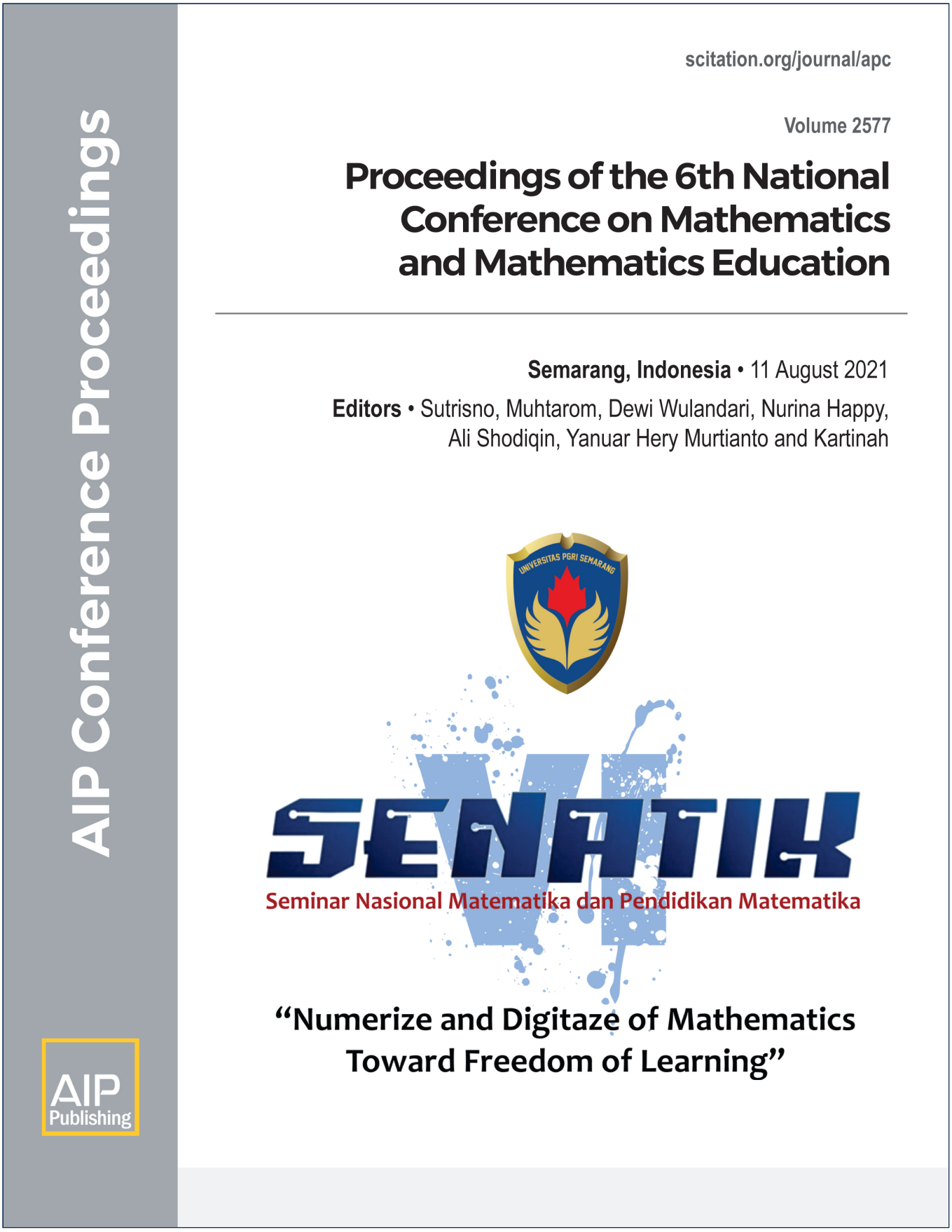

July 2022

PROCEEDINGS OF THE 6TH NATIONAL CONFERENCE ON MATHEMATICS AND MATHEMATICS EDUCATION

RESEARCH ARTICLE | JULY 13 2022

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AIP Conference Proceedings 2577, 020073 (2022)
https://doi.org/10.1063/5.0096046

Student's Self Concept, Self Regulated Learning, and Resilience Mathematics During the Covid 19 Pandemic in Indonesia

