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Critical Thinking Characteristics of Female National Science Olympiad Participants in Solving Mathematics Problems

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Abstract. This study aims to describe the characteristics of critical thinking of female OSN participants in solving math problems. This research is a case study qualitative approach. The research subjects were female participants of OSN SMP Mathematics Tulungagung Regency. The subject selection technique was snowball sampling. Research instruments were test questions and interview guidelines. Data collection techniques include written tests, interviews, documentation. Data validity checking triangulation techniques and reference adequacy. Data analysis includes data reduction, data presentation, conclusion drawing. Based on the research results, the subject fulfills 11 indicators, namely (1) reading carefully, repeatedly, writing mathematical sentences without explaining, focusing the question, (2) explaining the plan by understanding the problem, choosing the formula, writing the formula, (3) working coherently, structured, according to the formula, (4) explaining the information obtained by remembering the material and formulas used, (5) explained the steps to solve the problem clearly, coherently, thorough workmanship, and confidently, (6) argued according to his knowledge, relevant, and accurate but not logical, (7) used one solution and detected other possible plans by trying first, (8) explained other possible steps by paying attention to each stage, (9) tried to solve based on the plan made, (10) found the value of the element subsumed in the formula, the answer was correct and (11) was sure the answer was correct, checking by checking the calculation of the substitution of numbers in the formula from the beginning.

Keywords: Critical Thinking; Problem Solving; OSN Participants.

1 Introduction

Mathematics education is dominated by how students are able to solve mathematical problems. Critical thinking skills are needed in every step of problem solving [1]. Not apart from that, critical thinking skills in mathematics have benefits according to several previous studies including: a) Equipping students to survive in the times [2], b) Guaranteeing productive opportunities in the future [3], c) Making someone wiser in dealing with various problems in life [4], d) Minimizing negative impacts in every decision making [5].

Based on the explanation above, it can be seen that the ability to think critically in mathematics is very important. [6] said that critical thinking must be developed because it has intellectual potential. Thus, the government issued Permendikbud No. 21 of 2016 concerning Content Standards for Primary and Secondary Education which states that mathematics learning must be taught from primary to secondary levels with the aim of being able to equip people with critical thinking skills.

Facing the Golden Generation in the 21st century [7] says that the dominant thinking skill needed in the 21st century is critical thinking ability. However, seeing math classified as a difficult subject causes students to lack interest in math lessons. This has an impact on the low critical thinking skills of students in Indonesia.

Some facts show that the critical thinking skills of Indonesian students are low, which can be seen from the results of the Trends International Mathematics and Science Study (TIMMS) 2011 that Indonesia was ranked 38 out of 42 countries and the results of the Program for International Student Assessment (PISA) 2012 that Indonesia was ranked 64 out of 65 participants with a score of 375 [8]. In addition, Indonesia's 2015 PISA results are still below the international average [9].

Many students are weak in solving math problems, especially problems that are not routinely found [9]. This is because students lack the skills to solve math problems so that when faced with math

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problems students have difficulty solving them [10]. It is very clear that mathematics learning is always closely related to problems, so problem solving skills really need to be considered and developed [11].

Every additional value of 1 on critical thinking will increase math problem solving ability by 0.568 [12]. Thus critical thinking is very influential in solving math problems. In response to this, the government has improved the quality of education which has been mandated in Law No. 20 of 2003 concerning the National Education System with one of the objectives of developing students' abilities and shaping the character and civilization of a dignified nation in order to educate the nation's life. One of the efforts to improve is through the National Science Olympiad (OSN) for various subjects and various levels of education in elementary school, junior high school, and senior high school.

OSN aims to improve the competitive ability of students to compete healthily in the mastery of science and technology as well as improve students' abilities in the fields of Mathematics and Science (MIPA) [13]. With the emergence of OSN, many students are afraid because they face math problems that are not routinely found because OSN questions are classified as High Order Thinking Skill (HOTS) questions. OSN questions make students challenged in solving them. Overcoming fear in problem solving requires critical thinking skills [11].

