APPROACH

Nendi Rohaendi<sup>1</sup>

<sup>1</sup> IKIP Siliwangi Bandung

<sup>1</sup> [nendi.rohaendi88@gmail.com](mailto:nendi.rohaendi88@gmail.com)

Received: Jul 22<sup>nd</sup>, 2020 ; Accepted: Aug 18<sup>th</sup>, 2020

### Abstract

This article aims to examine the mathematical connection skills of students who learn using the Problem Based Learning approach and Self Regulated Learning compared to those who use ordinary learning. This research is using the experimental method. The population in this study were eighth-grade students of MTs Al-Hikmah 02 Talegong Garut district 2018/2019 academic year with a sample of the study were eighth-grade students of MTs Al-Hikmah 02 Talegong consisting of VIIB classes as a control class and VIIA as experimental classes taken randomly. The instrument used in this study was a mathematical connection ability test in the form of a description of 5 questions, as well as the scale of learning independence. Data were analyzed using the IBM SPSS Statistic 1.7 for windows program. From this study, the following results were obtained: (1) Increased mathematical connection ability of students with mathematical learning using the problem based-learning approach better than those who used ordinary learning. (2) Learning independence of students who use the problem based-learning approach is better than students who use ordinary learning. (3) Implementation of learning steps using the problem based-learning approach can develop mathematical connection skills and student learning independence. (4) the difficulties experienced by students in solving the problems of mathematical connection ability are found in indicators that understand or connect the relationship between mathematics and other sciences outside mathematics.

**Keywords:** Mathematical Connection, Problem-Based Learning Model and Self Regilated Learning

### Abstrak

Artikel ini bertujuan untuk menguji keterampilan koneksi matematika siswa yang belajar menggunakan pendekatan Problem Based Learning serta kemandirian belajar siswa dibandingkan dengan mereka yang menggunakan pembelajaran biasa. Penelitian ini menggunakan metode eksperimen. Populasi dalam penelitian ini adalah siswa kelas VIII MTs Al-Hikmah 02 Talegong Kabupaten Garut 2018/2019 tahun akademik dengan sampel penelitian ini adalah siswa kelas VIII MTs Al-Hikmah 02 Talegong yang terdiri dari kelas VIIB sebagai kelas kontrol dan VIIA sebagai kelas eksperimen yang diambil secara acak. Instrumen yang digunakan dalam penelitian ini adalah tes kemampuan koneksi matematis dalam bentuk uraian 5 pertanyaan, serta skala kemandirian belajar. Data dianalisis menggunakan program IBM SPSS Statistic 1.7 for windows. Dari penelitian ini, hasil berikut diperoleh: (1) Peningkatan kemampuan koneksi matematika siswa dengan pembelajaran matematika menggunakan pendekatan PBL lebih baik daripada mereka yang menggunakan pembelajaran biasa. (2) Kemandirian belajar siswa yang menggunakan pendekatan PBL lebih baik daripada siswa yang menggunakan pembelajaran biasa. (3) Implementasi langkah-langkah pembelajaran menggunakan pendekatan PBL dapat mengembangkan keterampilan koneksi matematika dan kemandirian belajar siswa. (4) kesulitan yang dialami oleh siswa dalam memecahkan masalah kemampuan koneksi matematika ditemukan dalam indikator yang memahami atau menghubungkan hubungan antara matematika dan ilmu-ilmu lain di luar matematika.

**Kata Kunci:** Koneksi Matematik, *Problem Based-Learning*, dan Kemandirian Belajar

**How to Cite:** Rohaendi, N. (2020). Mathematics Connection Ability and Self Regulated Learning Of Junior High School Students Trough Problem-Based Learning Approach. *JIML*, 3 (3), 102-111.

