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Investigating students' mathematical literacy: How students solve PISA-like problems in the Jambi context

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Abstract

Mathematical literacy is essential for preparing students to solve real-world problems, yet the cognitive processes underlying context-based problem solving remain insufficiently understood. In the PISA framework, mathematical literacy involves the ability to formulate, employ, and interpret mathematics in meaningful contexts. Previous studies have focused primarily on outcomes rather than the processes involved, particularly within local cultural settings such as Jambi. Given the persistent underperformance of Indonesian students in PISA, examining mathematical literacy in a local context is important. This study aimed to analyze students' mathematical literacy processes using Jambi-based contextual tasks. A qualitative descriptive design was employed involving 24 seventh-grade students selected through purposive sampling to represent high, moderate, and low ability levels. Data were collected through PISA-like written tests and semi-structured interviews and analyzed based on the processes of formulate, employ, and interpret/evaluate. The results showed that 68.06% of students were able to formulate problems, 52.78% successfully employed appropriate mathematical procedures, and only 34.72% correctly interpreted and evaluated solutions. These findings indicate that students experience the greatest difficulty in connecting mathematical results to real-life situations. The research process-oriented assessment and culturally contextualized tasks strengthen students' interpretative and evaluative competencies in mathematical literacy.

Keywords: Jambi context; mathematical literacy; mathematical process; PISA problems

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Introduction

Mathematical literacy is a fundamental competency for students facing 21st-century challenges, which require creative and critical thinking, decision-making, and problem-solving skills in various life contexts (Gustiningsi et al., 2024b; Xu et al., 2025). In the Program for International Student Assessment (PISA), mathematical literacy is one of the primary domains focused on in the assessment (OECD, 2023). This ability extends beyond mastery of mathematical procedures to encompass how students use their mathematical knowledge to formulate, employ, and interpret mathematical concepts to solve everyday problems (OECD, 2018, 2023a). A person with strong mathematical literacy skills is able to use their mathematical knowledge to address everyday challenges and problems (Kemendikbud, 2017, 2021).

According to the Indonesian education report, junior high school students' mathematical literacy, or numeracy, achievement is considered moderate, with an average percentage of 45.38% (Kemdikbud, 2025). Based on the 2022 PISA results, Indonesian students' mathematical literacy scores declined compared to the previous year's PISA results (OECD, 2023b). In 2022, Indonesia's mathematical literacy score was 366, compared to the OECD average of 472, compared to 379 in 2018, compared to the OECD average of 487 (OECD, 2023b). Indonesia's relatively low performance on PISA in recent cycles indicates a gap between student abilities and global competencies.

In addition to students' achievements in mathematical literacy nationally and internationally, studies at the regional level also show the same thing, especially in Jambi Province, Indonesia. Some study shows that the mathematical literacy ability of students in Jambi in solving PISA questions remains in the low category (Gusriani et al., 2025; Nurhidayati et al., 2025). Students have difficulty identifying relevant information, selecting appropriate concepts, and interpreting mathematical results (Marsyandia et al., 2025). Based on the initial test conducted, it showed that out of 20 students, 12 students, or 60%, were included in the low mathematical literacy category (Gustiningsi et al., 2025). This situation underscores the need for a more in-depth study that looks beyond final scores to examine how students think when solving PISA-type math problems. Jambi was studied because of its unique socio-cultural characteristics and strong contextual potential for developing reality-based mathematics learning (Charmila et al., 2016; Gustiningsi et al., 2026; Zalsi et al., 2025). This is in line with the PISA framework, which explicitly emphasizes that mathematical literacy involves the ability to use mathematics in various real-life contexts that are personal, social, and cultural (OECD, 2023c, 2023a). This underscores the importance of the analysis conducted on students in Jambi.

