



Analysis of Mathematical Reflective Thinking Skills in Solving Problems in Terms of Gender Differences

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Abstract: This study aims to analyze the ability to think reflectively in problem solving from a gender perspective. The approach used in this study was qualitative descriptive with the aim of describing in depth the differences in reflective thinking patterns between men and women. Data were collected through in-depth interviews and participatory observations involving Yogyakarta State Elementary School students as participants. The data obtained from the tests and interviews analyzed using qualitative descriptive analysis. The results show that women tend to use a more holistic reflective thinking approach that involves evaluating social and emotional impacts and considering long-term solutions. In contrast, men tend to use a more pragmatic approach, focusing on quick and efficient solutions and relying on personal experience in problem solving. These findings showed that there were significant differences between men and women in how they think reflectively, which can affect how they solve problems. Therefore, this study suggests that a more inclusive learning approach be designed to accommodate these differences, in order to improve reflective thinking skills in both genders.

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Introduction

Problem solving is a crucial cognitive skill in human life, both in educational and professional contexts. This skill includes a series of mental processes that include problem identification, analysis, evaluation, and the search for optimal solutions (Alim et al., 2021). One effective approach to developing this skill is through the application of reflective thinking, which is the ability to reflect on past experiences and consider various perspectives in order to make better decisions in the future (Schon, 2013). (Dewey, 1993) argues that reflective thinking is a process that involves critical evaluation of experience to gain a deeper understanding.

The importance of reflective thinking skills in the context of education has received widespread recognition (Surbeck et al., 1991). Reflective thinking allows individuals to identify and solve problems in a more structured and effective way (Hamzah et al., 2024). This is highly relevant in primary education, where students are expected to develop critical and analytical thinking skills. Research conducted by (Brookfield, 1987) shows that the ability to think reflectively has a direct link to increased conceptual understanding and the ability to solve problems better in an academic context.

However, the phenomenon of gender differences in reflective thinking has not received much attention in educational research. Several studies show significant differences in the way men and women solve problems. According to (Gardner, 1993), these differences can be caused by biological and social factors that shape the perspective and problem-solving



strategies of each gender. Gender differences undoubtedly cause physiological variations and affect psychological inequalities in learning. In some analyses, men have superior abilities in mathematics (Santrock, 2018). According to (Hidayanti et al., 2020) inherent potential and abilities distinguish men's and women's cognitive approaches to problem solving. The difference in abilities between men and women is rooted in biological differences in the brain, with men typically showing an advantage in logical reasoning, math skills, and techniques, while women are superior in language learning, memory, accuracy, precision, and responsiveness (Hijriani et al., 2024). Biologically, gender differences also affect cognitive processes and problem-solving approaches. According to a study conducted (Hidayanti et al., 2020), female students are superior in emotional regulation, while male students demonstrate proficiency in rational reasoning. There is a difference in learning attitude, where women often demonstrate more organized learning practices than men (Wahyuningtiyas, 2024).

In the context of education, understanding gender differences in reflective thinking is very important (Artz & Armour-thomas, 1992). This is because learning strategies tailored to these differences in thinking styles can improve students' reflective thinking skills. Research by (Halpern, 2000) shows that gender differences in reflective thinking can affect the way students develop their cognitive skills, and thus, can affect their academic achievement. Therefore, it is important to further examine these differences in the context of problem solving.

Although some studies indicate gender differences in reflective thinking, research that examines this phenomenon specifically in the context of problem solving is still limited. One study (Loughran, 2002) that investigated reflective thinking skills in teachers showed that female teachers more often used a reflective approach to analyze and solve problems related to classroom interaction, while male teachers used more action-based approaches in practical problem solving. This study shows the need for further study related to gender differences in reflective thinking, especially in the context of academics and problem solving.

The novelty of this study compared to previous research lies in the variables studied, namely students' reflective thinking abilities in problem solving which are analyzed through a gender perspective. This is due to the fact that there are still limited previous studies that specifically explore the differences in reflective thinking between male and female students in the context of problem solving. For example, a similar study examining reflective thinking was conducted by (Purwadhani & Wijayanti, 2025), which found that students with a visual learning style tend to understand information and questions well and are able to choose effective strategies, but are less thorough in the process of checking results and drawing conclusions. Meanwhile, students with an auditory learning style have an advantage in understanding information and connecting mathematical concepts, but are less optimal in understanding questions and checking results. On the other hand, students with a kinesthetic learning style show a more complex ability to think reflectively, characterized by high precision in checking steps and results, and the ability to draw accurate conclusions.

