



Pre-service teacher's mathematical disposition through problem-solving and problem-posing based ignatian pedagogy

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Abstract

Mathematical disposition is an important aspect that pre-service teachers must master to determine the success of mathematics learning. The objectives of this study were to show the statistical description and verify the research hypothesis regarding the comparison between problem-solving and problem-posing integrated with ignatian pedagogy as a novelty toward Elementary School Teacher Education students. Using a quantitative approach involving 84 students consisting of 9 males and 75 females as participants, used a comparison test between two learning models. The results of the parametric prerequisite test showed the value of Sig. < 0.05 for normality and Sig. > 0.05 for homogeneity. However, data analysis can not be continued parametrically but was tested using Mann-Whitney U (non-parametric). The hypotheses test results concluded that H_0 was accepted or there was no significant difference from the state of the students' mathematical disposition either using problem-solving or problem posing based on ignatian pedagogy. It was evidenced by the probability value, which showed 0.221, which was > 0.05. The implications of this study directly recommend using appropriate learning models to improve the mathematical dispositions of pre-service teachers.

Keywords: ignatian pedagogy; mathematical disposition; problem-posing; problem-solving

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Introduction

The student's ability, like creative thinking skills, innovation, collaborative and communicative mentality, and open-mindedness, are attention at the moment (OECD, 2016). Mathematics learning is one of the media to instill these abilities (Pramudiani et al., 2017). Besides being taught about theory, it is also taught about being positive in mathematics (Chlothilda et al., 2022). However, many orientations from ordinary people think that successful mathematics learning is those who get high cognitive scores (Suwito et al., 2021; Quraisy & Madya, 2021). At the same time, attitude in mathematics is more important for students because it relates to their success in learning mathematics (Lindawati, 2018).

Furthermore, mathematics is closely related to an affective aspect, and near an idea, a series of processes and reasoning to think logically, analytically, systematically, and critically, and workability also gives positive attention to mathematics (Kusumawardani et al., 2018; Purnomo, 2017). However, the reality contradicts the previous statement before. The researcher identified a number of issues with students as potential elementary school teachers, including their inability to pay attention during lectures, lack of interest in what they were learning, lack of confidence, which led to a lack of courage to express their opinions, and an automatic reduction in their critical attitudes toward solving problems in their studies. Some of these activities go against what is known as a mathematical disposition, which is a good attitude toward mathematics (Mandur et al., 2013). Mathematical disposition, namely a desire, conscious feeling, dedication, and a great tendency that comes from students to think and act mathematically in a positive way (Akbar et al., 2017; Supriadi, 2017). Mathematical disposition is one of the aspects that must be considered in learning mathematics because it is a determining factor for success in learning mathematics (Mandur, 2013). So, to lessen students' fear of mathematics, teachers must focus on affective components, too.

Mathematics is often regarded as a material that is quite difficult (Nurhikmayati, 2017). The analysis of students' difficulties in learning mathematics is categorized into concepts and principles (Cooney et al., 1975 in Nurhikmayati, 2017). Several studies have shown that not only elementary school students think mathematics is complex and full of challenges. Difficulties and challenges are experienced at every level (Dirgantoro, 2019; Kereh et al., 2013; Özerem, 2012), and problems in learning should be overcome through models, methods, or other ways of learning.

The learning model is a pattern used to guide learning implementation, marked by the presence of stages or steps called syntax (Afandi et al., 2013). The learning carried out with the suitable learning model is expected to achieve the goal. Researchers examine several learning models that are close to the goal of increasing interest, self-confidence, problem-solving, and several other affective aspects. Among the several learning models are problem-solving and problem-posing learning models. Apart from being effective, this learning model is also in line with the times with problem-solving, where both models emphasize the process of formulating new problems by asking questions, resulting in problem-solving strategies (Divrik et al., 2020). Both models emphasize ways that allow students to be creative in class, so this model can potentially increase student mathematics achievement (Calabrese et al., 2022; Iriani & Hidayah, 2017).

Research on the topic of problem-solving and problem-posing has been carried out by Peng et al.(2018) and Simanjuntak et al.(2021). This study found that both models were effective in learning mathematics. In this case, the authors mean that the effectiveness in question comes from a cognitive, affective, and psychomotor perspective. This aligns with research conducted by Cai et al. (2019), which states that a learning model is needed to build aspects of the disposition to instill a mathematical disposition. So, by looking at the context of the problem-solving and problem-solving learning models studied, researchers find dispositional aspects in these models.