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Abstract. The Covid 19 pandemic that has occurred throughout the world, including Indonesia, is a global disaster that was never expected to happen. The Indonesian government is making all efforts to slow down the spread of this virus. Vaccination programs, regional quarantines, and restrictions on community social activities are some of the efforts made. Then again, adaptation efforts to the ongoing pandemic and in the context of the economic recovery of the community, on June 1, 2020, the Indonesian government began to develop a new normal life order policy scenario in the midst of the COVID-19 pandemic situation. . One that is quite affected is the field of education where learning must change from face-to-face to online learning. The study used a qualitative descriptive method. The purpose of this study was to describe the mathematical self-concept, self-regulated mathematics learning, and mathematical resilience of students related to mathematical problem-solving abilities in mathematical modeling courses. The research subjects were students of the Mathematics Education Study Program which were divided into eight categories based on high and low categories in each variable. This study indicates that students with negative mathematics self-concept have a significant effect on students' mathematics self-regulated learning than others. Students with high mathematical resilience had better problem-solving abilities than students with low mathematical resilience.

INTRODUCTION

The COVID-19 pandemic in Indonesia, which has lasted for the last two years, has massively changed the way people live. As an effort to adapt to the ongoing Covid-19 pandemic, the Indonesian government has swiftly set up a new normal life order policy in all aspects. Through Presidential Regulation Number 82 of 2020 which was amended by Presidential Regulation Number 108 of 2020 concerning the Covid 19 Committee and National Economic Recovery, a new normal life order scenario was prepared in the midst of a pandemic in Indonesia [1]. Included in the scenario is the implementation of learning in schools. Learning that is usually done face-to-face in class is now turning to distance learning which is done online. This transition period is a difficult time, because all components of learning, including teachers, parents, students, and principals, need to quickly prepare tools, facilities, infrastructure, and self-preparedness to support distance learning success.

According to Rina and Taufiq [2] through their research on the implementation of online learning during the Covid pandemic in West Java Province, there were several obstacles found in the implementation of distance learning including for teachers the main obstacle was in preparation for learning, and difficulties controlling students during learning . As for schools, the impact of distance learning is curriculum targets that are not achieved and moral

Proceedings of the 6th National Conference on Mathematics and Mathematics Education
AIP Conf. Proc. 2577, 020073-1–020073-6; https://doi.org/10.1063/5.0096046
Published by AIP Publishing. 978-0-7354-4360-0/$30.00

assessment is difficult to do. For students, the obstacles faced are the difficulty of solving problems in learning materials and the difficulty of finding information about learning [3]. Adnan and Anwar [4] stated that online learning proving is helpful in safeguarding students and faculty's health midth the Covid-19 pandemic, however it is not as effective as conventional learning. The research data shows that 78.6% of respondents from university students felt that conventional classes were more effective as compared to online learning.

Factors that affect the effectiveness of learning mathematics, especially in students' ability to solve problems, are students' self-readiness to face changes in learning methods. Self-concept, mathematics self regulated learning, and students' mathematical resilience. In the research of Nita Delima and Dian Cahyawati on self-concept and student mathematics self regulated learning, it was stated that during the Covid 19 pandemic, students' mathematical self-concept directly affected students' mathematics self regulated learning [5].

According to Hidayat, in addition to the self-concept of mathematics and mathematics self regulated learning, one of the attitudes that are a factor in influencing the success of a person learning mathematics is mathematical resilience [6]. Mathematical resilience is the ability of students to survive when faced with difficulties, collaborate collaboratively, and express understanding in mathematical language [7]. Mathematical resilience is a mathematical ability that shows endurance and flexibility when studying mathematics [8]. Mathematical resilience can be described as a student's "struggle" in dealing with and overcoming mathematical problems[9]. According to Agusmanto & Tutiarny [8], when students with mathematical resilience have difficulty in solving mathematical problems, students will still have confidence that in the end Wilder & Lee [7] stated that there are four factors in mathematical resilience, namely: (1) brain ability that can be grown, (2) personal understanding of mathematical values, (3) understanding of how to work in mathematics, and (4) awareness of peer support and other supporting facilities. Thornton & Satton [10] identify five key aspects of mathematical resilience, namely: (1) mindset development which is shown through behavioral changes such as learning from mistakes, (2) has metacognition that is displayed through a willingness to reflect on answers and solving processes. problems, (3) have the ability to adapt, which is shown through the ability to adapt, which is shown through the ability to try new strategies or start again, (4) have the interpersonal aspect, which is shown through the effort to ask critical questions due to awareness of the lack of knowledge possessed, and (5) have a sense of purpose which is indicated by the students' desire to find the meaning of their learning. In comparison, Sugiono [11] is in line with Wilder and Lee [7]. He stated that mathematical resilience is the ability of students to survive when faced with difficulties, collaborate collaboratively, and express understanding in mathematical language.

