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UNRAVELING MATHEMATICAL PROBLEM-SOLVING PROFILES OF GAMER STUDENTS THROUGH GAMING MOTIVATION

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ABSTRACT

The ability to solve mathematical problems is a fundamental component of mathematics education. However, there remains a lack of research describing the profile of mathematical problem-solving based on motivation arising from gaming activities. This study aims to describe the mathematical problem-solving profiles of student gamers, based on the dominant dimensions of the Gaming Motivation Inventory (GMI). A qualitative approach utilizing a multiple-case study design was implemented, with two 11th-grade students serving as research participants. Two subjects were selected using purposive sampling from students enrolled in a single research class, based on their GMI questionnaire results: one student with the dominant dimension of Mastery and one student with the dominant dimension of Social. Data were collected using the GMI instrument, two PISA-based math problem-solving questions, and semi-structured interviews. The qualitative analysis model developed by Miles et al. was employed to analyze the data. Students' problem-solving processes were examined through Polya's four stages. The results indicated that both subjects completed all four stages of Polya's problem-solving process, yet displayed distinct problem-solving characteristics. The Mastery subject employed a systematic and persistent approach, while the Social subject favored visual representations and collaborative verification. These findings offer valuable guidance for mathematics teachers in designing learning activities that address students' diverse motivational characteristics.

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INTRODUCTION

Mathematical problem-solving skills are often considered the "heart" of mathematics learning because they not only emphasize content mastery but also emphasize the development of a systematic, critical, and logical mindset for finding solutions (Arili et al., 2024). Internationally, the NCTM has established problem-solving as the primary focus of mathematics instruction, enabling students to tackle real-life problems (Bijl et al., 2026; NCTM, 2000; Xin & Lam, 2024). International assessments demonstrate that Indonesian

students' mathematics proficiency remains low. The PISA 2022 result indicate that Indonesian students achieved an average mathematics score of 366, which is substantially lower than the OECD average of 472 (OECD, 2023). This finding indicates continuing challenges in Indonesian students' mathematical proficiency, particularly in applying mathematical knowledge to unfamiliar problems. This situation demonstrates that a large proportion of Indonesian students still rank very low in terms of Higher-Order Thinking Skills (HOTS), which involve analysis, evaluation, and creativity in solving non-routine problems (Meryansumayeka et al., 2021; Suheni et al., 2026).

Mathematical problem-solving is defined as the cognitive effort to transform a given situation to achieve a goal when no clear solution method is available (Arili et al., 2024; Samani et al., 2016). According to George Polya, problem-solving is carried out through four stages: understanding the problem, devising a plan, carrying out the plan, and looking back (Polya, 1973; Yilmaz-can, 2023). Each student is unique in how they acquire, retain, and apply knowledge, encompassing differences in cognitive, affective, and motivational aspects (Abidin & Jarmita, 2020; Widyawati et al., 2024). Students' responses to mathematics material will vary according to their individual psychological characteristics (Setiyowati et al., 2024; Widyanti & Khabibah, 2020). These differences in characteristics allow each student to exhibit a distinct problem-solving profile.

Advances in information and communication technology have transformed various aspects of modern society, including the use of the internet for communication, information dissemination, and entertainment (Felinaweny & Kurniawan, 2025). One form of online entertainment is digital gaming. In this study, student gamers are defined as students who engage in digital gaming, without restricting the type of game, frequency of play, or duration of gaming experience. Students who are gamers have diverse motivations for playing, ranging from skill mastery and boredom to social interaction (Király et al., 2022). These motivational characteristics can be identified using the Gaming Motivation Inventory (GMI) developed by Király et al.(2022).

Previous research on mathematical problem-solving profiles has primarily examined participant characteristics, such as learning styles, gender, and field-dependent and field-independent cognitive styles (Abidin & Jarmita, 2020; Firmansyah & Syarifah, 2023; Widyanti & Khabibah, 2020; Widyawati et al., 2024). On the other hand, research on gaming motivation has largely focused on psychological aspects, such as the relationship with gaming addiction or interest in learning (Kaimudin et al., 2024; Nur & Iqlimah, 2023). Although there are studies that discuss gaming motivation and problem-solving, research describing the mathematical problem-solving profiles of student gamers by grouping subjects based on GMI dimensions remains very limited.