---

## INTRODUCTION

Students' mathematical connection ability is still accepted in the low field, the low ability of students' mathematical connections supports several factors of student learning processes that are less qualified. If viewed from the indicators of connection ability, students avoid problems related to internal and external factors. This is in accordance with the opinion of Kutz (Hakim.M.A.A, 2013) states that mathematical connections are related to internal connections and external connections. Internal connections Commenting on connections between topics in mathematics, while external connections Accessing mathematical connections with disciplines and problems in everyday life Mathematical connections are a skill that must be built and learned, because with mathematical connection skills that will help students to be able to learn the relationship various concepts in mathematics and applying mathematics in everyday life (Siagian, 2016). Mathematical connection ability is an ability that has a relationship with the real world, the relationship between concepts in everyday life, this is in accordance with the opinion of Rahardjo (2016), the ability of mathematical connections is one's ability to connect internal and external relations in mathematics, which supports connections between mathematical topics, connections with other disciplines, and connections in everyday life. the relationship between concepts or principles in mathematics plays a very important role in mathematics. In other studies understanding students are required to be able to understand more than one concept and relate it (Fauzi, 2016). With knowledge, students will understand mathematics as a whole.

The lack of connection ability is needed by factors that are less concerned with students to argue the real world which can improve the quality of student learning. This is consistent with the results of the Sulistyaningsih study (Arikunto, 2012) that discusses the ability of students in mathematical connections is still low, the ability of low mathematical connections will improve the quality of learning that leads to low learning achievement in school.

Sugiman (Sri Sugiarti Basuki, 2014) in his study entitled "Mathematical Connections in Mathematics Learning in Junior High Schools" in Yogyakarta, obtained research results that prove the ability to use mathematical connections of new students reached an average of 53.8%. Likewise, this Mathematical Connection will help students in developing mathematical models that also discuss the relationship between concepts and data or problems or understanding provided, based on an analysis of several writings. Sumarmo (Hendriana, Rohaeti, & Sumarmo, 2017) summarizes activities that involve connection tasks, namely, discussing equivalent representations in concepts, processes, procedures, relationships with mathematical topics, and relationships with other procedures in equivalent representations.

One alternative to support this according to Amir.M.T (2009:12) is to use problem-based learning where students are involved to solve problems through scientific phases. With steps: orienting students to problems, organizing students to learn, guiding individual/group experiences, developing and collecting work, and analyzing and improving problem-solving processes. Problem-based learning known as problem-based learning is learning that is designed for students who are able to solve problems to find solutions (Sariningsih & Purwasih, 2017). Meanwhile, according to a survey conducted by the Program for International Student Assessment (PISA) Wardani dan Rumiati (2011) found that 69% of Indonesian students were only able to discuss the theme of the problem but could not find a connection between the theme of the problem and that had been mediated.

In completing the ability of mathematical connections using the problem-based learning model students are also required to work independently or with self-regulated learning. Learning independence is a process of careful design and self-monitoring of cognitive and

affective processes in completing academic tasks. With independent learning students can combine academic learning and self-control student learning is more motivated to achieve independent learning goals, take responsibility for themselves in learning and build learning goals so that students are given freedom so that students are not depressed with the help of independent learning (Hadin, Muhammad Pauji, & Arifin, 2018). Furthermore, Sumarmo Utari (2014) detailed indicators of learning independence as follows: 1) Inisiatif learning, 2) Diagnosing learning needs, 3) Setting learning targets and objectives, 4) Supporting, renewing and supporting learning, 5) Diverting challenges as challenges, 6) Utilize and find relevant sources 7) Choose and use learning strategies, 8) Approve and learn, and 9) Have a self-concept. But the results of Trends in International Mathematics and Science Studies Mullis, Martin, Foy, & Arora, (2011:338) show the level of learning independence of Indonesian students is still low.

## METHOD

The research method used in this research is experimental research. According to Rusefendi (2010) experimental research is a study that is really to see the causal relationship. The treatment we do for the independent variables will be seen in the dependent variable. Learning with the problem-based learning model as an independent variable and the ability of mathematical connections as the dependent variable. In this study two random classes will be used, the experimental class and the control class. Class experiment class that gets problem-based learning while the control class uses learning with the expository approach. Both classes are given a pretest and posttest. given questions illustrate the ability of students' mathematical connections, the questions at posttest are equivalent to the questions given at pretest, According to Rusefendi (2010:50): With:

A 0 X 0

A 0 0

A: Sampling in a random class

0 : Pretest and Posttest Mathematical Connection Capabilities

X: Learning with a problem-based learning approach

The subjects in this study were all students of class VIII unior high school, the experimental class was class VIIIA who had problem-based learning, while class VIIIB had regular learning. The instrument of the question given is in the form of easy as many as 5 items of tests that describe the mathematical connection capabilities that have been tested for validity, reliability, power difference, and level of difficulty. As well as using a range of student activeness tests, then the results of the study were tested using spss.17 to determine whether or not it was significant.

