DPJPM | Delta-Phi: Jurnal Pendidikan Matematika

Delta-Phi: Jurnal Pendidikan Matematika, vol. 1, pp. 06–10, 2023
Received 18 Feb 2023/published 30 Apr 2023
https://doi.org/10.61650/dpjpm.v1i1.19

Analysis of skills using pattern-finding strategies in solving mathematical problems given gender differences

M. Rizki Cahyadi[1], Fitroh Ariansyah[2], and Paulo Vitor da Silva Santiago[3]

1. *Universitas Muhammadiyah Malang, East Java, Indonesia*
2. *SMP Islam Nurul Anwar, East Java, Indonesia*
3. *Federal University of Ceara (UFC), Brazil*

E-mail correspondence to: mcahyadi24@gmail.com

Abstract

This study aims to describe the skills of using pattern-finding strategies in solving mathematical problems in terms of gender differences. This research is descriptive research with a qualitative approach. The subjects of this study were students of class VIII SMP Baiti Jannati, Sunggal sub-district, Deli Serdang district. The research subjects consisted of four students with high mathematical abilities, two male and two female students. The data collection technique used the problem-solving ability essay test instrument, which amounted to two questions, and the non-test instrument in the form of interviews. The data analysis technique in this study uses the Miles and Huberman model, which consists of four stages: data collection, data condensation, data presentation, and conclusions. The results of this study indicate that both male and female students can find and use patterns in solving mathematical problems. Based on these results, there is no difference in skills in using pattern-finding strategies between male and female students.

Keywords: Gender; Pattern finding; Problem-solving.

Introduction

Ability is a beneficial ability for students. The World Economic Forum (WEF) also includes problem-solving as one of the skills needed in the 21st century (Inganah et al., 2023; ND Safitri et al., 2023; WEF, 2015). Students who have good problem-solving skills will find it easier to overcome various difficulties encountered in everyday life (Hu et al., 2018; Meryansumayeka et al., 2021; Sekaryanti et al., 2023a). Therefore, it is essential to train students' problem-solving abilities.

Problem-solving abilities are generally formed through learning mathematics, often called mathematical problem-solving abilities (Lai et al., 2020; Qomariyah et al., 2023; Sekaryanti et al., 2023b). The National Council of Teachers of Mathematics (NCTM) states that problem-solving is integral to mathematics (NCTM, 2000; Paloloang et al., 2020). This shows the close relationship between problem-solving abilities and learning mathematics. Memnun (2012) added that problem-solving ability is a general goal of learning mathematics.

There are several problem-solving models, such as the Polya and Ideal models (Brookman-Byrne et al., 2019; Darmayanti et al., 2022; Fauza et al., 2022). Polya's problem-solving model was proposed by George Polya in 1971 through his book " How to Solve It: A New Aspect of Mathematical Method ". Polya offers four steps of problem-solving, namely understanding the problem, devising a plan, carrying (Russell et al., 2020) out the plan (Cundiff et al., 2020), and looking (Ismail et al., 2021), back (Bossé et al., 2021; Polya, 1973).

The Ideal Model is a stage of problem-solving developed by John D. Bransford and Barry S. Stein in their book entitled " The Ideal Problem Solver " (Nayazik, 2017). The name Ideal is an acronym for problem-solving steps, namely Identify problems and opportunities (identify problems and opportunities) (Mulyono, 2017), Define goals (define goals) (Yuntiaji, 2019), Explore possible strategies (explore strategies) (Rahmawati et al., 2021), Anticipate outcomes and Act (anticipate outcomes and act), and look back and Learn (looking back) (Bransford & Stein, 1993).

These two problem-solving models have the same principles, namely understanding the problem (Darmayanti, 2023; Syaifuddin et al., 2022), planning a strategy (In' am et al. et al., 2023; Sugianto et al., 2022), implementing it (Hasanah et al., 2022), and looking back at the solution to solving the problem and understanding and understanding a problem before acting or making a decision (Muniri & Choirudin, 2022). A good understanding of the problem will significantly assist in determining the strategy to be used in solving the problem (Choirudin et al., 2021). Each problem has its characteristics, so different approaches and strategies are needed to solve each problem.

Posamentier & Krulik, (2009) offers several strategies for solving mathematical problems, including organizing data (Yan et al., 2022), guessing and testing (Gray et al., 2020), solving simpler similar problems (Manzano-León et al., 2021), simulating actions (Björn et al., 2019), working backward (Baiduri, 2019), finding patterns (AN Vidyastuti et al., 2022), logical reasoning (Rizki et al., 2022), making pictures (Darmayanti et al., et al., 2022), and adopting different points of view. Among these strategies, finding patterns is the most frequently used in solving mathematical problems because mathematics is about looking for and finding patterns (Resnik, 1981).