METHOD

The type of research used in this research is descriptive qualitative. This research was carried out on students of the STKIP PGRI Nganjuk Mathematics Education Study Program in the fourth semester of the 2020/2021 academic year. Several stages in this research are: research preparation stage, data collection and analysis stage, and report preparation stage.

At the preparatory stage, the following activities were carried out: (1) reviewing theories about mathematical self-concept, mathematics self regulated learning, and mathematical resilience of students related to problem solving abilities, as well as studies on the effectiveness of learning during the Covid 19 pandemic in Indonesia and the factors that influence it. The results of the theoretical study aroused the curiosity of researchers of mathematical self-concept, mathematics self regulated learning, and mathematical resilience of students of the Mathematics Education Study Program of STKIP PGRI Nganjuk in the mathematical modeling course. (2) Conduct pre-research in the form of distributing online questionnaires via google form to fourth semester students of Mathematics Education study program STKIP PGRI Nganjuk to obtain an overview of researchers of mathematical self-concept, mathematics self regulated learning, and mathematical resilience of students, then compared with theoretical studies so that this activity encourage researchers to propose research problems. (3) To answer the problem, the researcher conducted a qualitative descriptive study. This study aims to describe the mathematical self-concept, mathematics self regulated learning, and mathematical resilience of students in solving mathematical problems in mathematical modeling courses. As a data collection tool, the researcher drafted an auxiliary instrument in the form of a written test of solving mathematical problems and interview guidelines, while to obtain the categories of mathematical self-concept, mathematics self regulated learning, and mathematical resilience, a questionnaire was prepared based on the theoretical studies that had been carried out. The Mathematics Self Concept questionnaire used consists of 9 statements with alternative answers on a Likert scale with 5 answer choices. This questionnaire is the result of adaptation and modification of the MSC questionnaire proposed by Githua & Mwangi (2003). This questionnaire has a validity coefficient of 0.529 successively; 0.392; 0.302; 0.463; 0.356; 0.381; 0.314; 0.353; 0.416 with a reliability coefficient of 0.536; So it can

be said that this questionnaire has a good reliability with all valid statement items to be used as an MSC measurement instrument. Meanwhile, the Mathematics Self Regulated Learning questionnaire consisted of 13 statements with 5 alternative answers on a Likert scale. This questionnaire is the result of adaptation and modification of the MSRL questionnaire proposed by Purdie et al. (1996) where the coefficient of the validity of each statement item in this questionnaire was respectively 0.586; 0.699; 0.642; 0.572; 0.517; 0.408; 0.503; 0.599; 0.410; 0.681; -0.161; 0.561; 0.569 with a reliability coefficient of 0.792. Thus, the Mathematics Self Regulated Learning questionnaire has excellent reliability, and all statement items in the questionnaire are valid to be used as a Mathematics Self Regulated Learning measurement instrument (4). After all the auxiliary instruments were valid, the researcher applied for a research permit at LPPM STKIP PGRI Nganjuk.

The following activities were carried out at the data collection and analysis stage: (1) selecting research subjects that met the subject selection criteria for the fourth-semester students of the Mathematics Education Study Program, STKIP PGRI Nganjuk, to complete the mathematical problem-solving test of the first mathematical modeling course. (2) The researcher analyzed the subject's written test results and then conducted the first interview via WhatsApp video call with the subject to clarify the answers given. Based on the results of this analysis, the research subject data was obtained for the first task-based interview. After a few days, the researcher gave a second mathematical problem-solving test in the mathematical modeling course, which was similar to the mathematical problem-solving test in the first mathematical modeling course, to the same subject. The results of the second problem-solving written test were analyzed, and then a second interview was conducted via WhatsApp video call with the subject to clarify the answers given. Based on the results of this analysis, the research subject data was obtained for the second task-based interview. (3) Next, time triangulation was carried out by comparing the first and second task-based interview data analysis results. If there is no significant difference between the first and second data, then the data is said to be valid. The valid data were then re-analyzed in more depth to obtain conclusions about the mathematical self-concept, self-regulated mathematics learning, and mathematical resilience of the students of the Mathematics Education Study Program of STKIP PGRI Nganjuk in the mathematical modeling course.