Within the PISA framework, the mathematical processes in mathematical literacy consist of formulate, employ, and interpret (and evaluate) (OECD, 2023a). Formulating indicates how effectively students recognize and identify opportunities to use mathematics in problem situations, and then provide the mathematical structures necessary to construct these contextual solutions in mathematical form. Employment refers to how well students perform calculations and manipulations, and apply concepts and facts they know to arrive at solutions to mathematically formulated problems. Interpretation (and evaluation) relates to how effectively students are able to reflect on mathematical solutions or conclusions, interpret them in a real-world context, and determine whether the results or conclusions are reasonable and/or useful (OECD, 2018). These three processes provide a comprehensive diagnostic framework for understanding how learners solve problems. Many studies have examined mathematical literacy, such as designing learning environments to support mathematical literacy skills (Gustiningsi et al., 2024a), examining the relationship between mathematical literacy and the opportunity to learn (Hwang & Ham, 2021), developing learning memes to support mathematical literacy skills (Wathani et al., 2022), some have examined student errors in solving mathematical literacy problems (Hidayanti & Hidayati, 2025). However, analysis of students' thinking processes based on the three mathematical processes (formulating, using, and interpreting) is still limited.

Furthermore, PISA-like mathematics problems with everyday contexts can be used not only as instructional resources but also as a means to reveal students' mathematical literacy processes, particularly in how they formulate, employ, and interpret mathematical ideas in real-life situations (Galen & Eerde, 2019; Gustiningsi, 2015; Gustiningsi et al., 2022; Zulkardi & Kohar, 2018). One context that has been explored in this regard is the local cultural context (Deda & Maifa, 2021; Muslimahayati, 2020) including that of Jambi province.

In the Jambi context, several studies have developed PISA-like mathematics tasks based on cultural artefacts such as batik motifs, historical objects, local products, museums, and traditional houses (Iswari et al., 2025; Lusiana et al., 2025; Lusinda et al., 2025; Rahmi et al., 2025; Syaharani et al., 2025). For example, Jambi batik motifs (e.g., *Durian Pecah* and *Angso Duo*) exhibit repetitive and structured patterns that can be modelled mathematically, while cultural sites such as the Siginjai Museum provide meaningful contexts for statistical interpretation. These studies demonstrate that the Jambi context offers mathematically rich and contextually relevant situations for engaging students in real-life problem solving.

However, previous studies in this context have primarily focused on the development, validity, and practicality of the tasks, without examining how students cognitively engage with and solve such contextualised problems. Consequently, there is still limited understanding of how students formulate problems, select strategies, apply mathematical concepts, and interpret solutions when working with PISA-like problems situated in local contexts. Addressing this gap, the novelty of this study lies in analysing students' mathematical literacy processes which are formulate, employ, and interpret, when solving PISA-like mathematics problems in the Jambi context.

Based on this description, this study aims to analyse students' mathematical literacy processes when solving PISA-like problems in the Jambi context, particularly in terms of how they formulate, employ, and interpret mathematical ideas. To achieve this aim, the study addresses the following research questions: (1) How do students formulate real-world problems into mathematical representations?; (2) How do students employ mathematical concepts and procedures in solving PISA-like problems?; (3) How do students interpret and evaluate their mathematical solutions in relation to the given context?

Methods

This study employed a descriptive qualitative approach. The objective of this descriptive qualitative study is to describe students' mathematical literacy skills, as reflected in their answers to PISA-type mathematics problems in the Jambi context. The participants were 24 seventh-grade students selected from a junior secondary school in Jambi. The selection of research subjects was carried out using purposive sampling. First, the researchers coordinated with the mathematics teacher to obtain information regarding students' academic performance based on classroom achievement and daily assessment results. Second, students were categorized into three ability levels consisting of high, medium, and low based on these records. From each category, students were then selected to represent variation in mathematical ability, ensuring that the sample reflected heterogeneous levels of mathematical proficiency. This selection was intended to capture a comprehensive description of students' mathematical literacy processes across different ability levels.

Data were collected using a written test as the main instrument. The test was designed to measure students' mathematical literacy skills in solving PISA-type mathematics problems within the Jambi context. The instrument consisted of three constructed-response items: two problems related to Jambi batik with the *Angso Duo* motif and one problem related to the *Sekapur Sirih* traditional dance. The development of the test instrument was based on the PISA framework proposed by OECD, which emphasizes content, context, and three mathematical processes: formulate, employ, and interpret. Accordingly, each item was designed to elicit students' performance across these three indicators of mathematical literacy. In terms of its development, the instrument was adapted and modified from previous PISA-like tasks used in prior studies on ethnomathematics and contextual mathematics and further contextualized to reflect local Jambi cultural contexts (Gustiningsi et al., 2026). The adaptation process involved selecting relevant real-life contexts, aligning them with PISA cognitive demands, and validating them through expert judgment to ensure content appropriateness and construct alignment. Thus, the test not only consisted of three items but was also systematically constructed to assess students' abilities in formulating mathematical models, applying mathematical procedures, and interpreting results in culturally meaningful contexts. The questions are shown in Figure 1-3.