A pattern is a model or arrangement with regularity in which the pattern-forming elements are arranged according to specific rules to predict the continuation (Mustakim et al., 2023; Safitri et al., 2023). Patterns can appear in various situations in systematic sequences of numbers, pictures, lists, or tables. Pattern finding simplifies and saves the troubleshooting process. So, students or individuals need to master identifying and finding patterns.

Each student certainly has a different mastery of pattern-finding skills in solving mathematical problems. Gender or gender differences are one of the factors that influence problem-solving abilities (Mefoh et al., 2017; Utomo et al., 2021). Male students are superior in visual-spatial problems than female students (Awalah et al., 2019; Santrock, 2008). Meanwhile, female students excel in verbal skills and memory tasks compared to male students (Akbar et al., 2020; Maccoby & Jackline, 1974).

The results of previous studies related to problem-solving show that female students have better problem-solving abilities than male students (Kusumaningsih et al., 2020; Nurfitri & Jusra, 2021; Tunnajach & Gunawan, 2021; Yerizon et al., 2021). This happens because female students are more thorough and structured in solving problems (Kusumaningsih et al., 2020; Subekti & Krisdiani, 2021). Apriani et al. (2017)revealed that male students experience difficulties understanding questions and making mathematical models compared to female students.

Research on students' problem-solving abilities regarding gender differences has been done a lot. In addition to the several studies above, there are also studies (Lestari et al., 2021) that (Oemolos & Mampouw, 2021) discuss mathematical problem-solving abilities regarding gender differences. These studies only discuss problem-solving abilities from the problem-solving stage, not yet discussing the strategies used in problem-solving in more detail. Based on that, this study seeks to discuss more deeply the ability to solve mathematical problems using pattern-finding strategies regarding gender differences. Through this research, the authors hope that students will be able to solve problems and be critical in determining effective and efficient strategies for solving these problems.

Research Methode

This research is descriptive research with a qualitative approach. This type of descriptive research aims to describe a phenomenon's condition or state (Creswell, 2010). A qualitative approach is used because the object of this research is a work process, namely the process of using pattern-finding strategies in solving mathematical problems regarding gender differences.

This research was conducted at Baiti Jannati Middle School, Sunggal sub-district, Deli Serdang district. The subjects in this study were students with high mathematical abilities who were selected according to input from the mathematics teacher to fulfill the objectives of this study. The research subjects consisted of four male students and two female students whose aim was to fulfill the constancy of the data.

Data collection was carried out using test and non-test instruments. The test instrument used is in the form of an essay test of problem-solving abilities, totaling two questions that are constructed to work with a pattern-finding strategy. Non-test instruments in the form of interviews were conducted to add and explore deeper information related to the pattern-finding strategies used by students to solve problems. The data analysis technique in this study used the *Miles and Huberman interactive analysis* model, which consisted of four stages: data collection, data condensation, data presentation, and conclusions (Miles & Huberman, 1994).

Results and Discussion

This research is descriptive research with a qualitative approach. This type of descriptive research aims to describe a phenomenon's condition or state (Creswell, 2010). A qualitative approach is used because the object of this research is a work process (In' am et al. et al., 2023; Rofiah et al., 2023), namely the process of using pattern-finding strategies in solving mathematical problems regarding gender differences.

The following are the results of students' mathematical problem-solving tests:

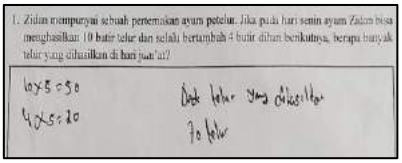

***Figure 1**. Answers of male students 1 question no 1*

Figure 1 is the work of male student 1 (L1) on question no 1. L1 immediately answered with "10 x 5 = 50" and "4 x 5 = 20" and concluded that the result was 70. If referring to the Polya problem-solving stage, L1 did not explicitly show the stage of problem-solving through writing, but that does not mean he did not do it. The researcher then interviewed L1 students to dig deeper into information regarding the problem-solving process that L1 did.

Researcher: "How did you get this '10 x 5'?"
L1 : "Look, sir –those asked for eggs on Friday multiplied by five packs. 10 is many eggs."
Researcher : "Then where does this 4 x 5 come from?"
L1 : "Every day it increases by 4 Sir, so multiply it by five as well."