## RESULTS AND DISCUSSION

### Results

The data in this study were obtained from pretest data, posttest data and normalized gain data. Pretest data was used to determine the ability before being given treatment and posttest data was used to determine students' abilities after being given treatment. While normalized gain data is used to see the improvement of students' mathematical connection abilities, which are obtained from the difference in pretest data with posttest data divided by the difference between pretest data with ideal maximum data of students' mathematical connection ability. From this data, the average value ( $\bar{x}$ ) and standard deviation (S) for each class can be seen in the following table.

**Table 1.** Description of Statistics of Students' Mathematical Connection Abilities

Variable		Experiment Class			Control Class		
Ability Connection Mathematical Students MTs		price	posts	N-Gain	price	posts	N-gain
	$\bar{x}$	11,8	21,9	0,62	10,9	13	0,12
	S	1,91	1,68	0,11	1,65	1,65	0,08
	N	20					

Based on the raw data presented in Table 1, it can be seen that the average data on the pretest connection ability of the experimental class is 11.8 and the control class is 10.9 so that the difference in the average value of the experimental class and control pretest is 0.9 difference from the data of the two classes show that the initial mathematical connection ability of the two classes is different. From these data also obtained a standard deviation for the initial ability of the experimental class of 1.91 and the control class of 1.65 means that in the experimental class the initial ability is slightly more diffuse than the control class for the provisions of the two classes with the same treatment.

In the posttest results, the average score of the experimental class posttest results is 21.9 and the average value of the control class posttest results is 13 so that the difference obtained from the average score of the posttest experimental class and the control class is 9.05. That the average value of the experimental class posttest results is better than the control class. In the experimental class, the average student gets the pretest of the ability of the mathematical connection of 11.8 from the average ideal value and posttest has increased to 21.9 Whereas in the control class, on average students get the pretest the mathematical ability of the initial connection is 10.9 from the average ideal value and posttest increased to 13 from the data obtained, it can be seen that in the experimental class mathematical connection ability had a greater percentage increase than the control class.

When viewed from the gain the experimental class looks bigger than the control class gain average. In general, it appears that there are differences in improving students' mathematical connection skills. It appears that the increase in mathematical connection skills of students who learn using the Problem Based Learning approach is better with a difference of 10.1, the average gain of 0.62 falls into the medium criteria rather than the one using ordinary learning with an average gain of 0.12 in into low criteria.

After the data were tested using SPSS 17 to see the difference in the two averages which began with the normality test, the normality test data proved above 0.05, 0.103 for the control class and 0.564 for the experimental class, then continued with homogeneity test after testing homogeneity data proved homogeneous above 0.05, which is 0.259, then proceed with the test of the difference in the two averages that appear in the following table:

**Table 2.** Difference Test Results for Two Average Ability Test Data Mathematical Connection

Class	$\bar{X}$	Sig.	Interpretation
Experiment	11,8	0,119	H0 is accepted
Control	10,9		

Used on Table 2, it can be seen that the significance value is more than 0.05, so H0 is accepted and it is concluded that there is no difference in the initial ability of MTs mathematical connection ability between those who get Problem based learning and those who get ordinary learning.

After analyzing the pretest data, it is done to test the results of posttest analysis with the results of the significant value of the posttest experimental class 0.104 and the control class 0.243, meaning that the posttest data significance values of the two classes are greater than 0.05. This indicates that the two samples are normally distributed. Furthermore, directly conducting a homogeneity test with the significance value of the homogeneity test is 0.173. That is, the significance value is greater than 0.05. This shows that the variants of the two samples are homogeneous and the final step tests the difference in the two averages as shown in the following table:

**Table 3.** Difference Test Results for Two Average Ability Postes Data Mathematical Connection

Class	$\bar{x}$	Sig.	Interpretation
Experiment	21,9	0,000	H0 is rejected
Control	13,0		