In addition to focusing on these two models, as a form of integration of the characteristics of Sanata Dharma University, researchers integrate an approach oriented towards student competence, namely Ignatian Pedagogy, as the novelty of this study. Ignatian pedagogy is an educational paradigm that uses the ignition method to direct individuals to find their God. This paradigm is applied in the learning process for students to understand more easily, increase their knowledge and better skills. Some special dynamics in learning based on pedagogical ignition are context, reflection, action, and evaluation (Suparno, 2019). The learning dynamics are applied by integrating human values close to mathematical abilities in terms of cognitive, affective, and psychomotor. According to Dominuco (in Hartana et al., 2016), integrated human values are 3C (competence, compassion, and conscience). That way, this research will focus on comparing the two models with the same orientation with a special approach as a feature of Sanata Dharma University, namely pedagogic ignition studied towards students' attitudes towards mathematics in elementary number and algebra lectures.

The correlation among the variables in this study lies in the value of the positive attitude that students must have. Mathematical disposition is oriented towards self-confidence, problem-solving skills, creative thinking, cooperation, and the application of mathematics in everyday life (Yaniawati et al., 2019). Some of these aspects are implicit in pedagogic ignition. Competence is related to creative thinking, problem-solving abilities, and the application of mathematics. Then, the value of compassion and conscience is related to collaboration carried out by students in discussion activities. The 3C value in pedagogic ignition will be integrated into the problem-solving and problem-posing syntax. Examples of integrating this syntax can be found in student discussion activities, problem-solving, and presentation activities that describe activities with a mathematical disposition orientation.

Interested in the value of ignatian pedagogy and mathematical disposition issues, researchers will conduct a more in-depth study. The several questions in this research are: 1). What is the statistical general description of the student's mathematical disposition? 2). Then, how is the comparison of the application of problem-solving and problem-posing models and their influence on students' mathematical dispositions? The hypothesis of this study is (H_0 = There is no significant difference between the use of problem-solving and problem posing learning models based on pedagogic ignition on students' mathematical dispositions, H_a = There is a significant difference between the use of problem-solving learning models and problem posing based on pedagogic ignition on mathematical dispositions. The objectives of this study were to describe students' mathematical dispositions and find out which learning model between the two models is more effective in supporting the development of students' mathematical dispositions.

Methods

Based on the research questions, this study used a quantitative method. To find out how big the difference of influence between the two models was, they were problem-solving and problem-posing based ignatian pedagogy. For the comparison test of two independent variables that differ from one dependent variable, researchers should use a parametric test, namely the independent t-test. However, in this study, the data should be tested in a normal distribution with homogeneous or heterogeneous characteristics.

The participants in this study were 84 Elementary School Teacher Education students, consisting of 9 males and 75 females at Sanata Dharma University, Yogyakarta, who came from two different classes. The criteria of these participants were students who took the numbers and algebra course with saturation sampling. The data distribution from participants consisted of 38 students from class D using the problem-solving model and 46 students from class B using the problem-solving model. The detailed distribution of participants in this study can be seen in Table 1.

Table 1. Distribution of research participants

Group/Model	Gender	
	Male	Female
Class D (Problem Solving)	1	37
Class B (Problem Posing)	8	38
Total	9	75
Participant total	84	

The cross-sectional survey method collected data by filling out a mathematical disposition questionnaire using a Likert scale of 1-4. Likert scale is considered suitable for measuring the attainment of attitudes (Sugiyono (2013)). The disposition questionnaire that was distributed consisted of 30 statement items representing each indicator, both positive and negative statements. The questionnaire was validated in content and construct using PCA analysis and tested for reliability with a Cronbach alpha value of 0.729. So, the reliability of this instrument was included in the high-reliability category. The questionnaire grid can be seen in Table 2.