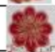
Problem 1

Problem 1 is shown in Figure 1.

Jambi Batik
Look at the figure of the Jambi Batik motif.

Jambi batik motifs
(source: personal documentation)

The Angso Duo motif is a Jambi batik motif made on 30 cm x 20 cm cloth. Motif descriptions are provided in the table.

Figure	Description Motif
	Swan facing left
	Swan facing right
	Flower
	Durian broke

If the fabric is expanded to 100 cm x 100 cm, are the number of swans facing right and left the same? Show your strategy.

Figure 1. Problem 1

Figure 1 presents problem 1 with the context of Jambi batik motifs (Angso Duo motif) on a piece of cloth measuring 30 cm × 20 cm, displaying several types of motifs, such as swans facing left, swans facing right, flowers, and durian broke patterns. The task asks students to determine whether the number of swans facing right and left remains the same when the fabric size is enlarged to 100 cm × 100 cm and to explain their solution strategy.

Problem 2

Problem 2 is shown in Figure 2.

Look at the following piece of cloth which is symbolized by n.

$n = 1$

$n = 2$

To create batik on larger pieces of cloth, we need to understand the pattern and number of motifs involved. For example, as shown in the picture, there are durian and flower motifs in varying numbers.

Complete the following table:

n	Number of durian broke images	Number of flowers images
1	1	4
2	2	8
3	…	…
4	…	…
5	…	…
7	…	…

What is your strategy for filling in the table above? Show your mathematical calculations.

Figure 2. Problem 2

The problem 2 presents a real-world context involving batik motif patterns on a piece of cloth represented by n. Students are required to identify the pattern of change in the number of durian and flower motifs for each cloth size, use mathematical reasoning to complete the table, and explain their solution strategy and calculations based on the identified pattern.

Problem 3

Problem 2 is shown in Figure 3.

Sekapur Sirih **Dance**

Sekapur Sirih Dance
(Sumber: https://www.youtube.com/watch?v=_XthFFdz_jA)

The Sekapur Sirih Dance is a traditional dance from Jambi Province performed to welcome honored guests. The image shows nine female lead dancers, one female dancer carrying a betel leaf, one male dancer carrying an umbrella, and two male dancers as escorts.
If there were only seven female lead dancers, what would be the possible positions of the dancers? Sketch your answer.

Figure 3. Problem 3

The problem 3 presents a real-world cultural context involving the Sekapur Sirih traditional dance from Jambi Province, which shows the arrangement of dancers' positions. Students are required to use spatial reasoning to determine the possible arrangement of dancers when the number of female lead dancers is reduced to seven and represent their solution through a sketch. Students were asked to complete the given problems by writing their answers on the provided sheet.

The data was then analyzed descriptively. Data were analyzed using qualitative analysis techniques through data reduction, coding, and categorization based on the mathematical literacy processes of formulate, employ, and interpret. The scoring of students' responses was carried out using an analytical rubric based on the PISA mathematical literacy framework, which consists of three processes: formulate, employ, and interpret. Each student's answer to the three test items was assessed separately for each process. The rubric was developed by breaking down each mathematical literacy process into specific observable indicators. The mathematical process is presented in Table 1.

Table 1. Mathematical process (OECD, 2023a)

Mathematical Process	Description
Formulate	Identifying and selecting problem situations that can be addressed using mathematics, and representing these contexts in mathematical form by choosing appropriate structures, models, or symbols.
Employ	Carrying out mathematical procedures, including calculations and manipulations, and applying acquired concepts, principles, and facts to obtain solutions to mathematically formulated problems.

Mathematical Process	Description
Interpret and evaluate	Interpreting mathematical results or solutions within real-world contexts, reflecting on their meaning, and evaluating the reasonableness, accuracy, and usefulness of the solutions or conclusions obtained.