These limitations reveal a research gap that warrants further investigation. The present study is novel in its application of the Gaming Motivation Inventory (GMI) to group subjects and describe the mathematical problem-solving profiles of student gamers. Thus, this study does not treat the GMI as a variable to be tested, but rather as the basis for grouping research subjects. This study examines the mathematical problem-solving processes of two student gamers, each exhibiting distinct dominant gaming motivations, Mastery and Social, using Polya's four stages of problem-solving as the analytical framework.

METHOD

A qualitative approach utilizing a multiple-case study design, as described by Yin (2018). This methodology facilitated an in-depth examination of the mathematical problem-solving processes demonstrated by student gamers, with a specific focus on the primary dimensions of their motivation for gaming. The selection of this approach aligns with Creswell (2012), who explains that qualitative research aims to explore or understand key phenomena in specific individuals within a particular research context. The multiple-case study design was

used to examine two cases in depth: students with Mastery as their dominant motivational dimension and students with Social as their dominant motivational dimension. Each case was analyzed according to Polya's problem-solving stages to describe the mathematical problem-solving profiles of the subject.

The study sample comprised 29 eleventh-grade students who are gamers at a high school in Lamongan. Subjects were selected using purposive sampling. In the initial stage, all students were given the Gaming Motivation Inventory (GMI) questionnaire to identify the dominant dimensions of gaming motivation for each student. In the second stage, the researchers consulted with the math teacher to gather data on students' math abilities in order to select students with relatively similar math abilities. According to the GMI questionnaire results, two students were selected, with one exhibiting mastery and the other Social as their dominant motivational dimensions. The selection of students took into account the GMI results, relatively comparable math abilities, the math teacher's recommendations, communication skill, and the students' willingness to participate in the study. Thus, two research subjects were selected.

This study used three instruments: the GMI questionnaire, a mathematical problem-solving test, and interviews. The GMI questionnaire was adapted from an instrument developed by Király et al. (2022) to identify the dominant dimensions of gaming motivation among students. The instrument consists of 26 statements adapted from the original instrument and covers six dimensions of motivation. The instrument was adapted through a process of translation and linguistic adjustment to ensure the statements were understandable to students in Indonesia while maintaining the meaning of each item in accordance with the dimension being measured.

Each statement was measured using a 1-7 Likert scale. Each dimension score was calculated as the mean of the scores for the statements associated with that dimension. The dominant motivational dimension is determined based on the highest average score for each GMI dimension. If a student achieves the same highest average score across more than one dimension, that student is recorded as having multiple dominant dimensions. In selecting research subjects, students with a single dominant dimension and clearly highest average score are prioritized to ensure that subject grouping aligns with the dimension that is the focus of the study.

The math problem-solving test consists of two questions on number patterns adapted from PISA questions (OECD, 2009). The context of the questions was adapted to the students' circumstances, and their problem-solving processes were analyzed using Polya's stages. Interview guidelines were used in semi-structured interviews to obtain information about the subjects' thought processes that were not evident on their answer sheets.

Data collection was conducted using the GMI questionnaire, a math problem-solving test, and interviews. The GMI questionnaire was administered to all students to identify the dominant dimensions of gaming motivation for each student. The results of the GMI questionnaire and information regarding the students' mathematical abilities, as provided by their teachers, were used to select two research subjects. Next, both subjects were given two written mathematical problem-solving questions. The problem-solving questions are presented in Figure 1 and 2.