Table 2. Mathematical disposition questionnaire grid

Indicators	Item (+)	Item (-)
Self-confidence (A1)	1, 4, 5	2, 3
Idea Exploration (A2)	7, 8, 9	6, 10
Persevere (A3)	11, 13, 14	12, 15
Attention and interest in learning (A4)	17, 18, 19	16, 20
High curiosity (A5)	21, 22, 23	24, 25
Appreciate the application of mathematics in everyday life (A6)	26, 27, 29	28, 30

The results of filling out the questionnaire were then analyzed statistically using the SPSS version 26 application. The first data analysis was carried out by conducting a prerequisite test for the parametric test, namely the Lilliefors test. The success of the normality test using the

standard significance value must be more than α (0.05). If the value of Sig. > 0.05, then the data can be said to be normal. Then, in this case, a homogeneity test of two variances is also carried out with the condition that if the value of Sig. > 0.05, then the data is said to be homogeneous. If the results of the prerequisite test are known, the next step is to determine the appropriate test according to the state of the data. Based on the results of the parametric prerequisite test, it was found that the data were not normally distributed because the Sig value <0.05. That way, researchers use the non-parametric Mann-Whitney U test as a substitute. More complete results will be explained in the results and discussion section.

Results

Disposition is often used to define each individual's behavior, attitudes, traits, and habits. Where the tendency of each individual is reflected in every activity they face, in this case, the learning activities carried out in class directly or indirectly also involve a disposition, including learning mathematics. Mathematical disposition is also defined as a habit or tendency to see mathematics as something logical or reasonable, understanding that mathematics is useful and valuable, coupled with belief in the persistence of learning mathematics. This is slightly different from the ideal definition previously described. Preliminary data from observations of learning activities in elementary number and algebra classes show that several indicators need improvement.

Based on the results of interviews with lecturers, observations of mathematics learning activities, and documentation studies of student learning outcomes that have been carried out in the preliminary study, researchers found obstacles to student attitudes that lead to mathematical dispositions. Students have owned the majority of aspects of disposition; it is just that a few notes as a result of this study are: 1) Factors that influence students' attitudes towards mathematics can be caused by early learning motivation, 2) Attitudes towards mathematics are related to activities and student learning outcomes, 3) Aspects of mathematical disposition that need to be optimized are self-confidence and curiosity. Seeing some existing indications, the researcher took the initiative to apply two learning models that led to the development of dispositional aspects. As explained in the introductory section, the researcher determines the choice of problem-solving and problem-posing models with several considerations of differences and similarities.

Furthermore, the integration of 3C (competence, conscience, and compassion) as values in pedagogic ignition is integrated into the problem-solving and problem-posing models. In the Lecture Program Unit (SAP), several activities that reflect these values are compassion and science, as reflected in student discussion activities. Because in discussion activities, humanity and conscience will certainly arise from students, there is potential for collaboration and mutual assistance. Then, the value of competence is reflected in the presentation activities. The researcher assumes that the competencies needed as prospective teachers are at least able to communicate well, and can be trained in presentation activities.

The results of applying the learning model of problem-solving and problem-posing based on pedagogic ignition can be observed through the observation sheet of learning implementation. From pre to closing, learning has been carried out according to the plan in (SAP). The difference in learning activities between ignition pedagogic-based problem solving

and ignatian pedagogic-based problem posing lies in the initial presence of the problem. In the problem-solving model, the teacher presents problems, while students present the problem posing problems. So, students make and complete the analysis results of the problems they find themselves in. Both involve discussion activities as an embodiment of syntax and compassion and conscience in pedagogic awareness.

After the learning activities of the two models were applied to different classes, the researcher gave a survey to fill in the student's mathematical disposition questionnaire. This is used to determine the significant development of students' mathematical disposition after participating in learning activities according to the treatment that has been given. The results of the descriptive analysis of Sanata Dharma University Elementary School Teacher Education students are shown in Table 3.

Table 3. Descriptive data of mathematical disposition state

Aspect	N	Mean	Mean of Each MD Indicator						SD	Min	Max
			A1	A2	A3	A4	A5	A6			
Problem-Solving	38	84.21	13.13	15.76	13.97	12.86	14.55	13.92			
Problem Posing	46	81.13	13.30	14.63	12.87	12.28	14.67	13.37			
Mathematical Disposition	84	82.52							8.165	63	106

Note: MD stands for Mathematical Disposition

Table 3 shows that the average result of completing the mathematical disposition questionnaire of 84 students was 82.52, with a standard deviation of 8.165. We can see that the average score of the student's mathematical disposition questionnaire who received treatment with the problem-solving learning model was higher than that of the class using the problem-posing model. The minimum score for both classes was identified as 63, and the maximum score was 106. Seeing this descriptive data condition, problem-solving models should be better for developing mathematical dispositions. However, researchers cannot conclude because there may be differences but not significant between the two models used. So, the researcher will continue with the normality and homogeneity tests in Table 4 and Table 5 as a prerequisite for the parametric test.