Based on the interview, it is known that L1 has been able to identify the elements of the problem but is mistaken in understanding the expected problem-solving objectives. L1 understands that Zidan's chickens produce at least ten eggs daily. L1 also understands that Friday is the fifth day and applies it to the number 5. These two elements ultimately result in the multiplication "10 x 5 = 50". This concept is also used to find the number of eggs added to produce the multiplication "4 x 5 = 20". In this problem, L1 has found a rule or pattern of egg addition, but L1 has not been able to use this pattern to solve the given problem.

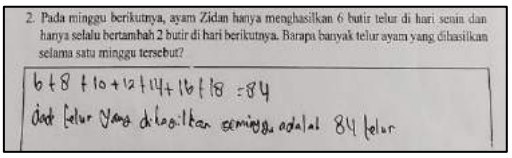

Figure 2. Answers of male students 1 question no 2

In question number 2, the problem is how many eggs are produced in a week if Monday produces six eggs and only adds two eggs the next day. In this problem, L1 arranges and totals the number of eggs produced daily for a week. Based on these answers, it can be seen that L1 has been able to find patterns from the problems given. This can be seen from how he correctly recorded the number of eggs for a week. L1 has also used this pattern to solve problems by adding all the eggs produced.

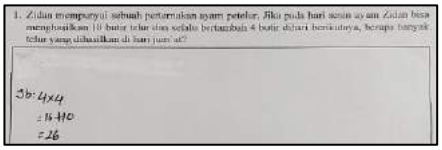

Figure 3. Answers of male students 2 Question No. 1

Figure 3 is the work of male student 2 (L2) on question no 1. Like L1, L2 does not explicitly show the stages of solving Polya's problem through writing. However, based on the results of the interviews, it can be seen that L2 already understands the problems given.

Researcher: "What does this '4 x 4' mean?"
L2 : "The number of eggs has increased, sir. The eggs will increase from Tuesday, then Wednesday, Thursday, and Friday, so four days, sir."
Researcher : "Okay. Then why is this added 10?"
L2 : "There were still many eggs added, sir. Continue adding 10, the principal amount, the eggs produced daily."

L2 understands that the goal of the problem is to find the number of eggs laid on Friday. L2 can also find patterns of egg addition from Monday to Friday, which is written as "4 x 4 = 16," which means that on Friday, there will be four times the addition of 4 eggs. Then L2 adds it by 10, the principal number of eggs produced each day.

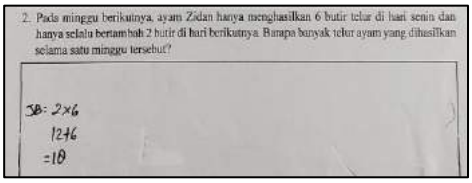

Figure 4. Answers of male students 2 Question No. 2

In question no. 2, L2 experienced a mistake in understanding the intent and purpose of the question. L2 considers question number 2 the same as question number 1, so they do it similarly.

Researcher : "Why did you work on this problem the same as number 1?"
L2 : "It is the same, sir. The difference is that it is Sunday."
Researcher : "Try rereading it because it is more thorough!"
L2 : "Oh yes, sir. For a week, sir."
Researcher : "That is right. You are not careful enough."
L2 : "Yes, sir, in a hurry, sir."

Based on the interviews, L2 admitted that he was in a hurry to read the questions, so he was not thorough. L2 considers that the intent and purpose of this problem is to determine the number of eggs produced on Sunday.

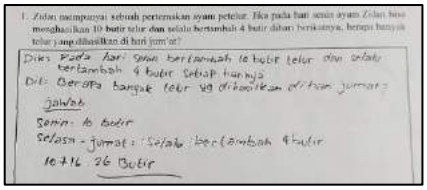

Figure 5. Female student answer 1 question no 1

Figure 5 shows the work of female student 1 (P1) on question 1. P1 writes down the stages of problem-solving, from problem identification to completion. However, there were several completion steps that P1 did not write down, so an interview was conducted about how the P1 process solved the problem.

Researcher : "Where did this 10 +16 come from?"
L2 : "Formula, sir. 10 is the first term. 16 of 4 times 4."
Researcher: "Where do four times four come from?"
L2: "From Tuesday to Friday, four days. Then multiply it by four because the difference is four, sir."