Critical thinking is logical thinking, reflective and focused on making decisions that are believed and can be justified [14]. In addition, critical thinking includes clear and intelligent thinking [15]. Critical thinking has 5 indicators according to [9], namely formulating the main problem, revealing the facts needed, choosing logical, relevant and accurate arguments, detecting bias based on different points of view, determining the consequences of a statement taken as a decision.

The critical thinking indicators cover the abilities needed by students in solving math OSN problems. In addition, critical thinking indicators are able to motivate students to become critical thinkers and are able to provide feedback to students about their critical thinking skills, so that by using these critical thinking indicators their characteristics can be seen [16]. A critical thinker will have good communication skills, easily adjust to changing conditions and will be highly valued for their abilities both in the academic world or the world of work [6]. Critical thinking indicators are appropriate to see the characteristics of students' critical thinking skills and provide the benefits of being a critical thinker [9].

The critical thinking ability of female students in solving problems is different from male students [17]. Female students are better able to handle holistic problems, namely problems as a whole accompanied by considerations to minimize errors [18]. Female students are good at organizing tactics and strategies but weak in providing simple explanations, building basic skills, and concluding problems [19]. In addition, according to [20] and [21] female students have better critical thinking skills because female students are good at organizing their way of thinking in solving problems.

Problem solving is the ability of students to solve problems that must be accompanied by certain procedures and critical thinking skills. In addition, [21] said that problem solving is a very important part of the mathematics curriculum because it will provide experience in using knowledge and skills to solve problems. This is reaffirmed by [22] that a math problem will not be a problem if they use the right procedure in problem solving. The problem solving procedure that is in accordance with the level of difficulty of OSN math problems is Polya's steps because OSN problems are not routine problems and have a higher level of difficulty that requires the ability to think critically carefully and carefully, this is in accordance with Polya's problem solving which must be thorough and careful [23]. Polya's problem solving steps have 4 stages, namely understanding the problem, making a solution plan, implementing the solution plan, re-examining the process that has been done.

Based on the above problems, it is necessary to conduct a study on the characteristics of critical thinking of female OSN participants at the district level with the aim of knowing how the characteristics of critical thinking. The title of this research is "Characteristics of Critical Thinking of Female OSN Participants in Solving Mathematics Problems". There is previous research conducted by [12] that there is an influence of critical thinking in problem solving, so that with the influence of critical thinking on problem solving it is clear that this research is very important to do. In addition, [17] described the differences in problem solving profiles of mathematics OSN medalists based on gender, but no one has examined the critical thinking characteristics of female OSN participants. Whereas characteristics are important and are a characteristic of each individual that makes a difference with other individuals which includes the way of thinking and behavior in making decisions, so this research is very necessary

This study aims to determine the characteristics of critical thinking of female OSN participants. Furthermore, it is able to equip teachers in designing learning strategies that can optimize and improve critical thinking skills and student learning outcomes that are applied in daily learning. In addition, it can be used to prepare future math OSN participants.

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2 Research Methods

This type of research is case study research using a qualitative approach. The subject used is one female student participating in OSN junior high school mathematics at the Tulungagung Regency level. The subject retrieval technique is Snowball Sampling which is done by coming to the Tulungagung Education, Youth and Sports Office to get OSN data. The research instrument is a critical thinking ability test question sheet on arithmetic rows and series material with one number of description form questions that have been validated by mathematics lecturers and mathematics teachers as well as OSN committees. Furthermore, the test questions were given to the subject via whatsapp because the research was conducted online in the COVID-19 pandemic season and semi-structured interview guidelines to clarify the results of the subject's answers which were carried out via whatsapp chat. Data collection techniques with written tests, interviews, and documentation. After each subject worked on the critical thinking ability test questions, an interview was conducted. The data validity test used in this research is triangulation technique which is done by comparing the results on the test sheet with the results from the interview and the adequacy of the reference in this study, namely chat screenshots. Data analysis was carried out qualitatively including reducing the research data, continuing to present the data in the form of descriptive text, then drawing conclusions from the research results. The indicators used in analyzing the data are presented in Table 1.