Table 4. Data normality test results

Aspect	Group/Model	Kolmogorov-Smirnov		
		Statistic	df	Sig.
Mathematical Disposition	Class D (Problem Solving)	0.163	38	0.012
	Class B (Problem Posing)	0.153	46	0.009

The distribution of the data obtained indicated that the distribution was not normal. We can see that the Sig values of the two variables are <0.05. Data from the problem-solving class get a Sig. 0.012, and the problem-posing class got a Sig. 0.009. Based on standards used in educational research and according to Sundayana (2016), if the value of Sig. < 0.05, it can be said that the data distribution is not normal. So, parametric tests cannot be used as a follow-up test to prove the research hypothesis. Instead, the researcher will answer the research hypothesis with the Man Whitney U non-parametric test.

Table 5. Data homogeneity test results

	Aspect	Levene Statistic	df1	df2	Sig.
Mathematical Disposition	Based on Mean	1.450	1	82	0.232
	Based on Median	1.692	1	82	0.197
	Based on the Median and with adjusted df	1.692	1	79.145	0.197
	Based on trimmed mean	1.475	1	82	0.228

From the results of the homogeneity test in Table 5, we can describe it based on the average value of the two classes of data obtained, which are homogeneous ($0.232 > 0.05$). Then, the analysis based on the median value is homogeneous ($0.197 > 0.05$). Likewise, the results of the data analysis based on the median with degrees of freedom (df) show that the value of Sig—data is in the homogeneous category. According to Sundayana (2016) and Sugiyono (2017), this is by the statement that the data is said to be homogeneous if the value of Sig. > 0.05 . So, overall, it can be concluded that the data is homogeneous. However, the researchers reviewed the requirements for carrying out parametric tests, namely that the data were normally distributed and homogeneous. If one of the prerequisite tests is not met, the researcher must use a non-parametric test.

Table 6. Comparison test results of problem-solving and problem-posing models

Aspect	Model	N	Mean Rank	Sum of Ranks
Mathematical	Class D (Problem Solving)	38	46.08	1751.00
Disposition	Class B (Problem Posing)	46	39.54	1819.00
	Total	84		
Mann-Whitney U Analysis	Mann-Whitney U		738.000	
	Asymp. Sig. (2-tailed)		0.221	

Table 6 shows the results of the non-parametric test to compare problem-solving and problem-posing learning models based on ignition pedagogics on the mathematical dispositions of Elementary School Teacher Education students at Sanata Dharma University. The analysis results show that each model group's average rating is 46.08 and 39.54. The class with the problem-solving model treatment has a higher average rating. This is also by the results of the previous description analysis in Table 3. The difference in the average rating of the two models is 6.54. This difference figure of 6.54 cannot be concluded to be significantly different. According to Sriwidadi (2011), the difference between the two population groups is significant if the Sig. < 0.05 . Probability value or Sig. The Mann-Whitney U test shows 0.221, which is > 0.05 ($0.221 > 0.05$). Relevant to the standards used in this study, the requirements for significance values in the non-parametric Mann-Whitney U test were also disclosed. Quraisy & Madya (2021), if the Sig value > 0.05 , then H_0 is accepted. Thus, the results of the hypothesis testing in this study concluded that there was no significant difference in the students' mathematical disposition either using the problem-solving model or problem-posing based on pedagogic ignition.

The first research question has been answered in Table 3, and answers to the second research question have been answered through analysis in Table 6 and proof of the hypotheses in this study. Several studies applying the same two models, namely problem-solving and problem-posing, have been widely applied. What makes this research different is integrating the cognitive pedagogic approach in the two models. So, the limitations of this study are relevant references to examine the relationship between the two models and mathematical dispositions.

Discussion

There is a clear difference based on the acquisition of the average mathematical disposition of the class using the problem-solving and problem-posing learning model that served in Table 3. The problem-solving class has a higher average score. We can also note that each disposition indicator studied also has differences. The idea exploration indicator scores higher than other indicators in problem-solving learning; in problem-posing, it ranks second. This means that, technically, to allow students to provide their creative ideas, both models are successful. In line with the research findings of Kapur (2015), problem-solving and problem-posing models can stimulate students to think critically and creatively in solving a problem. Simanjuntak et al. (2021) also found that the problem-solving model is more effective in increasing students' creative thinking skills.