Based on the results of the interviews conducted, it is known that P1 understands the problem as one of the material problems of the number pattern that he has studied, so P1 solves this problem with the rules/formula of the Un number pattern. This shows that P1 has been able to understand the characteristics of a problem, can choose the right strategy, namely finding patterns, and can carry out this strategy properly and correctly.

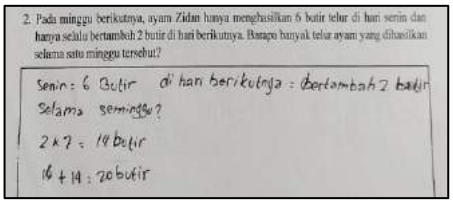

Figure 2. Female student answer 1 question no 2

In question no. 2, P1 could write down the information and identify the problem, but an error occurred in solving it. P1 solves the problem using the same method as question no 1. Similar to L2, P1 also assumes that the intent and purpose of this problem is to determine the number of eggs produced on Sunday.

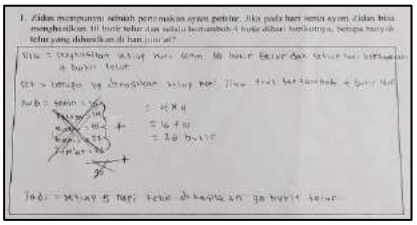

Figure 3. Female students answer two questions no 1

Figure 7 shows female student 2 (P2) answers to question no 1. P2 worked on the questions by writing down the information he could receive, but there was a mistake in receiving and understanding the information. This results in errors in finding solutions to troubleshooting. Even so, there are exciting things from the work process carried out by P2. P2 compiles and records egg yields every day according to predetermined rules. This shows that P2 understands and succeeds in finding patterns from the problems given. P2 is also able to apply the pattern rules. It is just that P2 is wrong in setting the goal of solving the problem.

Knowing there was a mistake in understanding P2, the researcher tried to help straighten the understanding of P2. However, unfortunately, P2 crossed out his work and imitated the work of his friends.

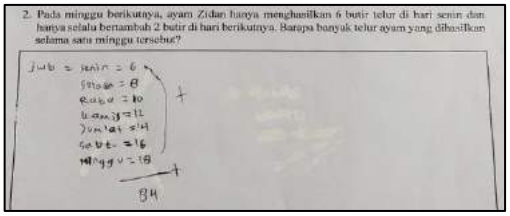

Figure 4. Female students answered two questions no 2

In question no. 2, P2 immediately answered by collecting data, compiling the number of eggs produced daily for a week, and then adding them up. Based on the answers, P2 already understands the intended and purpose of the problems. P2 can record and arrange patterns according to the rules given in the problem.

Selection and use of the right strategy will provide optimal results in solving problems. Based on the results of the mathematical problem-solving test, it is known that both male and female students can apply pattern-finding strategies in solving mathematical problems. Students can find specific rules of patterning on a given problem. Students are also able to use these rules to obtain solutions to problem-solving.

Even though students can use pattern-finding strategies, students are often not careful and do not understand the intent

and purpose of the problems given. Both male and female students experience mistakes in understanding the problem, so they are wrong in problem-solving. This is inversely proportional to the results of research (Peranginangin & Surya, 2017), which show that the problem identification indicator has the highest percentage compared to other indicators. So, students should be able to identify the problem well.

If you look at all aspects of problem-solving, the work of female students is more organized and structured than male students. This result aligns with research (Akbar et al., 2020), which reveals that female students are more organized in problem-solving. Several other studies have also revealed that the problem-solving abilities of female students are better than male students (Nurfitri & Jusra, 2021; Tunnajach & Gunawan, 2021; Yerizon et al., 2021). Male students tend to be lazy to write down information on the problems given and prefer to act directly according to their reasoning and understanding of the problem.

Conclusion

Based on the results and discussion, it can be concluded that there is no difference in the skills of using pattern-finding strategies between male and female students. Students can find specific rules of patterning on a given problem. Students are also able to use these rules to obtain solutions to problem-solving. Based on the results of this study, the researcher suggests that further research can provide more complex problems so that the pattern-finding process by students can be seen. In addition, research subjects can also be added so that the differences in skills in using pattern-finding strategies between male and female students can be seen clearly.

Reference

Akbar, M., Sa'dijah, C., & Sisworo. (2020). Profil Siswa Dalam Memecahkan Masalah Matematika Berdasarkan Gaya Kognitif Dan Gender. *Jurnal Kajian Pembelajaran Matematika (JKPM)*, *4*(April).