In addition to data obtained from students' written solutions, data were also collected from semi-structured interviews. Interviews were conducted after students completed tasks to explore their mathematical literacy processes based on the PISA framework: formulate, employ, interpret and evaluation. Each interview lasted approximately 15–20 minutes and was audio-recorded. Interview questions were designed to explore: (1) how students identify and formulate problem situations in mathematical form (formulating); (2) how students apply mathematical concepts, procedures, and reasoning to obtain solutions (applying); and (3) how students interpret and evaluate results in a given context (interpreting).

Each indicator was scored dichotomously for each item: 1 if the student demonstrated the indicator correctly and 0 if not. The total score for each process was then calculated by summing all students who successfully met the indicator criteria across the three items, and the percentage was obtained using the formula:

$$\text{score} = \frac{\text{number of students who fulfilled the indicator}}{\text{total students}} \times 100\%$$

To ensure the validity of the scoring process, the rubric was reviewed by mathematics education experts prior to use. After being analyzed, the data were described.

Results

The research results highlight the strategies employed by students in solving PISA-type mathematics problems in the Jambi context. These strategies demonstrate students' mathematical literacy skills, as evidenced by the mathematical processes that occur.

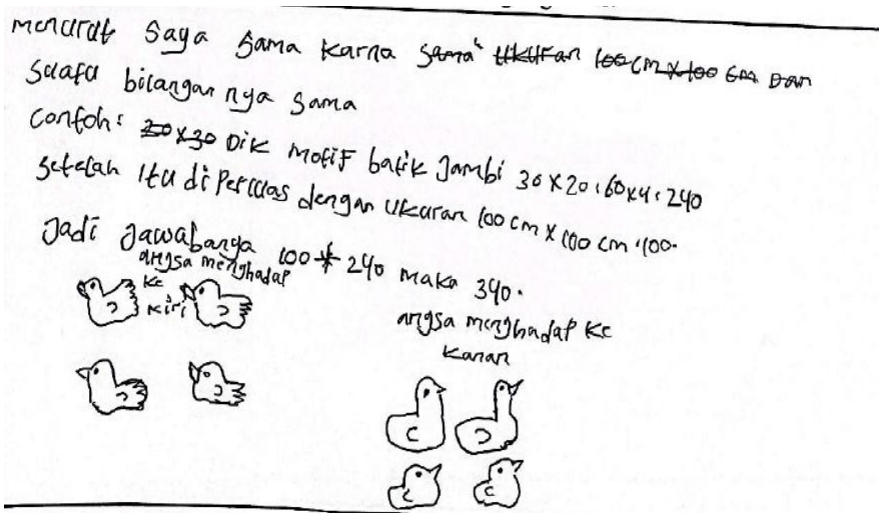
Table 2. Students' mathematical literacy skills

Mathematical Process	Number of students who fulfill the mathematics process (n = 24)			Mean (%)
	Question number 1	Question number 2	Question number 3	
Formulate	13 (54.17%)	18 (75%)	18 (75%)	68.06%
Employ	9 (37.50%)	17 (70.83%)	12 (50%)	52.78%
Interpret	2 (8.33%)	16 (66.67%)	7 (29.17%)	34.72%

Table 2 shows that students' mathematical literacy is not yet fully developed as an integrated process. Students are able to initiate the modeling process (formulate) and are moderately capable of carrying out mathematical procedures (employ), but they still experience significant difficulties in the interpretation process. This indicates that mathematics learning is still predominantly procedural in nature and has not yet been optimal in developing contextual reasoning skills.

The students' answer to Problem 1

In problem 1, there are 13 students were able to formulate the problem. They were able to transform the batik context into a mathematical model by understanding cloth size, motifs, and the concept of scale. However, only 9 students were able to apply or solve the problem with the correct steps. They calculated the area magnification ratio and determined the number of swans, then used multiplication. Furthermore, only 2 students were able to interpret the problem correctly. These 2 students were able to explain the meaning of the results, check them, and relate the calculations back to the context of batik crafting, thus determining the number of swans facing right and left. Students' answers to problem 1 are presented in Figure 4.