In contrast to the idea exploration indicator, which shows a high average, indicators of student attention and interest in learning have a low average. The two models show scores of 12.86 and 12.28 in the lower category. Interest in learning mathematics is indeed a problem that is often faced. Putri et al. (2019) revealed that mathematics is considered difficult, and only a few students like it. This is one of the factors causing low student attention in learning mathematics. This also happened in the Numbers and Algebra class; the researcher also tried to conduct interviews with several students during their preliminary studies regarding their interest in mathematics. The majority said that their lack of attention to mathematics was because they had instilled the stigma that mathematics was difficult and impossible for them to do.

Apart from these two indicators of mathematical disposition, the researcher observed that other indicators were in moderate positions, such as self-confidence, curiosity, and appreciation of mathematics. Students' self-confidence in the problem-posing class shows a higher average. The researcher indicated that this happened because, in this model, students were free to determine their problems. That way, they are more confident to solve it. Akay & Boz (2010) revealed that by problem posing, students' self-confidence will improve. Self-confidence is undoubtedly related to self-confidence (Rezaei, 2012), and the two go hand in hand (Blanco et al., 2020). So, it can be found that with more freedom and participation in the problem-posing model, students are more confident in solving problems.

After analyzing each of the factors of mathematical disposition, we will discuss the mathematical disposition of the learning outcomes of complex problem-solving and problem-posing models. This analysis is related to the results of the research hypothesis, which states that there is no significant difference between the use of problem-solving and problem-posing learning models based on pedagogic ignition on students' mathematical dispositions (H_0). The research conducted by Rosli et al. (2013) also analyzes problem-solving and problem-posing in

the assessment of learning mathematics. The results show no significant difference in results between the application of the two models. Similar findings were also found in Suarsana et al. (2019) research, which examined the two models of learning outcomes with the conclusion that there was no difference.

Although there is no significant difference, this study shows an average difference. Differences in results between the two models were also found by Falach (2016) in his research entitled "Comparison of the Effectiveness of Problem Solving and Problem Posing Approaches in Learning Mathematics in Junior High School Students," which showed that problem-solving was more effectively applied to build mathematical understanding and reasoning abilities. The same findings were also found in the research of Gros et al. (2020), which reveals that problem-solving is an effective model for learning congruence material. The effectiveness of the problem-solving model was also found in this study, where problem-solving has a mean and mean rank superior to problem posing. However, after being examined with a mathematical disposition, the two models do not differ significantly and are still superior to the problem-solving model in their application. This can happen because the two models have similarities based on problems.

This is relevant to research conducted by Voica et al., which states that problem-solving and problem-posing are similar, but both provide different results in learning (Voica et al., 2020). In research conducted by Voica, both models were applied to foster teacher candidate self-efficacy. Differences in student responses are shown by students' self-confidence to express opinions or provide reports; this problem is in line with the background of this study. Students who take classes with the application of problem-solving can provide the right results in solving problems and provide strong motivation to students. However, in problem posing, students feel that they have vital freedom to express opinions so that they obtain much control and autonomy through the problem-posing model. Both have advantages and disadvantages in developing student effectiveness. The same thing happened in this study; based on the statistical test results, the two models had an average difference. Other supporting data that occurs based on the results of observations made by researchers shows that by problem posing, students look more active and confident because they can find and solve problems according to their experiences.

Previous research also discusses comparisons between problem-solving and problem-posing that have been carried out by (Peng et al., 2018) entitled "Reciprocal Learning in Mathematics Problem Posing and Problem Solving: An Interactive Study between Canadian and Chinese Elementary School Students." This study recognizes problem posing as a learning model that can improve students' intellectual because learning math using poses is easier to understand. In addition to problem posing, students' interest increases, where they can pose problems according to their experiences. Then, for the problem-solving learning model as a comparison, the results show that students are more cooperative with this model. Students are active in solving problems together. Student cooperation in problem-solving is necessary for developing values in the 21st century. This research is relevant because both models are used to develop effective students with an orientation toward attitudes and skills in the 21st century.

Ignatian pedagogic-based problem-solving and problem-posing models applied to develop students' mathematical dispositions are suitable for use. This is proven by the differences in the results of the preliminary study and the study's final results (pre and post-treatment). Based on statistical tests, the two also do not differ much from the average ranking

results. What is noteworthy in this study is that a few previous studies have examined the same dependent variable. So, in concluding, researchers rely on purely statistical test results from this study alone.