The subjects in this study were 28 students of the fourth semester of the Mathematics Education Study Program, STKIP PGRI Nganjuk, for the Academic Year of 2020/2021. The subject selection technique used the purposive sampling method. The criteria for selecting the subject of this research are: (1) being in a mathematical modeling course, (2) being in the category of mathematical self-concept, self-regulated mathematics learning, and mathematical resilience to be studied, namely high and low categories, (3) being able to communicate their thoughts orally well written.

Determination of subjects divided into eight categories, namely (1) subjects with high mathematical self-concept, high mathematics self regulated learning, and high mathematical resilience, (2) subjects with high mathematical self-concept, high mathematics self regulated learning, and low mathematical resilience, (3) subjects with high mathematical self-concept, low mathematics self regulated learning, and high mathematical resilience, (4) subjects with high mathematical self-concept, low mathematics self regulated learning, and low mathematical resilience, (5) subjects with low mathematical self-concept, high mathematics self regulated learning, and resilience high mathematics, (6) subjects with low mathematical self-concept, high mathematics self regulated learning, and low mathematical resilience, (7) subjects with low mathematical self-concept, low mathematics self regulated learning, and high mathematical resilience, and (8) subjects with mathematical self-concept low, low mathematics self regulated learning, and low math resilience. The relationship between variables is described in Table 1.

TABLE 1. Relationship between variables and determination of research subject categories.

Mathematical self-concept	Self Regulated Learning	Mathematical Resilience	
		High (1)	Low (2)
High (1)	High (1)	X_{111}	X_{112}
	Low (2)	X_{121}	X_{122}
Low (2)	High (1)	X_{211}	X_{212}
	Low (2)	X_{221}	X_{222}

Based on the above categories in this study obtained as many as 8 research subjects. The data in this study are in the form of information or descriptions describing the research subject's self-concept, learning independence, and mathematical resilience. Sources of data were obtained from learning observations, written results of student work when working on problem-solving tests, and oral data in the form of recorded interviews between subjects and researchers to obtain confirmation of the subject's written answers and dig deeper into the information needed by researchers. In qualitative research, data is collected directly by the researcher. So that the main research instrument

is the researcher himself as the interviewer who is assisted by auxiliary instruments in the form of a questionnaire for classifying the categories of mathematics self-concept, independent learning, mathematical resilience, problem-solving test questions for mathematical modeling courses, and interview guidelines.

After all the instruments were validated, then the instrument was used as a tool to collect data. The data collection technique in this study was task-based interviews. In addition to collecting written data and interview results, the subject's behavior in solving problems was also observed. A voice recorder is used to facilitate data collection. After the data has been collected, coding is carried out according to the Polya type problem-solving indicators; then it is concluded how the problem-solving abilities in the mathematical modeling course of each research subject category are. The data obtained were used to answer the formulation of the research problem. The validity of the data was tested using a time triangulation test. The data analysis phase includes data reduction, data presentation, and drawing conclusions or verification. At the data reduction stage, the researcher summarizes, looks for themes and patterns, and removes unnecessary things from data collection results. Data collection was obtained directly by researchers from the subject in the form of written work and in-depth interviews through task-based interviews. After data from the results of the first task-based interview and data from the second task-based interview were collected, the results were analyzed with complete transcripts, then categorized according to the research focus, namely mathematical self-concept, learning independence, and mathematical resilience of students in problem-solving in mathematical modeling courses. The test is presented based on the steps for solving the Polya type problem as shown in Table 2.