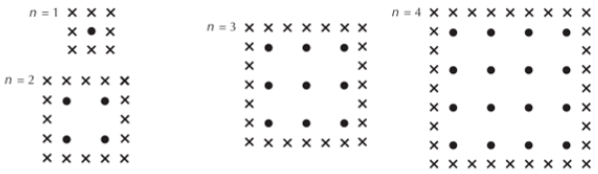
Problem 1

A farmer plants apple trees in a square pattern. To protect the apple trees from wild animals, he erects a bamboo fence around the apple orchard. The number of rows of apple trees is denoted by n. Observe the arrangement of the apple trees and the bamboo fence in the following figure.

Description:

× represents the bamboo fence

● represents the apple trees



Complete the following table based on the pattern in the figure.

Number of rows of apple trees (n)	Number of apple trees	Number of bamboo fences
1	1	8
2	4	
3		
4		

This pattern continues according to the same rule.

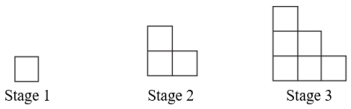
A farmer has 56 bamboo poles to build a fence. Determine the maximum number of rows of apple trees (n) the farmer can create and the number of apple trees that can be planted! Explain your steps and double-check that your result matches the number of bamboo poles available!

Figure 1. Problem 1

Figure 1 illustrates problem 1, which involves an apple orchard arranged in a aquare pattern and enclosed by a bamboo fence. Students must determine the maximum number of rows possible with 56 bamboo poles and calculate how many apple trees can be planted.

Problem 2

A child drew the following pattern.



In the first stage, there is 1 unit square; in the second stage, there are 3 units squares; in the third stage, there are 6 units squares; and so on, forming the pattern shown above. If the child wants to draw the pattern using 45 units squares, determine the highest stage the child can create! Explain the steps you took to solve the problem, then double-check whether the result matches the number of units squares available!

Figure 2. Problem 2

Figure 2 illustrates problem 2, in which a child constructs a regularly increasing pattern of unit squared. Students are required to determine the maximum achievable level using no more than 45 unit squares.

After completing both problems, each participant was interviewed using a semi-structured interview to clarify their thought processes at each stage of problem-solving, particularly those processes not evident in their written answers.

The data were analyzed using the qualitative data analysis model developed by Miles et al. (2014). Students' responses were analyzed based on Polya's four stages of problem-solving. Each student's written responses to both problems were analyzed based on the indicators presented in Table 1.

Table 1. Indicators of Polya's Problem-Solving Stages

Polya`s Stages	Indicators
Understanding the problem	Identifying information obtained from the given problem.
Devising a plan	Determining a solution strategy based on patterns found in the problem.
Carrying out the plan	Implementing the chosen solution strategy to arrive at a solution.
Looking back	Verifying that the result meets the conditions of the problem and drawing conclusions from the solution.

The units of analysis included written answers, solution steps, representations used, and students' statements during interviews. Data were coded based on subject identity, data source, and Polya's stages. Written answers and interview results were analyzed integrally, with interviews used to clarify and deepen information not explicitly evident in the written answers.

Polya's four stages were used as initial categories in the analysis, while problem-solving strategies-such as repeated addition, strategy shifts, and the use of diagrams were identified based on findings in the data. The analysis was conducted for each case to obtain an overview of each subject's mathematical problem-solving profile. The results of the analysis are then presented based on Polya's stages, while taking into account the dominant game-playing motivation that served as the basis for subject grouping.

RESULTS AND DISCUSSION

Results

Based on the results of the Gaming Motivation Inventory (GMI) questionnaire administered to 29 eleventh-grade students, six dimensions of gaming motivation were identified. Tabel 2 presents the detailed results of the GMI questionnaire.

Table 2. GMI Questionnaire Results

GMI Dimension	Number of Students
Mastery	12
Immersion/Escapism	3
Competition	2
Stimulation	3
Social	7
Habit/Boredom	2

Table 2 shows that the mastery and social dimensions are the most dominant, so the study focused on these two dimensions. Two subjects were selected, each consisting of one student from the mastery dimension and one student from the social dimension. The research subjects are presented in Table 3.