Conclusion

The problems encountered in this study include the disparity of mathematical dispositions as an essential aspect of learning mathematics. Researchers experiment by raising the learning model that has been studied containing aspects integrated with ignatian pedagogy as a novelty. The first finding in this research showed that problem-solving and problem-posing models had average scores of 84.21 and 81.13, respectively. From these responses, we can see that problem-solving is superior to be applied to students. Furthermore, researchers conducted a non-parametric test to prove the research hypothesis. From the results of this test, new findings were found as a result of research and proof of hypotheses. Based on the Mann-Whitney U test, the probability value or Sig. It shows the number 0.221, which is > 0.05 ($0.221 > 0.05$). From the results of this analysis, it can be concluded that H_0 is accepted or there is no significant difference from the state of the students' mathematical disposition either using problem-solving models or problem posing based on pedagogic ignition.

The results of this study have direct implications for mathematics learning activities, namely as a recommendation for learning models that can be applied to improve students' mathematical dispositions. However, the context of this research is limited to tertiary institutions which believe in the existence of Ignatian pedagogy as an approach and a characteristic of their learning. Because not all universities use this approach as a characteristic of learning.

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Conflicts of Interest

There is no potential for conflict of interest reported by the authors.

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Author Contributions

Yeni Fitriya: Conceptualization, writing-original draft, editing, and visualization; **Ali Mustadi:** Formal analysis and methodology; **Ikhlasul Ardi Nugroho:** Validation and supervision; **Andri Anugrahana:** Writing, review and editing.

References

- Afandi, M., Chamalah, E., & Wardani, O. P. (2013). *Model dan metode pembelajaran di sekolah [Models and methods of learning in schools]*. UNISSULA Press.
- Akay, H., & Boz, N. (2010). The effect of problem posing oriented analyses-II course on the attitudes toward mathematics and mathematics self-efficacy of elementary prospective mathematics teachers. *Australian Journal of Teacher Education*, 35(1), 59–75. <https://doi.org/10.14221/ajte.2010v35n1.6>
- Akbar, P., Hamid, A., Bernard, M., & Sugandi, A. I. (2017). Analisis kemampuan pemecahan masalah dan disposisi matematik siswa kelas XI SMA Putra Juang dalam materi peluang [Analysis of problem-solving abilities and mathematical dispositions of class XI SMA Putra Juang in the matter of opportunities]. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 2(1), 144–153. <https://doi.org/10.31004/cendekia.v2i1.62>
- Blanco, Q. A., Carlota, M. L., Nasibog, A. J., Rodriguez, B., Saldaña, X. V., Vasquez, E. C., & Gagani, F. (2020). Probing the relationship between students' self-confidence and self-efficacy while engaging in online learning amidst COVID-19. *Journal La Edusci*, 1(4), 16–25. <https://doi.org/10.37899/journallaedusci.v1i4.220>
- Cai, J., Robison, V., Moyer, J., Wang, N., & Nie, B. (2019). *Mathematical dispositions and student Learning : A metaphorical analysis AERA online paper repository. 2012*.
- Calabrese, J. E., Capraro, M. M., & Thompson, C. G. (2022). The relationship between problem posing and problem solving: A systematic review. *International Education Studies*, 15(4), 1-8. <https://doi.org/10.5539/ies.v15n4p1>
- Chlothilda, P., Tobu, J., & Hadisusanto, J. (2022). Analisis kecemasan matematis siswa SD dengan menggunakan neurosains kognitif [Analysis of elementary students' mathematical anxiety using cognitive neuroscience]. *November*, 336–343.
- Dirgantoro, K. P. S. (2019). Analisis kesulitan mahasiswa PGSD pada mata kuliah geometri [Analysis of the difficulties of PGSD students in geometry courses]. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 3(1), 13-26. <https://doi.org/10.33603/jnpm.v3i1.1008>
- Divrik, R., Mentiş Taş, A., & Pilten, P. (2020). Teachers' wiews on the problem-solving & problem-posing tasks in primary school mathematics textbooks. *Journal of Curriculum and Teaching*, 9(1), 73-85. <https://doi.org/10.5430/jct.v9n1p73>
- Falach, H. N. (2016). Perbandingan keefektifan pendekatan problem solving dan problem posing dalam pembelajaran matematika pada siswa SMP [Comparison of the effectiveness of problem solving and problem posing approaches in learning mathematics for junior high school students]. *PYTHAGORAS: Jurnal Pendidikan Matematika*, 11(2), 136-148. <https://doi.org/10.21831/pg.v11i2.10635>
- Gros, H., Thibaut, J. P., & Sander, E. (2020). Semantic congruence in arithmetic: A new conceptual model for word problem solving. *Educational Psychologist*, 55(2), 69–87. <https://doi.org/10.1080/00461520.2019.1691004>
- Hartana, A., Punajii, S., & Dedi, K. (2016). Penerapan strategi pembelajaran paradigma pedagogi igantian (reflektif) terhadap peningkatan hasil belajar dan motivasi berprestasi belajar ilmu pengetahuan alam (IPA) siswa kelas V sekolah dasar [Application of alternative (reflective) pedagogy paradigm]. *Jurnal Pendidikan: Teori, Penelitian dan Pengembangan*, 1(4), 765–779.
- Iriani, R., & Hidayah, N. (2017). The effect of problem posing and problem solving model on chemistry learning outcome. *5th South East Asia Development Research (SEA-DR) International Conference*, 100, 87–90. <https://doi.org/10.2991/seadric-17.2017.19>
- Kapur, M. (2015). The preparatory effects of problem solving versus problem posing on learning from instruction. *Learning and Instruction*, 39, 23–31. <https://doi.org/10.1016/j.learninstruc.2015.05.004>