Based on Table 3, it can be seen that the significance value is 0,000. Because one party test is done, what is seen is Monte Carlo Sig. (1-tailed). This value is less than 0.05 so H0 is rejected. So, this means that after learning, the achievement of mathematical connection skills of students who use the problem-based learning approach is better than those who use ordinary learning on a significant level of  $\alpha = 5\%$ . After doing the pretest-posttest analysis, the N-gain analysis was then used. To find out whether the increase in mathematical connection ability of the experimental class students and the control class differed significantly or not, a statistical test was performed. With the results of the normality test of the control class 0.92 and the experimental class 0.94. After the homogeneity test with a result of 0.24, the results of the two different test averages are as follows:

**Table 4.** Average Two Difference Test Results N-gain data Mathematical connection capability

Class	$\bar{x}$	Sig.	Interpretation
Experiment	0,62	0,000	H0 is rejected
Control	0,12		

From the calculation of the data in table 4, a significant value for 2-tailed = 0.00. After that, we do a one-party hypothesis test  $H_a: \mu_1 < \mu_2$ , then the sig value (2 tailed) must be divided into two. to be = "r" =  $0,000 / 2 = 0,000$ . Because significant =  $0.00 < \alpha = 0.05$  then H0 is rejected, so it can be concluded that the increase in mathematical connection skills of students using Problem-based learning is better than students who use ordinary learning. Furthermore,

analyzing statistical tests at the same time as self-regulated learning with the results of trials that the two samples are not normally distributed, then non-parametric tests are carried out directly because in the test the difference between the two posttest averages is a one-sided hypothesis test,  $H_0$ . The Mann-Whitney test used in this study is (1 tailed) with the following results:

**Table 5.** Test Results for the Differences in Two Average Self-regulated Learning

Levene Statistic	Df	Mw	Sig.
<i>Asymp.sig.(1 tailed)</i>	20	164	0.33

Based on table 5 above, it can be seen that the significance value  $> 0.05$ , learning using self-regulated learning in the experimental class is better than the control class. The implementation of learning applied to students appears in the picture as follows:

**Discussion**



**Figure 1.** Student Orientation on Problems in learning steps, Grouping and guiding investigations, Presenting results of answers or discussions.

Figure 1 is a step in implementing learning that is applied when research in the field begins with student orientation to the problem, Fogarty (Fathin, 2016) said that the orientation of students in the problem is a stage of learning that is oriented to giving problems in the context of students' daily lives that are relevant to students' real life, giving these problems is related to one indicator of mathematical connections, namely linking mathematics with students' daily lives. At this stage the teacher submits questions to students given in the form of student activity sheets in the form of problems in Pythagorean material during learning student learning activities run systematically in the experimental class even though at the first meeting they still seem confused because students are still adapting to the learning applied by the teacher, while aiming carried by the problem based learning learning model requires students to play an active role in learning and students are required to be able to construct their own knowledge, trying to solve the problem given, in line with the opinion Rahmat (2015:12) states this is because students are not familiar with the learning model because students are still accustomed to conventional learning where the teacher dominates the learning process in the classroom.

At the grouping stage and guiding students' investigations the teacher organizes students giving problem questions to each group, each group works and understands the problem carefully. At the presentation stage, there are some students who are indifferent but at this stage, students can be overcome by the way the teacher provides a stimulus. at this stage students are required to train their independence by collaborating in groups, carried out with the aim of increasing learning independence, because these activities involve all aspects of

students' ability to recognize emotions themselves, recognize other people's emotions, motivate themselves, manage self emotions, fostering relationship with other people, the process of giving and receiving messages between group members, can generate potential, skills, patterns or more through certain channels by involving some influence and feedback. As said by Fatimah (Rista, 2016:3) in adolescence the development of independence is more psychological in nature, such as practicing learning to plan, choosing alternatives, making decisions, acting in accordance with his own decisions and being responsible for everything he does. So that work activities in one group play an important role to train the independence of students who are psychological in nature because the independence of a teenager can be strengthened through the process of socialization that occurs between adolescents and peers.

When the presentation is complete, the teacher asks the students who are listening to ask questions or argue if there are answers that are different from the results of the group discussion. At this stage of learning, students are encouraged to have the ability to solve problems in real situations. Students have the ability to build their own knowledge through learning activities. This is in line with Rohida (2016) introduce that problem-based learning is a learning process that is the starting point of learning based on problems in real life and then from this problem students are stimulated to study problems based on the knowledge and experience they have experienced before so that new knowledge and experience will be formed.