Table 3. Research Subject

Code	Dominant Dimension	Average Score
SM	Mastery	5,14
SS	Social	7,00

Table 3 shows that two subjects were selected based on the two dominant dimensions: mastery and social. Both subjects then took a mathematical problem-solving test and participated in an interview to describe their profiles of problem-solving strategies based on their GMI dimensions.

Subjects' Answer to Problem 1

Problem 1 involved a pattern of the number of apple trees and the number of bamboo fence poles in each row of apple trees. The solutions to this problem were analyzed using the four steps of Polya's. The analysis focused on two research subjects, SM and SS, based on their answer sheets and interview results. Subject SM`s answer to problem 1 is presented in Figure 3.

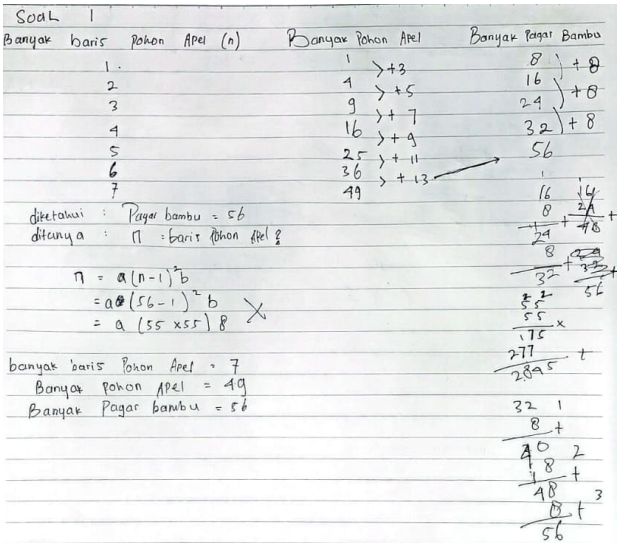


Figure 3. SM`s Answer to Problem 1

Figure 3 shows SM's answer sheet, which presents the information from the question in a table containing the number of rows of apple trees (n), the number of apple trees, and the number of bamboo poles. Although the table is not neatly formatted and lacks dividing lines, SM was able to complete the data provided in the question. SM also wrote down the known information-namely, that there were 56 bamboo fences- and noted that the question asked for the maximum number of rows of apple trees. The interview results indicate that SM successfully restated the information presented in the problem, indicating that SM could identify it. During the devising-a-plan stage, SM observed the differences between the numbers in the table. On the answer sheet, SM determined the number of apple trees by adding consecutive odd numbers.

In contrast, the number of bamboo fences was determined using a pattern of multiples of eight. Based on the interview results, SM stated, *"I looked at the apple trees; from the number of apple trees in the table, 1 to 4 plus 3, and 4 to 9 is 4 plus 5-basically, adding each row in the table."* On the answer sheet, SM tried to use the formula $n = a(n-1)^2 b$ to solve the problem but could not find the correct answer, so SM crossed it out and replaced it with a manual calculation. SM chose the manual calculation because it was considered easier.

During the carrying out the plan stage, SM filled in the table according to the specified pattern, resulting in 25, 36, and 49 apple trees; 40, 48, and 56 bamboo fences; and 7 rows of apple trees. The calculations were performed by using multiples of eight for the number of bamboo fences and adding consecutive odd numbers for the number of apple trees. This process is shown in the calculation notes on the right-hand answer sheet. During the looking back stage, SM double-checked their solution against the problem. In the interview, SM explained that *"it`s correct because we were looking for 56 bamboo fences, and the number of apple trees is 49 and the number of rows of apple trees is 7."* SM also wrote the conclusion on the answer sheet: there are 7 rows of apple trees, 49 apple trees, and 56 bamboo fences. Meanwhile, SS's answer to problem 1 is shown in Figure 4.