- Kereh, C., Sabandar, J., & Tjiang, P. C. (2013). Identification of student learning difficulties in mathematical content on introduction to core physics. *Prosiding Seminar Nasional Sains Dan Pendidikan Sains VIII*, 4(1), 10–16.
- Kusumawardani, D. R., Wardono, & Kartono. (2018). Pentingnya penalaran matematika dalam meningkatkan kemampuan literasi matematika [The importance of mathematical reasoning in improving mathematical literacy skills]. *PRISMA, Prosiding Seminar Nasional Matematika*, 1(1), 588–595.
- Lindawati, S. (2018). Literasi matematika dalam proses belajar matematika di sekolah menengah atas [Mathematical literacy in the process of learning mathematics in high school]. *Jurnal Prinsip Pendidikan Matematika*, 1(1), 28–33. <https://doi.org/10.33578/prinsip.v1i1.18>
- Mandur, K. (2013). Kontribusi kemampuan koneksi, kemampuan representasi dan disposisi matematis terhadap prestasi belajar matematika peserta didik SMA swasta di kabupaten manggarai [The contribution of connection ability, representation ability and mathematical disposition . *E-Jurnal Program Pascasarjana Universitas Pendidikan Ganesha Program Studi Matematika*, 2.
- Mandur, K., Sadra, I. W., & I Nengah Suparta. (2013). Representasi , dan disposisi matematis terhadap prestasi belajar matematika [Representation, and mathematical disposition of achievement in learning mathematics]. *E-Journal*, 2(4), 65–72.
- Nurhikmayati, I. (2017). Kesulitan berpikir abstrak matematika siswa dalam pembelajaran problem posing berkelompok [Difficulties in students' abstract mathematical thinking in group problem posing learning]. *KALAMATIKA Jurnal Pendidikan Matematika*, 2(2), 159-176. <https://doi.org/10.22236/kalamatika.vol2no2.2017pp159-176>
- OECD. (2016). Skills matter: further results from the survey of adult skills. *OECD*, April 2014, 1–14.
- Özerem, A. (2012). Misconceptions in geometry and suggested solutions for seventh grade students. *Procedia - Social and Behavioral Sciences*, 55, 720–729. <https://doi.org/10.1016/j.sbspro.2012.09.557>
- Peng, A., Ezeife, A., & Yu, B. (2018). Reciprocal learning in mathematics education: An interactive study between two Canadian and Chinese elementary schools. *Comparative and International Education*, 47(1), 1-14. <https://doi.org/10.5206/cie-eci.v47i1.9323>
- Pramudiani, P., Oktafiani, A. F., Aziz, T. A., & Purnomo, Y. W. (2017). Enhancing conceptual knowledge about shape through realistic mathematics education. *The Journal of Innovation in Elementary Education*, 3(1), 31–38.
- Purnomo, Y. W. (2017). A scale for measuring teachers' mathematics-related beliefs: a validity and reliability study. *International Journal of Instruction*, 10(2), 23–38. <https://doi.org/10.12973/iji.2017.1022a>
- Putri, B. B. A., Muslim, A., & Bintaro, T. Y. (2019). Analisis faktor rendahnya minat belajar matematika siswa kelas V di SD negeri 4 gumiwang [Factor analysis of the low interest in learning mathematics for fifth grade students at public elementary school 4 gumiwang]. *Jurnal Educatio FKIP UNMA*, 5(2), 68–74.
- Quraisy, A., & Madya, S. (2021). Analisis nonparametrik mann whitney terhadap perbedaan kemampuan pemecahan masalah menggunakan model pembelajaran problem based learning [Mann Whitney nonparametric analysis of differences in problem solving abilities using problem based learning models]. *VARIANSI: Journal of Statistics and Its Application on Teaching and Research*, 3(1), 51–57. <https://doi.org/10.35580/variansiunm23810>
- Rezaei, A. (2012). Can self-efficacy and self-confidence explain Iranian female students' academic achievement? *Gender and Education*, 24(4), 393–409. <https://doi.org/10.1080/09540253.2011.630314>