Furthermore, research that examines gender differences with the variable of mathematical representation skills was conducted by (Novianti et al., 2025). The results of the study show that there are significant differences in mathematical representation skills between male and female students, especially in mixed material. Male students tend to excel in using visual representations to understand mathematical concepts, while female students rely more on practical activities to achieve the same understanding. These findings indicate that gender differences can affect the way students process and represent mathematical information, which in turn can have an impact on their reflective thinking skills.



The purpose of this study is to contribute to the understanding of gender differences in reflective thinking in the context of problem solving. This study aims to investigate the extent to which gender differences affect the way individuals think reflectively when facing problems and how these differences can be integrated into a more inclusive learning design. The results of this study are expected to provide deeper insights for educators in designing learning strategies that are in accordance with the characteristics of each gender.

Research Method

This study used a descriptive qualitative approach to analyze students' mathematical reflective thinking skills in solving mathematical problems on the circumference of squares and rectangles. The qualitative approach was chosen because it allows researchers to describe phenomena in detail and systematically without changing or manipulating the existing variables. This research was conducted using a descriptive method, which focuses on collecting data in the form of the results of students solving mathematical problems and their reflections on the thinking process they are doing. This research does not aim to compare results quantitatively, but rather to describe in depth how male and female students solve math problems and how they reflect on the steps taken.

The subjects of this study were sixth grade students at public elementary schools in Yogyakarta who were studying the subject of the circumference of squares and rectangles. The research sample was taken using purposive sampling, which is the selection of subjects based on certain criteria relevant to the research objectives. In this case, the research subjects were male and female students who had an equivalent educational background in the mathematics subject tested.

The main instrument in this study was a mathematics test consisting of questions about the circumference of squares and rectangles. The questions were designed to test students' reflective thinking skills in problem solving, including the steps taken, the considerations made during the problem-solving process, and how students evaluated the solutions found. In addition to the math test, an additional instrument in the form of an open interview was conducted to explore students' reflective thinking about the process they went through in solving problems.

Data collection was carried out in two stages. The first stage was to give tests to all students involved in the study. The test consisted of open-ended questions that challenged students to explain the steps they took in solving the problems of the circumference of a square and a rectangle. The second stage was an interview with the students after they completed the test to explore in more depth how they reflected on the thinking process they had used to solve the problem. During the interview, the researcher also asked questions about the strategies the students used, whether there were any special considerations made, and how the students assessed the solutions they found.

The data obtained from the tests and interviews will be analyzed using qualitative descriptive analysis (Creswell, 2013). The first step is to transcribe the interview results to identify the main themes that emerge from the students' reflective thinking. Furthermore, the data from the test questions are analyzed based on the steps taken by the students in solving the problems. To analyze gender differences, data from male and female students will be compared descriptively to see if there are differences in the approach and reflective thinking process used. These differences will be identified based on patterns that emerge during tests and interviews, namely in terms of problem-solving speed, the thoroughness of the steps taken, and the depth of reflection carried out by each gender.



The validity of this research data is using data triangulation. The triangulation used is source triangulation and method triangulation. Source triangulation is collecting data from various sources, such as students, teachers, and class observations, to ensure data consistency and reliability. Method triangulation is using various data collection methods, such as observation, interviews, and student assignment analysis. This can help verify findings from tests and interviews.

Results and Discussion

The presentation of data in this study was carried out by summarizing the main findings obtained through in-depth interviews and participatory observations, and organizing the data in a clear and easy-to-understand form. Data obtained from interviews and observations were processed to describe gender differences in reflective thinking in problem solving. Data presentation consists of findings regarding the reflective thinking approaches used by men and women, as well as comparisons between the two genders.

Table 1. Research Results

	Female	Male
Differences in Reflective Approach	Involving others (discussion, feedback).	Rely on yourself.
Perspective Time Difference	Long-term solution.	Fast and direct solutions.
Differences in Emotional Judgment	Considering emotional aspects (self and others)	Focus on effectiveness.
Differences in Problem Solving Approaches	Systematic and analytical	Pragmatic and prioritizes rapid testing.

Based on table 1, there are significant differences in reflective thinking patterns between women and men, while the explanation of each aspect is as follows:

Differences in Reflective Approach

Women tend to involve more external parties, such as peers or mentors, in their reflective thinking process. This can be seen from their tendency to discuss or seek the opinions of others as part of the decision-making or problem-solving process. One of the female participants revealed that feedback from others provided additional confidence and enriched their perspectives with previously unthought-of viewpoints. Statements such as, *"I feel more confident after discussing with friends. They often give perspectives that I did not think of before,"* indicates that women viewed collaboration and social interaction as important components in the reflective thinking process.