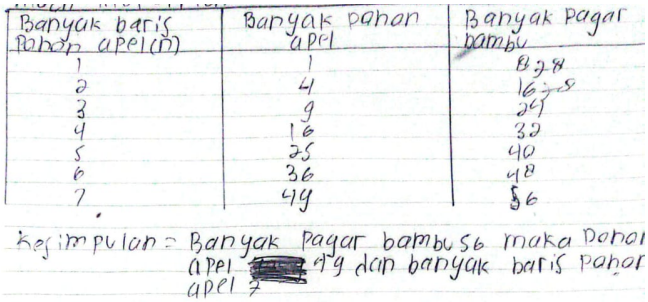


Figure 4. Subject SS`s Answer to Problem 1

Figure 4 shows subject SS's answer sheet, which presents the information in the question as a table showing the number of rows of apple trees (n), the number of apple trees, and the number of bamboo fences. The table is neatly organized with a ruler and includes dividing lines between data points. However, SS did not explicitly write down the known and asked information on the answer sheet. Based on the interview results, SS was able to recount the information in the question. However, SS stated that the question asked for the number of bamboo fences; nevertheless, SS was able to identify the information in the question and solve it correctly, even though the explanation of what was being asked remained inaccurate. During the devising-a-plan stage, SS identified that the number of apple trees followed a pattern of multiples of 8. Based on the interview results, SS stated, *"To find the number of apple trees, n is squared; to determine the number of bamboo fences, you start with 8 and keep adding 8; if it's stage 4, it's automatically 8+8+8+8."*

During the carrying out the plan stage, SS filled out the table up to row 7, resulting in 25, 36, and 49 apple trees, as well as 40, 48, and 56 bamboo fences. During the looking-back stage, SS double-checked the results by counting them again. This is evident from SS's interview response, in which SS stated, *"Counted them again."* On the answer sheet, SS wrote the conclusion that if there are 56 bamboo fences, then there are 49 apple trees and 7 rows of apple trees.

Subjects' Answers to Problem 2

Problem 2 concerns a pattern of unit squares across stages 1, 2, and 3, with the number of unit squares in each stage being 1, 3, and 6. Students were asked to determine the highest stage that could be formed with a maximum of 45 unit squares. The solutions to this problem were analyzed using the four steps of Polya's. The analysis was conducted on two research subjects, SM and SS, based on their answer sheets and interview results. Subject SM's answer to problem 2 is presented in Figure 5.

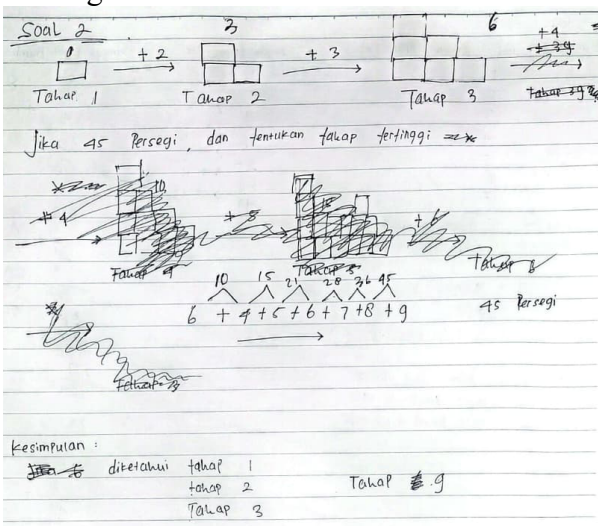


Figure 5. SM`s Answer to Problem 2

Figure 5 shows SM's answer sheet, which presents the information in the question by redrawing the patterns in stages 1, 2, and 3 and writing down the number of unit squares in each stage-namely, 1, 3, and 6. SM wrote down on the answer sheet the known information-namely, stage 1, stage 2, and stage 3 and also wrote down the information being asked, namely whether 45 squares represent the highest stage. Although it was not yet written in complete and neat sentences. Analysis of the interview findings indicates that SM successfully restated the information and stated that it asked for the highest stage the child could create using a maximum of 45 unit squares. This finding suggests that SM successfully identified the relevant information within the problem. During the plan-devising stage, SM identified a pattern by observing the number of unit squares at each stage. This is evident from the interview, where SM stated, *"By looking at the number of squares."* Initially, SM tried using multiplication, but that strategy did not yield the correct answer; subsequently, SM switched strategies to manual counting based on the increment pattern visible on the answer sheet. Based on interview results, SM explained, *"I tried to multiply, but I'll try calculating it manually again."* SM also explained, *"I got confused because with that multiplication method, I kept trying to multiply; I reached step 39, but when I checked again, it turned out to be wrong."* On the answer sheet, SM also tried drawing the pattern step by step but was unsuccessful, so they crossed it out.