- Rosli, R., Goldsby, D., & Capraro, M. M. (2013). Assessing students' mathematical problem-solving and problem-posing skills. *Asian Social Science*, 9(16 SPL), 54–60. <https://doi.org/10.5539/ass.v9n16p54>
- Simanjuntak, M. P., Hutahaean, J., Marpaung, N., & Ramadhani, D. (2021). Effectiveness of problem-based learning combined with computer simulation on students' problem-solving and creative thinking skills. *International Journal of Instruction*, 14(3), 519–534. <https://doi.org/10.29333/iji.2021.14330a>
- Sriwidadi, T. (2011). Pengujian mann whitney U pada analisis pengaruh pelatihan wiraniaga dalam penjualan produk baru [Testing Mann Whitney U on the analysis of the influence of sales force training in selling new products]. *Binus Business Review*, 2 No, 2, 751–762.
- Suarsana, I. M., Lestari, I. A. P. D., & Mertasari, N. M. S. (2019). The effect of online problem posing on students' problem-solving ability in mathematics. *International Journal of Instruction*, 12(1), 809–820. <https://doi.org/10.29333/iji.2019.12152a>
- Sugiyono. (2013). *Metode penelitian pendidikan (pendekatan kuantitatif, kualitatif dan R&D) [Educational research methods (quantitative, qualitative and R&D approaches)]*. Alfabeta.
- Sugiyono. (2017). *Statistika untuk penelitian [Statistics for research]*. CV ALFABETA.
- Sundayana, R. (2016). *Statistika Penelitian Pendidikan [Educational Research Statistics]*. CV ALFABETA.
- Suparno, P. (2019). Ignatian pedagogy paradigm to improve students competence, conscience, compassion, commitment and interest on physics research methodology course. *IJIET (International Journal of Indonesian Education and Teaching)*, 3(1), 50–57. <https://doi.org/10.24071/ijiet.v3i1.1714>
- Supriadi. (2017). *Kemampuan dasar matematika, kemampuan berpikir kritis, kreatif dan disposisi matematis [Basic mathematical ability, critical thinking ability, creative and mathematical disposition]*. Universitas Pendidikan Indonesia.
- Suwito, U. hasanah, Handayani, A. D., & Yohanie, D. D. (2021). Kemampuan pemecahan masalah dan disposisi matematis pada materi kubus dan balok ditinjau dari kemampuan matematika [Problem solving abilities and mathematical dispositions on cube and block material in terms of mathematical ability]. *Efektor*, 8(2), 110–121. <https://doi.org/10.29407/e.v8i2.15984>
- Voica, C., Singer, F. M., & Stan, E. (2020). How are motivation and self-efficacy interacting in problem-solving and problem-posing? *Educational Studies in Mathematics*, 105(3), 487–517. <https://doi.org/10.1007/s10649-020-10005-0>
- Yaniawati, R. P., Indrawan, R., & Setiawan, G. (2019). Core model on improving mathematical communication and connection, analysis of students' mathematical disposition. *International Journal of Instruction*, 12(4), 639–654. <https://doi.org/10.29333/iji.2019.12441a>