Besides the above, the advantages are in line with the opinion of Akinoglu (Purwanto, 2015:12) that "the advantages of problem-based learning are student-centered learning not on the teacher, the learning model develops student self-control, teaches prospective plans in dealing with reality and expresses emotions, this model allows students to see events in a multidimensional manner with more perspective, to developing student skills for problem-solving, encourage students to learn materials and new concepts in problem-solving, develop collaboration and communication skills of students that enable them to learn and work in groups ". This will encourage an increase in mathematical connection capabilities.

As for some of the difficulties students feel in solving the problem of mathematical connection skills are shown in the table as follows:

**Table 6.** Results of analysis of Student Mathematical Connection Capabilities

Information	Problem 1	Problem 2	Problem 3	Problem 4	Problem 5
Average	1,9	5,4	3,45	5,45	5,6
SMI	2	6	4	8	6
Percentage (%)	95	90	86,25	68,1	93
KKM	70				

Table 6 shows that for question 4 the average obtained by students is 5.45 and has a percentage of 68.1 from the results of the analysis of the answers to the experimental class students, still lacking in indicators of Pythagorean relationships with other fields of science other than mathematics. when solving mathematical connections, it is when students have to explain mathematical models or patterns. In addition, students have difficulty when making corrections independently or checking the truth of a statement or process, the lack of accuracy of students to solve problems and carelessness or lack of accuracy of students in the calculation, causing the answer to be incorrect. This is in line with research Gantinah (Julia, 2017:66) who concluded that the lack of mathematical connection skills in students was due to several factors such as a

lack of initial understanding of the subject matter and a lack of students preparing for the material. Besides learning mathematics, in general, is an exercise in working on many questions that are almost the same as examples, as a result, students' abilities do not develop, one of the students' answers can be seen in Figure 2 as follows:

4. Dik: Kecepatan Sampai = 2 m/s  
 Kecepatan Arus Air = 5 m/s  
 Dit: Tentukan besar dan arah resultan dari sampai?  
 Jawab:  $\sqrt{2^2 + 5^2}$   
 $= \sqrt{4 + 25}$   
 $= 29$

**Figure 2.** One of the answers to the experimental class students about question number 4

In Figure 2, students are lacking in describing the process of steps or procedures and cannot simplify the roots and lack the final conclusion, so it can be seen that the students' answers do not meet the answer criteria based on the indicator indicators listed even though the students' answers are slightly correct but there are some answers less precise that needs to be improved so that it can be concluded that students are still lacking in understanding or connecting between the relationship of mathematics with other sciences in mathematics.

In addition to Problem based Learning learning models can help mathematical connection skills but problem-based learning also has a relationship with learning independence because in these learning students are required to be independent as the opinion Tan (Rida Desnita Lutfitasari, 2017:4) Problem Based Learning is an innovation in learning because in Problem Based Learning students are required to study independently. Independence is one aspect of personality that is very important for individuals. Someone in living this life is never free from trials and challenges. Individuals who have high independence are relatively capable of dealing with all problems because independent individuals are not dependent on others. And from the results of research conducted by Permana dan Sumarmo (Sri Sugiarti Basuki, 2014) reported that students' mathematical connection skills through problem-based learning are classified as sufficient qualifications. So this learning model can develop mathematical connection skills.

## CONCLUSION

Achieving mathematical connection skills of students who learn using the Problem-based learning approach is better than using ordinary learning. Improving the ability of mathematical connections of students who learn to use problem-based learning is better than using ordinary learning, Learning Independence students who learn to use problem-based learning better rather than using ordinary learning, the implementation of learning steps that use problem-based learning can develop mathematical connection skills and student learning independence. Difficulties experienced by students in solving mathematical connection skills in indicators understand or connect the relationship between mathematics and other sciences in mathematics.

## ACKNOWLEDGMENTS

For this research, the researcher would like to thank the various parties who have helped in the research process to completion, our supervisors who have helped the research process from beginning to end, to the Leaders and Teachers of the MTs Al-Hikmah 02 Talegong-Garut school who have provided opportunities to carry out research, to colleagues in arms who have helped with the research process and its support.