During the carrying out the plan stage, SM used a step-by-step addition strategy following the pattern 6+4=10, 10+5=15, 15+6=21, 21+7=28, 28+8=36, and 36+9=45, as shown on the answer sheet. Based on the interview results, SM explained that *"by adding 6+4=10, stage 5 is 10+5=15, stage 6 is 15+6=21, and so on until reaching 45 squares so the maximum stage is stage 9 with a total of 45 unit squares."* Although SM encountered difficulties because the multiplication results they tried did not yield the correct answer, they tried another strategy: performing the calculations by hand until they obtained the correct answer. During the looking back stage, SM double-checked their work by recalculating the problem. Based on the interview results, SM explained, *"I calculated it again carefully."* SM also wrote the conclusion on the answer sheet: stages 9 and 45 unit squares. These findings indicate that SM was able to understand the problem, adjust strategies when the initial approach failed, perform calculations systematically, and double-check the results obtained throughout the process. Meanwhile, subject SS's answer to problem 2 is shown in Figure 6.

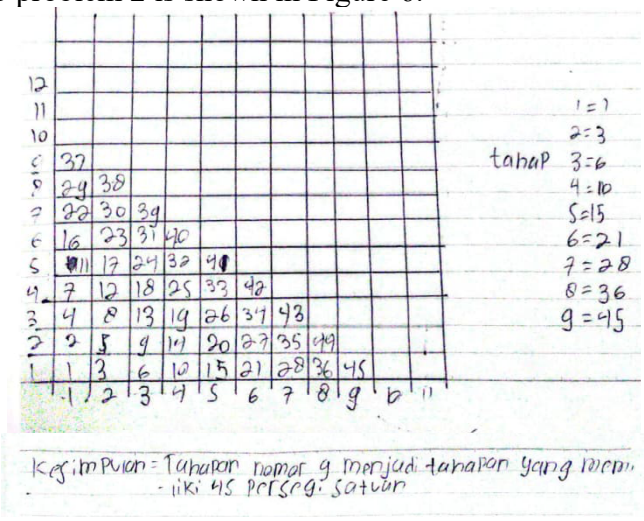


Figure 6. Subject SS`s Answer to Problem 2

Figure 6 shows subject SS's answer sheet, which presents the solution to the problem by drawing a large pattern depicting the progression of unit squares from stage 1 to stage 9. SS did not explicitly record the information provided in the question on the answer sheet; instead, SS drew the overall pattern directly. In addition to drawing the pattern, the subject wrote the number of unit squares for each stage. In the interview results, the participant explained that

stage 1 had 1 unit square, stage 2 has 3 unit squares, and stage 3 had 6 unit squares, and that the question asked was to determine the highest stage if the child wanted to draw a maximum of 45 unit squares. This indicates that SS was able to identify the information in the problem. During the devising-a-plan stage, SS used a drawing strategy to determine the stage that produced 45 unit squares. This was evident from the interview with SS, who stated, *"At first, I wanted to draw it by hand like the example, and eventually I tried drawing it a second way."* Unlike SM's strategy of drawing each stage separately and looking for patterns in those drawings, SS created a single large drawing illustrating the progression of the pattern so that each addition of a unit square could be observed directly.