Table 1. Indicators of Critical Thinking in Polya's Solving Steps

Code	Indicators of Critical Thinking in Polya's Solving Steps
1a	Able to formulate the main problem through understanding the problem
1b	Able to formulate the main problem through making a solution plan
1c	Able to formulate the main problem through implementing a solution plan
2b	Able to uncover the facts needed through making a solution plan
2c	Able to uncover the facts needed through implementing the solution plan
3c	Able to choose logical, relevant, and accurate arguments through implementing the solution plan
4b	Able to detect bias according to different points of view through making a solution plan
4c	Able to detect bias according to different points of view through implementing solutions
5a	Able to determine the consequences of a statement taken as a decision through understanding the problem
5b	Able to determine the consequences of a statement taken as a decision through making a solution plan
5c	Able to determine the consequences of a statement taken as a decision through implementing a solution plan
5d	Able to determine the consequences of a statement taken as a decision through re-examining the process that has been carried out

The test instruments used are as follows:

The fourth term, seventh term, tenth term, and 1010th term of an arithmetic sequence are respectively $t, t^2, t+t^2$, *and 2018. The 100th term minus the 10th term of the sequence is....*

3 Results and Discussion

In this study, the results of the analysis of critical thinking characteristics of female OSN participants in solving math problems based on 12 indicators of critical thinking in Polya's problem solving were obtained. The analysis was carried out for each Polya step that leads to critical thinking indicators on the subject as follows:

1. Problem Understanding Stage

   The results of the written test and interview to the subject in formulating the subject matter, the subject wrote down the known and questioned information without giving an explanation, understood the meaning asked well and correctly. The way to understand the problem is to read carefully the given problem and repeatedly, write in mathematical sentences what is known and focus on the question so that it becomes clear what to look for to solve it. Furthermore, the results of the written test and interview to the subject determine the consequences of a statement taken as a decision. The subject can determine the result of understanding the problem well, namely after understanding the problem the subject spontaneously thinks about the meaning of the problem, namely thinking about what to look for correctly. So that the test results and interviews at the stage of understanding the problem are valid.

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2. Making a Solution Plan Stage
   The results of the written test and interviews with the subject in formulating the subject matter the subject wrote down the formula to be used appropriately and explained the steps to be used in detail and structured. Furthermore, the results of the written test and interviews with the subject reveal the facts needed properly. The subject knows the information used correctly, namely the Un arithmetic formula by remembering the arithmetic line material after understanding that the problem is an arithmetic line. The subject explained that the formula used was sufficient because then the results asked could be found. The explanation of the adequacy of the subject's reference is less clear detailed and complete. Furthermore, the results of the written test and interviews to the subject detect bias according to different points of view the subject only uses one alternative solution and can detect bias according to different points of view properly and correctly. In addition, the results of the written test and interview to the subject explain the possibilities that occur from other plans used by trying it first. So that the test results and interviews at the stage of making a solution plan are valid.
3. Stage of Implementing the Solution Plan
   The results of the written test and interviews with the subject in formulating the subject matter the subject carries out the plan that has been made properly and correctly. The subject works coherently and structured and the first thing to do is to find the value of the element used to find the unknown final result, then easily substitute it into the formula to get the final result that is asked. Furthermore, the results of the written test and interview to the subject revealed the required facts well and correctly. The subject explained how to solve the problem clearly and coherently. When the process of working is accompanied by accuracy and confidence and the stages are neatly structured. In addition, the results of the written test and interview to the subject chose relevant and accurate logical arguments. The subject is able to argue but only briefly explains why using the formula is according to his knowledge and the argument expressed by the subject is not logically explained, but it is still relevant because the subject pays attention to the suitability of the formula with the request of the problem, and it is accurate that the formula used to solve is correct and produces the correct answer. Furthermore, the results of the written test and interview to the subject detected bias from a different point of view. The subject explains the possibilities that occur if done using other steps well and clearly, namely paying attention to each stage of the steps used and also being able to determine the consequences of a statement taken as a decision through implementing a solution plan. So that the test results and interviews at the stage of implementing the solution plan are valid.
4. Rechecking the Process
   The results of the written test and interviews to the subject in determining the consequences of a statement taken as a decision well and correctly. Convinced the answer is correct by rechecking the answer by rechecking the calculation or substitution of numbers into the formula starting from the beginning. As well as trying to find the value of U100-U10 directly without looking one by one. So that the test results and interviews at the stage of re-examining the process that has been carried out are valid.