TABLE 2. Step of problem solving

Stage	Step of Problem Solving (Polya)
1	Understand the problem
2	Make a plan for solving mathematic problem
3	Execute a plan for solving mathematic problem
4	Reflection the answer

After the data is reduced, the data that has been categorized based on predetermined indicators from each subject is then presented in narrative text and tables. This presentation shows how mathematical self-concept, learning independence, and mathematical resilience of students in solving problems in mathematical modeling courses from each subject category. From the data that has been presented, conclusions are then made according to the problem-solving indicators in the mathematical modeling course that have been determined to describe the mathematical self-concept, learning independence, and mathematical resilience of each subject category. The conclusions of data analysis from the results of the first task-based interview and data from the results of the second task-based interview were then compared so that conclusions were obtained about mathematical self-concept, learning independence, and mathematical resilience of students of the Mathematics Education Study Program STKIP PGRI Nganjuk in solving problems in the mathematical modeling course.

RESULT AND DISCUSSION

This study aims to describe the mathematical self-concept, mathematics self-regulated learning, and mathematical resilience of students related to mathematical problem-solving abilities in mathematical modeling courses. To see the categories of mathematical self-concept, mathematics self-regulated learning, and mathematical resilience of each student, the scores from the questionnaire for each variable are grouped according to Table 3.

TABLE 3. Distribution of students' mathematical self-concept, mathematics self regulated learning, and mathematical resilience

Variable	Interval	Category	%
Mathematics Self Concept (Nita & Dian, 2021)	$1.00 \leq MSC \leq 3.00$	Negative	17.9
	$3.00 \leq MSC \leq 5.00$	Positive	25.0
Mathematics Self Regulated Learning (MRSL) (Cakir *et al.,* 2016)	$1.00 \leq MSRL \leq 2{,}35$	Low	10.7
	$3.70 \leq MSRL \leq 5.00$	High	42.9
Resilience Mathematics	$109 \leq RM \leq 140$	Low	7,1
	$171 \leq RM \leq 202$	High	46,4

From Table 3, it appears that most of the subjects have a positive Mathematics Self Concept. Only a small percentage of students have negative Mathematics Self Concepts during online learning during the Covid-19 pandemic. In the Mathematics Self Regulated Learning variable, it appears that most of the subjects have high Mathematics Self Regulated Learning. Self-regulated learning can help students to form better study habits and strengthen their learning abilities [12]. This data supports one of the main goals of higher education: creating lifelong learners who are independent and have self-regulated learning in finding, maintaining, and processing knowledge [13]. In line with Maksum and Lestari [14], Dina and Nugraheni [15], found that the self-regulated learning profile of the students studied was at a good and good level. This study also showed that 42.9% of students had self-regulated mathematics learning at a high level. Sudiana *et al*. [16] showed that students who received learning with virtual class were higher than students who received conventional learning. This research took place during the Covid-19 pandemic, where classroom learning was conducted online. Online learning during the Covid-19 pandemic was able to increase student self-regulated learning [17].

Furthermore, students' mathematical resilience in problem-solving can be seen from Table 2 that 46.4% of students have a high level of mathematical resilience and 7.1% of students have a low level of mathematical resilience. In relation to problem-solving, based on the results of the first and second task-based interviews, it was found that students with high mathematical resilience had better problem-solving abilities than students with low mathematical resilience. Students with high mathematical resilience are able to identify problems by writing down information obtained from the problem clearly and completely, able to describe the condition of the problem using pictures clearly and completely and understand well the intent of the problem, able to connect different elements of information obtained, able to apply previously learned mathematical concepts to create new knowledge that is useful in achieving solutions, and able to propose alleged problem-solving strategies but are not yet complete. The findings in this study are that in students with high resilience, in addition to being able to meet the five indicators mentioned above, the subject is also able to meet other problem-solving indicators, namely being able to test assumptions in accordance with problem solving strategies that have been prepared appropriately and using relationships that have been identified. has been made to reach a solution, able to compile evidence against the solution obtained by writing down the calculation process in a systematic, complete, and clear manner so as to produce the right solution, able to provide logical reasons for the solution obtained, and able to draw conclusions appropriately. This is in line with research that has been done previously by Rahmatia and Miatun [18], where students who have high resilience have better problem solving skills and are confident when faced with various problems, while students with moderate resilience are still lacking in solving mathematical problems because have not been able to achieve systematic steps, are less thorough, and tend to give up quickly when faced with difficult questions.