During the carrying out the plan stage, SS implemented the chosen strategy by combining a visual representation of the big picture with an addition pattern. On SS's answer sheet, the drawn figures were numbered according to the order of addition, so that the total number of squares at each stage could be determined without having to redraw each stage separately. Based on the interview results, SS explained that *"If we want to know the next step, we just add to reach the final step. For example, to find the 4th step, it`s 6+4=10; to find the 5th step, it's 10+5=15; for the 6th step, we add result on the 5th step to 6, which gives 21, and so on until the final step."* The results for each step are shown on the right side of the figure. Using this strategy, SS determined that stage 9 contains 45 unit squares. During the looking back stage, SS double-checked their solution. Based on the interview results, SS explained that the answer was double-checked by *"recalculating it and discussing it again with friend mentioned earlier."* This finding indicates that SS performed a double check by recalculating and confirming the result with a friend before finalizing the answer. On the answer sheet, SS wrote that stage number 9 has 45 unit squares. Table 4 presents a summary of the two subjects' problem-solving profiles, determined from analysis of two mathematics problem-solving profiles according to Polya's four stages.

Table 4. Summary of Mathematical Problem-Solving Profiles for Each Subject Based on Polya's Four Stages

Polya`s Stage	Mastery Subject (SM)	Social Subject (SS)
Understanding the problem	Identified the given information and the information being sought in the question, as explicitly stated on the answer sheet.	Identified the information provided and the information being sought, but did not accurately state what was being sought in Problem 1 during the interview. Nevertheless, the student was able to solve the problem correctly but did not explicitly write the question's details on the answer sheet.
Devising a plan	Determine a systematic problem-solving strategy by identifying patterns and performing manual calculations, and adjust the strategy if no answer is found.	Determining a solution strategy by recognizing patterns and using visual representations.
Carrying out the plan	Apply the chosen strategy systematically to arrive at the correct solution.	Applying the chosen strategy using visual representations supported by mathematical calculations.
Looking back	Verify the solution independently by checking the calculations and ensuring the answer meets the question's requirements, and write the conclusion on the answer sheet without using a complete sentence.	Verifying the solution by recalculating and discussing it with peers before finalizing the answer, and explicitly writing the conclusion on the answer sheet.

Discussion

The results of this study show that student who are gamers and whose motivation includes both mastery and social dimensions were able to complete Polya's four stages of problem-solving in sequence. However, the two dimensions showed differences in strategy selection at each stage, ranging from information representation to methods of verifying solutions. These findings suggest that differences in gaming motivation dimensions do not alter the problem-solving sequence but rather result in differences in individual strategies and cognitive persistence when seeking solutions. This indicates that each individual has a unique way of acquiring, retaining, and applying mathematical knowledge, which is influenced by cognitive and motivational aspects (Abidin & Jarmita, 2020; Widyawati et al., 2024). The use of the GMI as a basis for grouping has proven effective in identifying variations in the cognitive strategies of student gamers in problem-solving situations.

Subjects with the Mastery (SM) dimension demonstrated systematic strategies. During understanding the problem, SM tended to present information in the form of data tables and to write down the information provided in the problem as key variables for thoroughly solving the problem. During devising and carrying out the plan stage, SM initially attempts to use formulas but switches to a systematic manual calculation strategy when the initial approach fails to yield a solution. SM exhibits the cognitive flexibility often observed in expert level games they tend to employ an inquiry cycle in decision making (Alt, 2023; Jacques, 2022). SM`s use of systematic search strategy when calculating growth patterns is a strategy students tend to employ when facing problems containing many numerical values (Held et al., 2026; Meryansumayeka et al., 2021). This behavior reflects the motivations of "completion" and "advancement" within the mastery dimension, where mechanical mastery of the game is demonstrated through persistence in solving problems until they are fully resolved. Furthermore, SM`s tendency to independently and carefully double check their work indicates that they feel satisfied upon solving a problem. Students with mastery motivation feel satisfied when they successfully overcome difficult challenges, so they are less likely to give up when a formula fails to work.