The results of research on the characteristics of critical thinking of female OSN participants in problem solving based on Polya's steps can be seen in the results of data analysis and validity presented in Table 2 below:

Table 2. Critical Thinking Characteristics of Female OSN Participants in Solving Problems

Code	Description
1a	- Write down what is known from the problem and what is asked without giving an explanation. - Initially had difficulty after reading repeatedly to understand the meaning of the problem - Understanding the problem is to read carefully the problem given, write in mathematical sentences what is known and focus on the question so that you understand what to look for to solve the problem.
1b	- Writing down the formula that will be used - Understand the form of the problem then understand that the material of the problem is the arithmetic sequence then choose the main formula of Un arithmetic to solve the problem.
1c	- Implement the plan according to the written formula - Working coherently and structured - The first step is to find the value of the element used to find the unknown final result, then substitute it into the formula to get the final result that is asked.
2b	- Recalling arimetic sequence material after understanding that the problem is arimetic sequence. - Explaining the Un arietmatika formula is sufficient because the results can be found (explanation of information is less clear, less detailed, and less complete)

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2c	-	Explained how to solve the problem clearly and coherently. - The working process is thorough and confident and the stages are well-structured.
3c	-	Able to argue according to their knowledge but the argument is not explained logically, but it is relevant and accurate.
4b	-	Using one alternative solution - Explains the possible outcomes of other plans used by trying them first
4c	-	Explains the possibilities that occur if done using other steps well and clearly - Pay attention to each stage of the other steps used.
5a	-	Spontaneously thinking about the meaning of the problem i.e. thinking about what to look for
5b	-	Trying to solve the problem based on the solution plan that has been made
5c	-	Explained after finding the elements needed to find the final result then inputting the value into the formula and found the final result. - Produces the correct answer as requested by the question
5d	-	Confident that the answer is correct - Rechecking the calculation or substitution of numbers into the formula from beginning to end (result found)

The results of this study indicate that female OSN participants have critical thinking characteristics in problem solving. The indicator of being able to formulate the main problem through understanding the problem, the subject wrote down the information known from the problem and asked without providing an explanation. This is different from [24] where female subjects provide detailed explanations related to the known and questionable elements. However, the results of this study show that what is known and asked is written correctly, this is in line with [6] that female subjects understand the problem by writing the known and questioned elements precisely, in detail, and completely.

The subject initially said that the problem given was a little confusing and resulted in a little difficulty in understanding the problem but after the subject read the problem repeatedly, he finally understood the meaning asked in the problem so that according to the subject, he did not experience difficulties. This is according to [17] female subjects in understanding the problem read the problem at least twice. This study found a new discovery of how female subjects understand the problem, namely reading carefully the given problem, writing in mathematical sentences what is known, and focusing on the question so that they understand what to look for to solve the problem.

The indicator of being able to formulate the main problem through making a solution plan, the subject wrote down the formula to be used in making the plan while [17] female subjects in the planning stage did not write down the formula to be used. The subject explained the plan to be used by understanding the form of the problem then understanding the material then choosing the main formula to solve the problem in essence the explanation was conveyed by the subject in general, this is in accordance with [15] female subjects convey their strategic plans in general. So that the subject fulfills this indicator.

The indicator of being able to formulate the main problem through carrying out the subject's solution plan carries out the plan according to the formula written which is commensurate with [15] that female subjects carry out the plan according to the plan that has been prepared. At the stage of carrying out the subject's solution plan, the subject works coherently and structured, this result is not in accordance with [19] that female subjects do not work coherently. In the study, the subject explained the strategy clearly, the earliest looking for values and elements used to find the unknown final result which was then substituted into the formula to get the final result asked. This is in accordance with [19] that female subjects convey explanations very well. So that the subject fulfills this indicator.