Translation:
I think they're the same because the numbers are the same.
Example: The Jambi batik motif is 30 x 20 = 60 x 4 = 240.
Then, expand it to 100 cm x 100 cm = 100.

So the answer is 100 + 240, which is 340.

Figure 4. Student A's answer

Figure 4 shows student A's answer stating that the number of swans facing right is the same as the number of swans facing left. This shows that the student A does not understand the problem given, the student A cannot identify that if the initial batik motif measuring 30 cm x 20 cm is expanded to 100 cm x 100 cm then the number of images on the batik will be different because the size of the increase between the length and width of the cloth is different, the length increases by 70 cm and the width increases by 80 cm, the student A does not identify that there will be a right-facing swan that is cut off so that the number of swans facing right and left cannot be the same. This shows that student A does not fulfill the formulate process. The student A's answer also does not fulfill the employ process, the mathematical calculations carried out by the student are not correct, the multiplication of 60 x 4 made by the student also has nothing to do with the problem. Student A also makes the wrong calculation, the student multiplies 100 x 100 = 100. Figure 4 also shows the conclusion made by student A is not correct. Student A failed to interpret the results in a real-world context, nor did he evaluate the reasonableness of the results. This indicates that the student's answer did not fulfill the interpret and evaluate process. In Figure 4, student A failed to formulate, employ, and interpret.

To further clarify the student's reasoning underlying the written response, an interview was conducted. Based on the interview, Student A identified the given information and the problem objective but failed to construct an appropriate mathematical model, assuming numerical similarity and directly multiplying the values. Student A applied an incorrect procedure by assuming the motif was repeated four times without a proper mathematical basis. Furthermore, student A did not evaluate whether the result reflected the real situation, indicating difficulties in formulating, employing, and interpreting the solution. Furthermore, other students' answers can be seen in Figure 5.

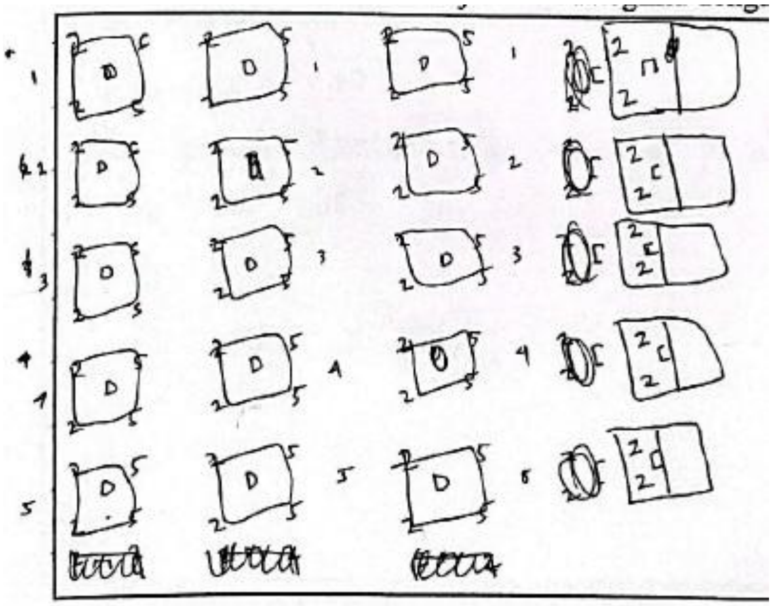
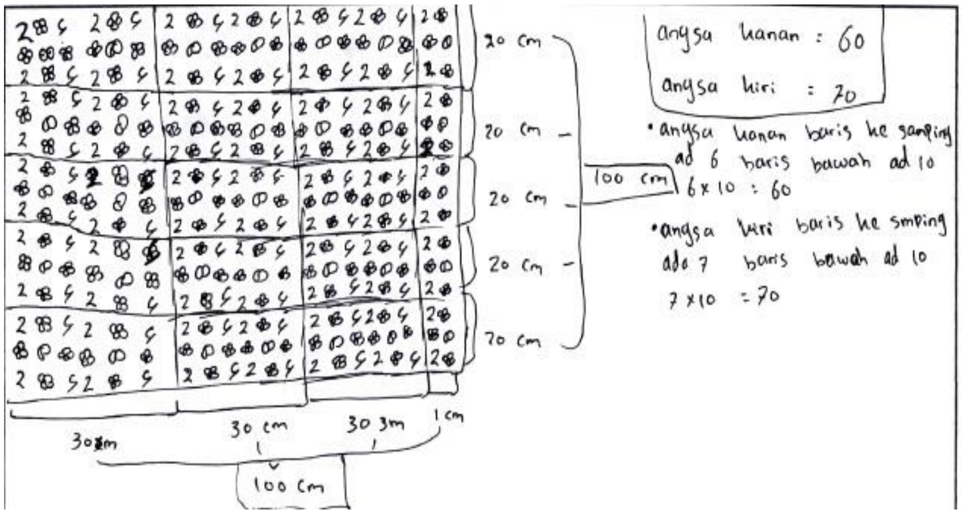