Furthermore, from the results of task-based interviews, conclusions were obtained about mathematical self-concept, learning independence, and mathematical resilience of students of the Mathematics Education Study Program STKIP PGRI Nganjuk in solving problems in the mathematical modeling course as shown in Table 4.

TABLE 4. Mathematics Self-Concept, Mathematics Self Regulated Learning, and Student Mathematical Resilience in Problem Solving Mathematical Modeling Courses

Stage	Step of Problem Solving (Polya)	Subject Categories							
		1	2	3	4	5	6	7	8
1	Understand the problem	✓	✓	✓	✓	✓	✓	✓	✓
2	Make a plan for solving the mathematic problem	✓	✓	✓	✓	✓	✓	✓	✓
3	Execute a plan for solving the mathematic problem	✓	✓	✓		✓	✓	✓	
4	Reflection the answer	✓	✓	✓		✓			

CONCLUSION

The findings in this study are that Mathematic Self Concept, Mathematics Self Regulated Learning, and Mathematics Resilience high in addition to being able to apply four steps of mathematical problem solving, are also able to meet other indicators of mathematical problem solving, namely being able to test assumptions in accordance with problem-solving strategies that have been prepared appropriately and using relationships- relationships that have

been made to reach a solution, able to compile evidence of the solution obtained by writing down the calculation process in a systematic, complete, and clear manner so as to produce the right solution, able to provide logical reasons for the solution obtained, and able to conclude appropriately.

ACKNOWLEDGMENT

The author's gratitude goes to all STKIP PGRI Nganjuk Mathematics Education Study Program students in the fourth semester of the 2020/2021 academic year who volunteered to respond to this research instrument.

REFERENCES

1. Peraturan Presiden Tentang Komite Covid 19 dan Pemulihan Ekonomi Nasional, Number 108, Jakarta (2020)
2. R. Mutaqinah and T. Hidayatullah. J. PETIK. **6**, 86 - 95 (2020)
3. K. D. Yuangga and D. Sunarsi, J. Guru Kita **4**, 19 – 29 (2020)
4. A. Muhammad and A. Kainat. J. Pedagog. Sociol. Psychol. **2,** 45 – 51 (2020)
5. N. Delima and D. Cahyawati, J. Pendidik. Mat. **15,** 102 – 114 (2021)
6. W. Hidayat. KALAMATIKA J. Pendidik. Mat. **2**, 15-28 (2017)
7. S. J. Wilder and C. Lee. Open Research Online University of Warwick (2010), available at https://www.m-a.org.uk/resources/downloads/4C-Mel-Muldowney-Developing-Mathematical-Resilience.pdf
8. A. J. B Hutauruk and T. Naibaho. SEPREN J. Math. Educ. Appl. **2**, 78 – 91 (2020)
9. H. C. Waxman, J. P. Gray, and Y. N. Padron. Berkeley, Center for Research on Education, Diversity, and Excellence Research Report (2003)
10. S. Thornton and J. Statton. "Developing mathematical resilience among aboriginal students," In *Mathematics education: Expanding Horizons Proceedings of The 35th Annual Conference of The Mathematics Education Research Group of Australasia*, edited by J. Dindyal, L. P. Cheng, and S. F. Ng (MERGA, Singapore, 2012).
11. Sugiyono. *Metode Penelitian Pendidikan* (*Pendekatan kuantitatif, kualitatif, dan R&D*) (ALFABETA, Bandung, 2013). P. 337.
12. C. A. Wolters and M. Hussain, Metacognition Learn. **10,** 293–311 (2015).
13. M. A. Jado, J. Educ. Pract. **6**, 89–104 (2015)
14. A. Maksum and I. Lestari, Parameter J. Pendidik. **32,** 75–86 (2020)
15. D. Dina and A. R. E. Nugraheni, J. Inov. Pendidik. Kimia **11,** 1921 –1931 (2017)
16. R. Sudiana, A. Fatah, and E. Khaerunnisa, J. Penelit. Pembelajaran Mat. **10,** 312-318 (2017)
17. A. Sadikin and A. Hamidah. BIODIK: J. Ilm. Pendidik. Biologi **6,** 214–224 (2020)
18. R. Rahmatiya and A. Miatun. J. Teorema Teor. Ris. Mat. **5**, 187 – 202 (2020)