The indicator of being able to reveal the facts needed through making a solution plan the subject remembers the material after understanding the concept of the problem. This result is in accordance with [15] that female subjects prepare plans by connecting prior knowledge to solve problems. The subject explains the formula is sufficient because the results can be found, this shows that the explanation of the adequacy of information is less detailed, less clear, and less complete. This is different from [6] that the female subject provided detailed, complete, and clear reasoning.

The indicator of being able to reveal the facts needed through carrying out the subject's solution plan explains how to solve the problem clearly and coherently with the process of working with accuracy and confidence and the stages are neatly structured. This result is different from [24] who explained that female subjects in solving problems tend to be careful, hesitant and structured, so besides being different in this study, it also gets the same theory, namely the subject's work is neatly structured at each of its stages. In addition, the results of this study are also in accordance with [17] female subjects show a confident attitude when implementing the plan. So that the subject fulfills this indicator.

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The indicator of being able to choose logical, relevant and accurate arguments through carrying out the subject's solution plan argues according to his knowledge but the argument is not conveyed logically, but is relevant and accurate. This is different from [6] that female subjects in each step taking are accompanied by reasons that tend to be logical, but also have similarities with the reasons conveyed are relevant. In addition, there is a new discovery in this study, namely the argument presented by the subject is accurate or correct. So that the subject does not meet these indicators.

The indicator of being able to detect bias according to different points of view through making a solution plan the subject uses one alternative solution in accordance with [15], namely female subjects only provide one alternative problem solving. In addition, the results of this study differ from [17] which states that female subjects tend to make two plans to solve. The subject explained the possibilities that occurred from other plans by trying them first. This is different from [17] that female subjects are able to reveal the possibilities with other plans when using two alternative solutions. So that the subject fulfills this indicator.

The indicator of being able to detect bias according to different points of view through carrying out the solution plan explains the possibilities that occur if done using other steps well and clearly by paying attention to each stage of the other steps used. The results of this study are commensurate with the theory of [15] that female subjects check the completeness of each stage to be able to explain the correctness of the steps used. So that the subject fulfills this indicator.

The indicator of being able to determine the consequences of a statement taken as a decision through understanding the problem the subject spontaneously thinks about the meaning of the problem, namely thinking about what to look for. The results of this study differ from [24] that the female subject after understanding the problem the subject only wrote down what was known and asked. So that the subject fulfills this indicator.

The indicator of being able to determine the consequences of a statement taken as a decision through making a solution plan the subject tries to solve the problem based on the solution plan that has been made. This is in accordance with [24] which states that female subjects solve problems in accordance with the predetermined solution plan. So that the subject fulfills this indicator.

The indicator of being able to determine the consequences of a statement taken as a decision through implementing the subject's solution plan explains well the consequences that occur after implementing the subject's solution plan after finding the elements needed to find the final result then substituting the value in the formula and the final result is found. This result is in accordance with [15], namely the female subject correctly carries out the process of implementing the solution plan. In this study the subject produced the answer correctly and in accordance with the question request. This is in accordance with [6] that female subjects produce answers that are in accordance with what the question asks. So that the subject fulfills this indicator.

The indicator of being able to determine the consequences of a statement taken as a decision through re-examining the process that has been done the subject is confident that the resulting answer is correct. These results are different from [6] female subjects in giving confidence in their answers with little doubt about the answers obtained. In addition, it also has differences with [15] female subjects are inconsistent and doubt the truth of their answers and also different from [24] which states that female subjects lack confidence in the answers given. The subject checks what has been done by double-checking the calculation or substitution of numbers into the formula. This is in accordance with [17] that female subjects reexamine answers by repeating or rechecking calculations that have been made.

Checking is done by the subject from the beginning to the end until the results are found, which means that checking is done at each step. These results have in common with [6], namely the female subject re-examines the answer at each step taken. So that the subject fulfills this indicator.