AN Vidyastuti, MM Effendi, & Darmayanti, R. (2022). Aplikasi Tik-Tok: Pengembangan Media Pembelajaran Matematika Materi Barisan dan Deret Untuk Meningkatkan Minat Belajar Siswa SMA. *Jurnal Math Educator Nusantara: Wahana Publikasi Karya Tulis Ilmiah Di Bidang Pendidikan Matematika*, *8*(2), 91–106. https://doi.org/10.29407/jmen.v8i2.18267

Apriani, E., Djadir, D., & Asdar, A. (2017). Kemampuan Pemecahan Masalah Matematika Ditinjau dari Kemampuan Awal Matematika dan Perbedaan Gender. *Issues in Mathematics Education (IMED)*, *1*(1). https://doi.org/10.35580/imed

Awalah, E. A., Budiarto, M. T., & Imah, E. M. (2019). Mental rotation of junior high school students in terms of differences in sex. *International Journal of Trends in Mathematics Education Research*, *2*(4).

Baiduri, B. (2019). Strategi Literasi dalam Pembelajaran Matematika pada Era Industri 4.0. *MUST: Journal of Mathematics Education, Science and Technology*, *4*(1), 77. https://doi.org/10.30651/must.v4i1.2782

Björn, P. M., Äikäs, A., Hakkarainen, A., Kyttälä, M., & Fuchs, L. S. (2019). Accelerating mathematics word problem-solving performance and efficacy with think-aloud strategies. *South African Journal of Childhood Education*, *9*(1). https://doi.org/10.4102/sajce.v9i1.716

Bossé, M. J., Bayaga, A., Lynch-Davis, K., & ... (2021). Assessing Analytic Geometry Understanding: Van Hiele, SOLO, and Beyond. *International Journal for …*, *22*(1).

Bransford, J. D., & Stein, B. S. (1993). *The Ideal Problem Solver* (2nd ed.). W. H. Freeman and Company.

Brookman-Byrne, A., Mareschal, D., Tolmie, A. K., & Dumontheil, I. (2019). The Unique Contributions of Verbal Analogical Reasoning and Nonverbal Matrix Reasoning to Science and Maths Problem-Solving in Adolescence. *Mind, Brain, and Education*, *13*(3). https://doi.org/10.1111/mbe.12212

Choirudin, C., Anwar, M. S., Azizah, I. N., Wawan, W., & Wahyudi, A. (2021). Pengembangan LKPD Matematika Berbasis Kaligrafi dengan Pendekatan Guided Discovery Learning. *Jurnal Pendidikan Matematika (JPM)*, *7*(1), 52. https://doi.org/10.33474/jpm.v7i1.6738

Creswell, J. W. (2010). *Research Design Pendekatan Kualitatif, Kuantitatif, dan Mixed*. Pustaka Pelajar.

Cundiff, P. R., McLaughlin, O., Brown, K., & Grace, K. (2020). In Search of Greater Understanding: The Impact of Mastery Learning on Social Science Education. *Teaching Sociology*, *48*(2). https://doi.org/10.1177/0092055X20907979

Darmayanti, R. (2023). Gema Cow-Pu: Development of Mathematical Crossword Puzzle Learning Media on Geometry Material on Middle School Students' Critical Thinking Ability. *Assyfa Learning Journal*, *1*(1), 37–48.

Darmayanti, R., Sugianto, R., Baiduri, Choirudin, & Wawan. (2022). Digital comic learning media based on character values on students' critical thinking in solving mathematical problems in terms of learning styles. *Al-Jabar: Jurnal Pendidikan Matematika*, *13*(1), 49–66. http://ejournal.radenintan.ac.id/index.php/al-jabar/index

Darmayanti, R., Sugianto, R., & Muhammad, Y. (2022). Analysis of Students' Adaptive Reasoning Ability in Solving HOTS Problems Arithmetic Sequences and Series in Terms of Learning Style. *Numerical: Jurnal Matematika Dan Pendidikan Matematika*, *6*(1).