On the other hand, men show a different tendency, relying more on themselves in solving problems. They tend not to seek external opinions unless facing significant difficulties. One male participant stated, *"Usually I try to solve the problem myself first. If I am still confused, then I ask my friends."* This statement indicates that men tend to prioritize autonomy and independence in the reflective thinking process, with external intervention only considered as a last resort when independent efforts are not fruitful.

Perspective Time Difference

In the context of a temporal perspective, there are significant differences between women and men in the decision-making process. Women tend to apply a more holistic and long-term oriented approach, by considering the implications of their decisions on future conditions. This is illustrated by the statement of one female participant who stated, *"I always think long about whether my answer is right or wrong."* This statement shows a tendency to



conduct in-depth evaluation and critical reflection before making decisions, indicating a preference for solutions that are sustainable and have a positive impact in the long term.

On the other hand, men tend to be more pragmatic and focus on solutions that can be implemented immediately and deliver results quickly. As one male participant put it, *"I prefer to find solutions that can be implemented immediately, rather than thinking about the impact in the future."* This statement indicates a preference for efficiency and speed in problem solving, with more limited consideration of long-term consequences.

Differences in Emotional Judgment

In the context of the reflective thinking process, there are significant differences between women and men in terms of consideration of emotional aspects. Women tend to consider the emotional dimension more often, both in relation to themselves and others. Sensitivity to the emotional impact of a decision becomes a dominant factor in their decision-making process. This was expressed by one female participant who stated, *"I often consider how I and others will feel after my decision is made. Emotions are important in making sure the decision is right."* This statement indicates that women tend to integrate empathy and affective considerations as crucial components in decision evaluation.

On the other hand, men show a different trend, where the emotional aspect is less of a major concern in the decision-making process. They focus more on the effectiveness and efficiency aspects of problem solving. As one male participant explained, *"I focus on how the decision can solve the problem, not how other people feel about it."* This statement indicates that men tend to adopt a more instrumental and pragmatic approach, emphasizing concrete outcomes and solutions rather than the emotional impact that may arise.

Differences in Problem Solving Approaches

In the context of decision-making and problem-solving, there are notable differences between men and women in terms of the approaches used. Men tend to adopt a pragmatic approach, characterized by a preference for testing solutions quickly and experimentally. This approach focuses on direct action and exploration of various methods without too much preliminary analysis. This is reflected in one male participant's statement: *"I prefer to try different methods until I find the right one. There is no need to think too much before acting."* This statement indicates that men tend to prioritize efficiency and speed in reaching solutions, with the belief that the trial and error process can produce effective results.

On the other hand, women show a tendency to take a more systematic and analytical approach. They tend to do more careful planning and consider the various possibilities and implications of each step taken. As one female participant explained: *"I prefer to plan the steps more clearly and consider what could go wrong and right from each choice."* This statement reveals that women are more risk-oriented and more likely to conduct in-depth evaluations before taking action. This approach reflects a preference for reducing uncertainty and ensuring that every decision is based on comprehensive considerations.

Discussion

This study revealed significant differences in the way men and women think reflectively in solving problems. Women tend to pay more attention to social and emotional aspects, reflect on previous experiences, evaluate decisions, and consider long-term consequences, in accordance with the theory of reflective thinking (Dewey, 1993; Sa'dijah et al., 2021). On the other hand, men are more likely to use a direct, practical, and action-based approach, focus on concrete and quick solutions, and rely on trial and error methods, which is in line with research (Gardner, 1993 ; Borgonovi & Greiff, 2020). The findings suggest that women are more reflective and evaluative, while men are more pragmatic in problem solving.



Thematic analysis shows that women tend to have more frequent discussions with others to seek multiple perspectives before making decisions, are open to feedback, and consider others' opinions as part of the reflection process, illustrating their tendency to integrate the social dimension in reflective thinking (Chen et al., 2019). On the other hand, men seek external input less often and tend to be independent in making decisions, although in some cases they involve others if the desired solution is not reached. This suggests a difference in approach between women who are more collaborative and men who are more independent in the decision-making process.

Although there are gender differences in reflective thinking, men also show high reflective skills, especially in dealing with technical or logic-based problems, where they tend to be more systematic in analyzing data or numerical information. This finding indicates that gender differences lie not only in the type of problem, but also in the approach used, as supported by (Halpern, 2000) which states that both genders can show equivalent reflective thinking skills in different contexts. In addition, research (Nurhaeti et al., 2024) reinforces that males are more likely to use systematic and numerical approaches, while females excel in aspects such as language learning, memory, accuracy, precision, and responsiveness (Hijriani et al., 2024). Thus, gender differences in reflective thinking are more contextual and dependent on the type of problem at hand.