4 Conclusions and Suggestions

Based on the results of research and discussion, it can be concluded that female subjects fulfill 11 of the 12 indicators of critical thinking in Polya's problem solving. The characteristics of critical thinking of female OSN participants can be seen in each indicator. 1a understand the problem by reading carefully, repeatedly, writing math sentences without giving explanations and focusing on the question. 1b explaining the solution plan by understanding the problem, choosing the formula, and writing down the formula. 1c working coherently, structured, and according to the formula written down. 2b explained the information obtained by remembering the material and formulas used, the explanation of the adequacy of the reference was less detailed and complete. 2c explains the steps to solve the problem clearly, coherently, with thorough workmanship and confidence. 3c argues according to his knowledge with relevance and accuracy but not logical. 4b uses one alternative solution and detects other possible plans by trying first. 4c explained other possible steps by paying attention to each step. 5a spontaneously thought of what to look for. 5b tried to solve the problem based on the solution plan that had been made. 5c found the value of the element substituted in the formula and the answer is correct. 5d was sure the answer was correct by checking the answer, namely checking the calculation of substituting the

numbers in the formula from the beginning. Furthermore, teachers can use female OSN participants as peer tutors to improve students' critical thinking skills, especially prospective math olympiad participants.

References

[1] S. K. Nisak and S. Hadi, "Analisis Proses Berpikir Kritis Siswa Dalam Menyelesaikan Soal Peluang," in *Prosiding Seminar Nasional Pendidikan Matematika*, 2015, pp. 208–220.

[2] N. Khasanah, T. Listiawan, and Mugianto, "Analisis Berpikir Kritis Siswa Dalam Pemecahan Masalah Matematika Pada Materi Lingkaran," in *Seminar Nasional Hasil Penelitian Dan Absimas*, 2017, pp. 291–299.

[3] G. P. Ningsi, "Analisis Kemampuan Berpikir Kritis Dan Kreatif Siswa Dalam Memecahkan Masalah Matematika Siswa Kelas IX SMPN 1 Mbeliling, Manggarai Barat, Flores, Nusa Tenggara Timur," in *Seminar Nasional Etnomatnesia*, 2016, pp. 539–543.

[4] D. N. Rohmatin, "Profil Berpikir Kritis Mahasiswa Pendidikan Matematika Dalam Memecahkan Masalah Nilai dan Vektor Eigen ditinjau dari Pemetaan Kemampuan Aljabar," *J. Gamatika*, vol. 3, no. 2, pp. 101–109, 2013.

[5] L. Rahmawati, Subanji, and D. S. N. Afifah, "Analysis Of Critical Thinking from Student With Quantive Approach," in *International Conference Computer Science and Engineering*, 2019, pp. 1–4, doi: 10.1088/1742-6596/1339/1/012084.

[6] B. Cahyono, "Analisis Ketrampilan Berpikir Kritis Dalam Memecahkan Masalah Ditinjau Perbedaan Gender," *J. AKSIOMA*, vol. 8, no. 1, pp. 50–64, 2017.

[7] N. M. Fuad, S. Zubaidah, S. Mahanal, and E. Suarsini, "Improving Junior High Schools ' Critical Thinking Skills Based on Test Three Different Models of Learning," *Int. J. Instr.*, vol. 10, no. 1, pp. 101–116, 2017, doi: 10.12973/iji.2017.1017a.

[8] S. Nurkholifah, Toheri, and W. Winarso, "Hubungan Antara Self Confidence Dengan Kemampuan Berpikir Kritis Siswa dalam Pembelajaran Matematika," *Edumatica J. Pendidik. Mat.*, vol. 8, no. 1, pp. 58–66, 2018.

[9] R. L. Sadikin and G. M. Muhammad, "Peningkatan Kemampuan Berpikir Kritis Matematis Siswa SMA Dengan Model Brain Based Learning (Penelitian Tindakan Kelas)," *Journals Math. Educ. TRIPLE S*, vol. 1, no. 1, pp. 15–28, 2018.

[10] T. Tarzimah and T. S. M. Meerah, "Students ' Difficulties in Mathematics Problem-Solving : What do they Say ?," *ICMER Int. Conf. Math. Educ. Res.*, vol. 8, pp. 142–151, 2010, doi: 10.1016/j.sbspro.2010.12.020.