Fauza, M. R., Inganah, S., Darmayanti, R., Prasetyo, B. A. M., & Lony, A. (2022). Problem Solving Ability: Strategy Analysis of Working Backwards Based on Polya Steps for Middle School Students YALC Pasuruan. *Jurnal Edukasi Matematika Dan Sains)*, *10*(2), 353–363. https://doi.org/10.25273/jems.v10i2.13338

Gray, L. M., Wong-Wylie, G., Rempel, G. R., & Cook, K. (2020). Expanding qualitative research interviewing strategies: Zoom video communications. *Qualitative Report*, *25*(5). https://doi.org/10.46743/2160-3715/2020.4212

Hasanah, N., Syaifuddin, M., & Darmayanti, R. (2022). Analysis of the Need for Mathematics Teaching Materials "Digital Comic Based on Islamic Values" for Class X SMA Students in Era 5.0. *Numerical: Jurnal Matematika Dan Pendidikan Matematika*, *6*(2). http://ejournal.radenintan.ac.id/index.php/al-jabar/index

Hu, Y. H., Xing, J., & Tu, L. P. (2018). The effect of a problem-oriented teaching method on university mathematics learning. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(5). https://doi.org/10.29333/EJMSTE/85108

In'am, A., Darmayanti, R., Hariyadi, A., & Mardiningrum, W. W. (2023). MICROTEACHING: Analysis of the Readiness of Prospective Mathematics Teacher Students in Teaching Function Material. *Delta-Phi: Jurnal Pendidikan Matematika*, *1*(3).

In'am, A., Darmayanti, R., Maryanto, B. P. A., Sah, R. W. A., & Rahmah, K. (2023). DEVELOPMENT LEARNING MEDIA EAV ON MATHEMATICAL CONNECTION ABILITY OF JUNIOR HIGH SCHOOL. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(1).

Inganah, S., Darmayanti, R., & Rizki, N. (2023). Problems, Solutions, and Expectations: 6C Integration of 21 st Century Education into Learning Mathematics. *JEMS (Journal of Mathematics and Science Education)*, *11*(1), 220–238. https://doi.org/10.25273/jems.v11i1.14646

Ismail, I., Angriani, A. D., Kusumayanti, A., Islam, U., & Alauddin, N. (2021). Development of Measurement Tool for Understanding, Application, and Reasoning Mathematics of Madrasah Ibtidaiyah Students. *Jurnal Matematika Kreatif Inovatif Kreano*, *12*(1), 26–38.

Kusumaningsih, W., Setiawan, P. Y., & Utami, R. E. (2020). Profil Berpikir Aljabar Siswa SMP dalam Pemecahan Masalah matematis Ditinjau dari Gaya Kognitif dan Gender. *JIPMat*, *5*(1). https://doi.org/10.26877/jipmat.v5i1.5574

Lai, C. P., Zhang, W., & Chang, Y. L. (2020). Differentiated instruction enhances sixth-grade students' mathematics self-efficacy, learning motives, and problem-solving skills. *Social Behavior and Personality*, *48*(6). https://doi.org/10.2224/sbp.9094

Lestari, W., Kusmayadi, T. A., & Nurhasanah, F. (2021). Kemampuan Pemecahan Masalah Matematika Ditinjau Dari Perbedaan Gender. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(2), 1141–1150. https://doi.org/10.24127/ajpm.v10i2.3661

Maccoby, E. E., & Jackline, C. (1974). *The Psychology Of Sex Differences*. Stanford University Press.

Manzano-León, A., Camacho-Lazarraga, P., Guerrero-Puerta, M. A., Guerrero-Puerta, L., Alias, A., Aguilar-Parra, J. M., & Trigueros, R. (2021). Development and validation of a questionnaire on motivation for cooperative playful learning strategies. *International Journal of Environmental Research and Public Health*, *18*(3). https://doi.org/10.3390/ijerph18030960

Mefoh, P. C., Nwoke, M. B., Chukwuorji, J. C., & Chijioke, A. O. (2017). Effect of Cognitive Style and Gender on Adolescents' Problem Solving Ability. *Thinking Skills and Creativity*, *25*, 47–52. https://doi.org/https://doi.org/10.1016/j.tsc.2017.03.002

Memnun, D. S. (2012). A Research On The Mathematical Problem Solving Beliefs Of Mathematics, Science And Elementary Pre-Service Teachers In Turkey In Terms Of Different Variables. *International Journal Of Humanities And Social Science*, *2*(24), 245–254.

Meryansumayeka, M., Zulkardi, Z., Putri, R. I. I., & Hiltrimartin, C. (2021). Students' Strategies in Solving PISA Mathematical Problems Reviewed from Problem-Solving Strategies. *Jurnal Pendidikan Matematika*, *15*(1), 37–48. https://doi.org/10.22342/jpm.15.1.10405.37-48

Miles, M. B., & Huberman, A. (1994). *Qualitative Data Analysis: A Sourcebook of New Method*. SAGE.