Meanwhile, the subjects in the Social (SS) dimension demonstrated visual and interactive strategies for problem-solving. During the problem-understanding stage, SS did not explicitly write down known information on the answer sheet but explained the problem's context well during the interview. During devising and carrying out the plan stage, SS used drawings to build an initial understanding. SS combined these drawings with a step-by-step addition pattern, demonstrating the use of visual representations in the problem-solving process. Implementing visual strategies facilitates students' problem-solving in mathematics (Meryansumayeka et al., 2021). This aligns with Schoenherr and Schukajlow (2024), who explain that external visualization encompasses the processes of creating, using, and interpreting visual representations in mathematics learning. Another finding regarding SS is that during the review stage, SS not only recalculated the results but also confirmed them or discussed them with peers to ensure their accuracy.

These activities align with Hansen (2022) research, which shows that interactions in collaborative mathematical problem-solving can involve efforts to mutually understand ideas, express and listen to opinions, and jointly develop problem-solving processes. These findings align with the characteristics of the Social dimension, which encompasses the aspects of "social" and "cooperation" in gaming activities (Király et al., 2022). The students' understanding of the problem, as evidenced by their explanations during the interviews, also supports the view that understanding the problem serves as the foundation for students' determination of problem-solving strategies in the next stage (Hadiyanti & Manurung, 2025).

Previous research has examined mathematical problem-solving profiles based on various student characteristics, such as gender, learning styles, and cognitive styles. This study offers a different perspective by using the dimension of gaming motivation as the basis for

grouping participants to describe the mathematical problem-solving profiles of students who play games. In this study, the Gaming Motivation Inventory (GMI) was used to determine the dominant dimensions of gaming motivation, while Polya's stages were used to describe the mathematical problem-solving process (Király et al., 2022; Polya, 1973). Using the GMI as the basis for grouping provides an overview of the problem-solving profiles of student gamers based on the dominant dimensions of gaming motivation, specifically "Mastery" and "Social", which were examined in this study.

These research findings underscore the necessity of offering student diverse methods for representing, explaining, and examining problem-solving processes. The findings regarding the "Mastery" and "Social" dimensions indicate the use of different approaches to solving and examining problems. Therefore, mathematics instruction should provide students with the space to use representations and interactions that align with their thinking processes. However, these implications are not intended to prescribe instructional interventions based on GMI dimensions, as this study did not examine the relationship or influence between gaming motivation and mathematical problem-solving.

This study has several limitations. The research subjects were drawn only from two dimensions of the GMI Mastery and Social with a limited number of participants in each dimension. Furthermore, the study was limited to a single school and used two problem-solving tasks with relatively similar contextual patterns; thus, the findings do not yet encompass a broader range of mathematical problem contexts. The use of retrospective interviews also means that explanations of the subjects' thought processes depend on their ability to recall the problem-solving processes they had already carried out. Future research could involve participants from additional GMI dimensions, use problem-solving tasks across more diverse contexts, and consider variations in data collection contexts to gain a broader understanding of student gamers' mathematical problem-solving profiles by gaming motivation dimension.

CONCLUSION

The study found that students with different dominant dimensions on the Gaming Motivation Inventory (GMI) exhibited different mathematical problem-solving profiles when completing the four stages of Polya`s. Students in both the Mastery and Social dimensions were able to understand the problem, formulate a solution plan, apply appropriate strategies, and verify their answer. However, there were differences in the strategies used during the problem-solving process. Students with the Mastery dimension tend to use a systematic and persistent approach, while students with the Social dimension prefer to use visual representations and collaborative verification. These findings indicate that the differences between these two GMI dimensions are reflected in students` problem-solving characteristics, rather than in the sequence of problem-solving steps themselves.

These findings suggest that mathematics teachers should recognize students` motivational characteristics when designing learning activities to support a variety of problem-solving strategies. Taking students` motivation to play games into account can help teachers provide more enjoyable learning experiences. However, this study has limitations regarding the dimensions examined, it covers only two dominant dimensions of the GMI: Mastery and Social. Future research should examine additional dimensions of the GMI to provide a more comprehensive understanding of student gamers' profiles in mathematical problem solving.

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