[11] A. Widyawati, D. S. N. Afifah, and G. Resbiantoro, "Analisis Kesalahan Siswa dalam Memecahkan Masalah Lingkaran Berdasarkan Taksonomi Solo Pada Kelas VIII," *J. Pendidik. Mat. dan Sains*, vol. 1, no. 1, pp. 1–9, 2018.

[12] H. Kusmanto, "Pengaruh Berpikir Kristis Terhadap Kemampuan Siswa Dalam Memecahkan Masalah Matematika (Studi Kasus Di Kelas VII SMP Wahid Hasyim Moga)," *J. Eduma*, vol. 3, no. 1, pp. 92–106, 2014.

[13] J. P. Mairing, I. K. Budayasa, and D. Juniati, "Profil Pemecahan Masalah Siswa Peraih Medali OSN Matematika," *J. Pendidik. dan Pembelajaran*, vol. 18, no. 1, pp. 65–71, 2011.

[14] A. Masek, "The Effect of Problem Based Learning on Critical Thinking Ability : A Theoretical and Empirical Review," *IRSSH Int. Rev. Soc. Sci. Humanit.*, vol. 2, no. 1, pp. 215–221, 2011.

[15] M. R. Yuwono, Udiyono, D. H. Ma'arif, and Sulistiana, "Student's Critical Thinking Profile To Solve The Problem Of Analytical Geometry Viewed From Gender," *Al-Jabar J. Pendidik. Mat.*, vol. 10, no. 1, pp. 37–46, 2019.

[16] I. Rahmawati, A. Hidayat, and S. Rahayu, "Analisis Ketrampilan Berpikir Kritis Siswa SMP Pada Materi Gaya Dan Penerapannya," in *Prosiding Seminar Nasional Pendidikan IPA*, 2016, pp. 1112–1119.

[17] J. P. Mairing, I. K. Budayasa, and D. Juniati, "Perbedaan Profil Pemecahan Masalah Peraih Medali OSN Matematika Berdasarkan Jenis Kelamin," *J. Ilmu Pendidik.*, vol. 18, no. 02, pp. 125–134, 2012, doi: 10.17977/jip.v18i2.3612.

[18] A. S. Nur and M. Palobo, "Profil Kemampuan Pemecahan Masalah Matematika Siswa Ditinjau Dari Perbedaan Gaya Kognitif Dan Gender," *J. Mat. Kreat.*, vol. 9, no. 2, pp. 139–148, 2018.

[19] S. Damayanti, "Kemampuan Berfikir Kritis Siswa SMP Dalam Pembelajaran Himpunan Dengan Model Jucama Ditinjau Dari Gender," *Artik. Simki-Techsain*, vol. 02, no. 07, pp. 2–8, 2018.

[20] Hasratuddin, "Meningkatkan Kemampuan Berpikir Kritis Siswa Smp Melalui Pendekatan Matematika Realistik," *J. Pendidik. Mat.*, vol. 4, no. 2, pp. 19–33, 2010, doi: 10.22342/jpm.4.2.317.

[21] L. Misu, "Mathematical Problem Solving Of Student By Approach Behavior Learning Theory," *Int. J. Educ. Res.*, vol. 2, no. 10, pp. 181–188, 2014.

[22] I. P. E. Sugiantara, N. W. Arini, and I. D. K. Tastra, "Pengaruh Strategi Pemecahan Masalah Berbasis Teori Polya Terhadap Hasil Belajar Matematika Siswa Kelas V," *J. Mimb. PGSD Univ. Pendidik. Ganesha*, vol. 2, no. 1, 2014.
[23] S. Anwar and S. M. Amin, "Penggunaan Langkah Pemecahan Masalah Polya Dalam Menyelesaikan Soal Cerita Pada Materi Perbandingan Di Kelas VI MI AL-Ibrohimy Galis Bangkalan," *J. Pendidik. Mat. e-Pensa*, vol. 1, no. 1, pp. 1–6, 2013.
[24] N. Indrawati and N. Tasni, "Analisis Kemampuan Pemecahan Masalah Berdasarkan Tingkat Kompleksitas Masalah dan Perbedaan Gender," *J. Saintifik*, vol. 2, no. 1, pp. 16–25, 2016.