Mulyono, B. (2017). Reorientasi civic disposition dalam kurikulum Pendidikan Kewarganegaraan sebagai upaya membentuk warga negara yang ideal. *Jurnal Civics: Media Kajian Kewarganegaraan*, *14*(2). https://doi.org/10.21831/civics.v14i2.17007

Muniri, M., & Choirudin, C. (2022). The Flow of Analytical Thinking High Cognitive Level Students In Mathematics Problem Solving. *AL-ISHLAH: Jurnal Pendidikan*, *14*(4), 6147–6158. https://doi.org/10.35445/alishlah.v14i4.2413

Mustakim, A., Ngaliyah, J., & Darmayanti, R. (2023). Quantum Teaching Model: Untuk Meningkatkan Hasil Belajar Matematika Siswa MTs. *Jurnal Penelitian Tindakan Kelas*, *1*(1), 10–18.

Nayazik, A. (2017). Pembentukan Keterampilan Pemecahan Masalah Melalui Model IDEAL Problem Solving Dengan Teori Pemrosesan Informasi. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *8*(2), 182–190. https://doi.org/10.15294/kreano.v8i2.7163

NCTM. (2000). *Principles and Standards for School Mathematics*. Reston.

ND Safitri, R Darmayanti, U Usmiyatun, & D Nurmalitasari. (2023). 21st Century Mathematics Learning Challenges: Bibliometric Analysis of Trends and Best Practices in Shinta Indexed Scientific Publications. *JEMS: Jurnal Edukasi Matematika Dan Sains*, *11*(1), 136–152.

Nurfitri, R. A., & Jusra, H. (2021). Analisis Kemampuan Pemecahan Masalah Matematis Peserta Didik Ditinjau dari Resiliensi Matematis dan Gender. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(2). https://doi.org/10.31004/cendekia.v5i2.723

Oemolos, S., & Mampouw, H. L. (2021). Profil Pemecahan Masalah Nilai Ekstrim Ditinjau dari Perbedaan Gender. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(2), 1169–1182. https://doi.org/10.31004/cendekia.v5i2.612

Paloloang, M. F. B., Juandi, D., Tamur, M., Paloloang, B., & Adem, A. M. G. (2020). META ANALISIS: PENGARUH PROBLEM-BASED LEARNING TERHADAP KEMAMPUAN LITERASI MATEMATIS SISWA DI INDONESIA TUJUH TAHUN TERAKHIR. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *9*(4), 851. https://doi.org/10.24127/ajpm.v9i4.3049

Peranginangin, S. A., & Surya, E. (2017). An Analysis of Students' Mathematics Problem Solving Ability in VII Grade at SMP Negeri 4 Pancurbatu. *International Journal of Sciences: Basic and Applied Research*.

Polya, G. (1973). *How to Solve It (2nd ed.)* (New Jersey :, Ed.). Prence University Press.

Posamentier, A. S., & Krulik, S. (2009). *Problem Solving in Mathematics Grades 3-6: Powerful Strategies to Deepen Understanding*. Corwin A SAGE Company.

Qomariyah, S., Darmayanti, R., Rosyidah, U., & Ayuwanti, I. (2023). Indicators and Essay Problem Grids on Three-Dimensional Material: Development of Instruments for Measuring High School Students' Mathematical Problem-Solving Ability. *Jurnal Edukasi Matematika Dan Sains*, *11*(1), 261–274. https://doi.org/10.25273/jems.v11i1.14708

Rahmawati, M., Kurniati, D., Trapsilasiwi, D., Osman, S., & Jember, U. (2021). The Students' Truth-Seeking Behaviour in Solving the Problems With No Specified Universal Set Based on IDEAL Problem Solving. *Jurnal Matematika Kreatif Inovatif Kreano*, *12*(2), 302–311.

Resnik, M. D. (1981). Mathematics as a Science of Patterns: Ontology and Reference. *Noûs*, *15*(4), 529–550. https://doi.org/10.2307/2214851

Rizki, N., Laila, A. R. N., Inganah, S., & Darmayanti, R. (2022). Analysis of Mathematic Connection Ability in Mathematics Problem Solving Reviewed from Student's Self-Confidence. *Seminar Nasional Teknologi Pembelajaran*, *2*(1), 111–126. http://snastep.um.ac.id/pub/index.php/proceeding/indexKeahliandanPerformaPakardalamTeknologiPendidikanuntuk

Rofiah, N., Anwar, M. S., & Ridho'i, A. V. (2023). Analisis Kesulitan Belajar Matematika ditinjau dari Motivasi Belajar Siswa. *Delta-Phi: Jurnal Pendidikan Matematika*, *1*(3).