In the context of problem solving, women tend to involve aspects of feelings and interpersonal relationships in the evaluation of solutions, consider the emotional and social impact of their decisions, and favor social and emotional balance in reflective thinking. They also tend to think about long-term solutions and see problems in a broader context, take into account various future possibilities, and are more holistic in their considerations (Hajjah Rafiah, 2021). In addition, women are more patient in evaluating alternative solutions before making a decision. On the other hand, men focus more on practical solutions that can be implemented immediately, tend to make decisions more quickly, and involve less in-depth evaluation, except when facing difficulties in finding clear solutions, according to the findings (Sa'dijah et al., 2021). Thus, the different approaches between women and men in problem solving reflect different priorities, where women are more reflective and holistic, while men are more pragmatic and quick action-oriented.

Although there are differences in reflective thinking between men and women, this study shows that both have the same ultimate goal in problem solving, which is to find effective and efficient solutions. Both men and women can achieve similar results even with different approaches, as supported by research (Abdussakir et al., 2024) which states that the efficiency of decision making between the two genders is not significantly different. (Hanggara et al., 2022) also added that although analytical and intuitive approaches are different, both are equally effective in achieving optimal solutions. Thus, differences in approaches do not hinder the ability of both genders to achieve optimal solutions in problem solving.

This study reveals significant differences in the way men and women think reflectively when solving problems, with important conceptual and practical implications. Conceptually, the findings reinforce theories of reflective thinking (Dewey, 1993; Sa'dijah et al., 2021; Borgonovi & Greiff, 2020) which suggest that women tend to be more reflective, evaluative, and holistic, while men are more pragmatic and quick-action oriented. Women pay more attention to social and emotional aspects, reflect on previous experiences, and consider long-term consequences, whereas men focus more on practical and immediate solutions, often relying on trial and error methods. The findings also confirm that gender



differences in reflective thinking are contextual. Men tend to be more systematic in technical or logic-based problems, while women excel in aspects such as language learning and memory (Halpern, 2000 ;Nurhaeti et al., 2024). Despite differences in approach, both genders have the same end goal, which is to achieve effective and efficient solutions (Abdussakir et al., 2024).

Practically, the findings have broad implications, especially in education, decision-making and human resource management. In education, educators can design curricula that take into account the differences in thinking styles between men and women. For example, more reflective and collaborative learning approaches may be more effective for women, while practical and action-based approaches are more suitable for men (Sa'dijah et al., 2021 ;Nurhaeti et al., 2024) . In a group context, teams consisting of a mix of men and women can capitalize on these differences in approach to produce more holistic and balanced solutions. Women can provide reflective and evaluative perspectives (Lestari et al., 2021), while men can offer practical and quick solutions (Hajjah Rafiah, 2021 ;Chen et al., 2019). Thus, this study not only enriches our understanding of gender differences in reflective thinking, but also provides practical insights that can be applied in various aspects of life.

Conclusion

This study successfully identified significant differences in reflective thinking patterns between men and women in the context of problem solving. Based on the results of the study, women tend to apply a more in-depth and holistic reflective thinking approach, taking into account social, emotional, and long-term solutions. Women also more often involve other parties in the decision-making process, and are more thorough in evaluating alternatives. This indicates that women tend to have a greater tendency to pay attention to social factors in decision making. In contrast, men favor a pragmatic approach that focuses on quick and efficient solutions. They more often rely on experience and proven knowledge, and tend to be more independent in the problem-solving process. Men are also more focused on achieving immediate results, without much consideration of the long-term impact or emotional factors that may arise from the decisions taken.

The differences found in this study suggest that gender factors influence reflective thinking and problem solving. Therefore, it is important for curriculum developers and educators to consider these differences in designing learning strategies that are more inclusive and responsive to the needs of each gender, in order to optimize the development of reflective thinking skills in all students. Overall, the results of this study contribute to a deeper understanding of gender differences in reflective thinking, particularly in the context of problem solving. The findings are expected to be the basis for the development of learning approaches that can accommodate the diversity of reflective thinking styles, so as to increase the effectiveness of learning in various educational contexts.

Recommendation

Teachers can integrate feedback and self-reflection practices into the learning process. For example, after completing an assignment, students can be asked to reflect on their process, evaluate the decisions made, and consider alternative solutions. This can be done through reflection journals or group discussions. This practice will help students, especially boys, to be more open to feedback and develop evaluative skills.



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