## REFERENCES

- Amir.M.T. (2009). *Inovasi Pendidikan Melalui Problem Based Learning*. Jakarta: Prenada Media Group.
- Arikunto. (2012). *Penilaian Pembelajaran Matematika*. Bandung: Reflika Aditama.
- Fathin. (2016). Pengaruh Pendekatan Problem Based Learning Terhadap Kemampuan Pemahaman dan Koneksi Matematis Siswa Pada Materi Perbandingan. *Jurnal Pena Ilmiah UPI*.
- Fauzi, K. M. A. (2016). Peningkatan kemampuan koneksi matematis dan kemandirian belajar siswa dengan pendekatan pembelajaran metakognitif di sekolah menengah pertama. *Digital Repository Univerdsitas Negeri Medan*.
- Hadin, H., Muhammad Pauji, H., & Arifin, U. (2018). Analisis Kemampuan Koneksi Matematik Siswa Mts Ditinjau dari Self Regulated Learning. *Jurnal Pembelajaran Matematika Inovatif*, 1(4), 657–666.
- Hakim.M.A.A. (2013). *Meningkatkan Kemampuan Koneksi matematik SMP*. STKIP Siliwangi Bandung.
- Hendriana, H., Rohaeti, E., & Sumarmo, U. (2017). *Hardskill dan Sotskill Matematika Siswa*. Bandung: Reflika Aditama.
- Mullis, Martin, Foy, & Arora. (2011). *Tingkat Kemandirian Belajar di Indonesia*. Jakarta: Iternasional Mathematic and Science.
- Purwanto. (2015). Model Pembelajaran Problem Based Learning Untuk Meningkatkan Komunikasi dan Koneksi Matematik. In *Artikel Tesis UNPAS* (p. 12). Bandung: UNPAS.
- Rahardjo, S. (2016). Analisis Kemampuan Koneksi Matematis Siswa Kelas VII pada Materi Teorema Pythagoras. *Prosiding Konferensi Nasional Penelitian Matematika Dan Pembelajarannya (KNPMP) I 2016*, 1(Knpmp I), 377–384.
- Rahmat. (2015). Efektifitas Penggunaan Model Guided Discovery Learning Ditinjau Dari Pemecahana Masalah Matematika Siswa. *Jurnal FKIP UNILA*.
- Rida Desnita Lutfitasari. (2017). Implikasi Pembelajaran Problem Based Learning Untuk Meningkatkan Kemampuan Pemecahan Masalah dan Representasi Matematis Ditinjau Dari Kemandirian Belajar Siswa. *Jurnal UNPAS Bandung*.
- Rista. (2016). Meningkatkan Belajar Kemandirian Siswa Dengan Menggunakan Layanan Konseling Kelompok. *Jurnal FKIP UNILA*.
- Rohida, I. (2016). *Meningkatkan Pemahaman dan Koneksi Matematis Serta Minat Belajar SMA Melalui Model Pembelajaran Problem Based Learning*. STKIP Siliwangi.
- Rusefendi, E. . (2010). *No Title Dasar-Dasar Penelitian Pendidikan dan Bidang Eksakta*. Bandung: Tarsito.
- Sariningsih, R., & Purwasih, R. (2017). Pembelajaran Problem Based Learning untuk Meningkatkan Kemampuan Pemecahan Masalah dan Self Efficacy Mahasiswa Calon Guru. *Jurnal Nasional Pendidikan Matematika*, 1(1), 163–177.
- Siagian, M. D. (2016). Kemampuan Koneksi Matematik dalam Pembelajaran Matematika. *Journal of Mathematics Education and Science*, 2, 58–67.

- Sri Sugiarti Basuki. (2014). Mosharafa Jurnal Pendidikan Matematika Volume 3, Nomor 3, September 2014. *Jurnal Pendidikan Matematika*, 3(September), 151–158.
- Sumarmo Utari. (2014). Pengaruh Pembelajaran Bebas Masalah dengan Seting Kooperatif Jigsaw Terhadap Kemampuan Koneksi Matematis Serta kemandirian Belajar SMA. Yogyakarta: Seminar Pendidikan Matematika.
- Wardani, S., & Rumiati. (2011). *Instrumen Hasil Penilaian Belajar Matematika SMP*. Yogyakarta: Badan Pengembangan Sumber Daya Manusia Pendidikan dan Penjaminan Mutu Pendidikan.