Russell, J. L., Correnti, R., Stein, M. K., Thomas, A., Bill, V., & Speranzo, L. (2020). Mathematics Coaching for Conceptual Understanding: Promising Evidence Regarding the Tennessee Math Coaching Model. *Educational Evaluation and Policy Analysis*, *42*(3). https://doi.org/10.3102/0162373720940699

Safitri, E., Setiawan, A., Darmayanti, R., & Wardana, M. R. F. (2023). Pinokio dalam Pembelajaran Matematika Materi Geometri untuk Siswa SMP. *Jurnal Penelitian Tindakan Kelas*, *1*(2), 106–113.

Santrock, J. W. (2008). *Psikologi Pendidikan (Terjemahan)* (2nd ed.). Kencana.

Sekaryanti, R., Darmayanti, R., Choirudin, C., Usmiyatun, U., Kestoro, E., & Bausir, U. (2023a). Analysis of Mathematics Problem-Solving Ability of Junior High School Students in Emotional Intelligence. *Jurnal Gantang*, *7*(2), 149–161. https://doi.org/10.31629/jg.v7i2.4944

Sekaryanti, R., Darmayanti, R., Choirudin, C., Usmiyatun, U., Kestoro, E., & Bausir, U. (2023b). Analysis of Mathematics Problem-Solving Ability of Junior High School Students in Emotional Intelligence. *Jurnal Gantang*, *7*(2), 149–161. https://doi.org/10.31629/jg.v7i2.4944

Subekti, F. E., & Krisdiani, T. (2021). Deskripsi Kemampuan Pemecahan Masalah Matematis Ditinjau dari Gender pada Materi Bangun Ruang. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(2). https://doi.org/10.24127/ajpm.v10i2.3534

Sugianto, R., Cholily, Y. M., Darmayanti, R., Rahmah, K., & Hasanah, N. (2022). Development of Rainbow Mathematics Card in TGT Learning For Increasing Mathematics Communication Ability. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *13*(2), 221–233.

Syaifuddin, M., Darmayanti, R., & Rizki, N. (2022). Development of a Two-Tier Multiple-Choice (TTMC) Diagnostic Test for Geometry Materials to Identify Misconceptions of Middle School Students. *JURNAL SILOGISME : Kajian Ilmu Matematika Dan Pembelajarannya*, *7*(2), 66–76. http://journal.umpo.ac.id/index.php/silogisme

Tunnajach, N. F., & Gunawan. (2021). Analisis Kemampuan Pemecahan Masalah Matematis Siswa dalam Menyelesaikan Soal Berbasis Kontekstual pada Materi Trigonometri Ditinjau dari Perbedaan Gender. *MATH LOCUS: Jurnal Riset Dan Inovasi Pendidikan Matematika*, *2*(1), 7–14.

https://doi.org/10.31002/mathlocus.v2i1.1467

Utomo, H. P., Hendrayana, A., Yuhana, Y., & Saputro, T. V.D. (2021). Pengaruh Gender Terhadap Kemampuan Pemecahan Masalah dan Penalaran Matematis Ditinjau dari Minat Belajar. *TIRTAMATH: Jurnal Penelitian Dan Pengajaran Matematika*, *3*(2). https://doi.org/10.48181/tirtamath.v3i2.12643

WEF. (2015). *New Vision for Education: Unlocking the Potential of Technology*. World Economic Forum.

Yan, Z., Natarajan, K., Teo, C. P., & Cheng, C. (2022). A Representative Consumer Model in Data-Driven Multiproduct Pricing Optimization. *Management Science*, *68*(8). https://doi.org/10.1287/mnsc.2021.4182

Yerizon, Y., Wahyuni, P., & Fauzan, A. (2021). Pengaruh Problem Based Learning Terhadap Kemampuan Pemecahan Masalah Matematis Ditinjau dari Gender dan Level Sekolah. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(1). https://doi.org/10.24127/ajpm.v10i1.2812

Yuntiaji, D. A. (2019). Analisis Kesulitan Siswa dalam Memecahkan Soal Matematika Berdasarkan Ideal Problem Solving pada Materi Limit Fungsi. *MAJAMATH: Jurnal Matematika Dan Pendidikan Matematika*, *2*(2). https://doi.org/10.36815/majamath.v2i2.396