Figure 5. Student B's answer

The Figure 5 shows that student B was able to formulate the problem. Student B understood and identified that the dimensions for one complete image represent 30 cm x 20 cm, so student B added images to the sides and bottom to meet the dimensions of 100 cm x 100 cm. This demonstrates that student B has successfully completed the formulating process. However, student B erred in applying the concept (employment) to solve the problem. Student B sketched a batik motif using 15 complete images and 5 cropped images. However, in the 15 complete images, student B only drew 2 swans facing right and 2 swans facing left, whereas there should be 4 swans facing right and 4 swans facing left for each complete image. Student B also failed to interpret until the end whether the right-facing swan was the same as the left-facing swan. This demonstrates that student B was able to formulate the problem, but failed to employ and interpret (and evaluate).

The interview results were used to confirm and explain student B's written response. Based on the interview, Student B was able to identify the dimensions of the batik motif (30 × 20 cm) and relate them to the cloth size (100 × 100 cm), indicating a correct understanding of the problem situation and successful formulation of a mathematical representation. However, student B applied an incorrect procedure in determining the number and orientation of the swan motifs, as the counting strategy did not accurately represent the pattern structure. Furthermore, student B did not evaluate whether the obtained result reflected the actual condition of the motif arrangement, indicating difficulties in employing appropriate procedures and interpreting the solution within the contextual situation. Furthermore, other student's answer are presented in Figure 6.



Translation:
Right swan = 60
Left swan = 70

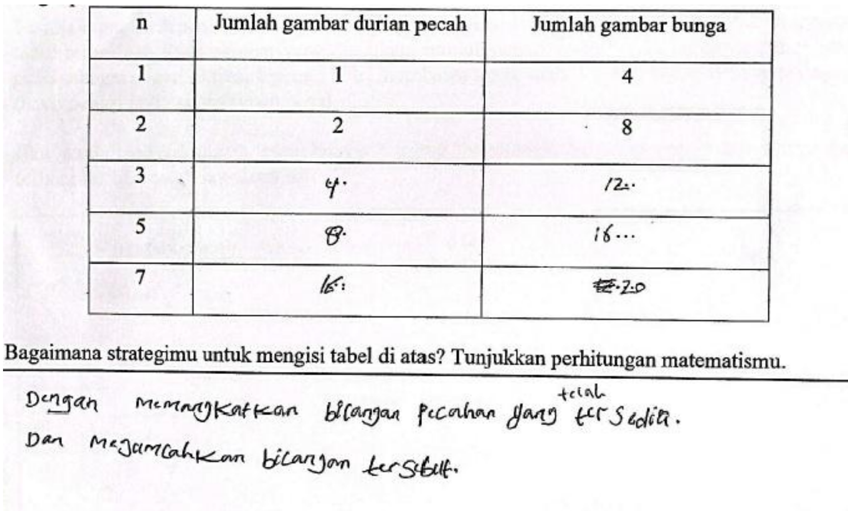
There are 6 rows of right swan on the side, and 10 below.
6 x 10 = 60.
There are 7 of left swan in the side row, and in the bottom row there are 10.
7 x 10 = 70.

Figure 6. Student C's answer

Figure 6 shows student C formulating the problem correctly. Student C drew a sketch of a batik motif measuring 100 cm x 100 cm. Student C repeated the drawing sideways, resulting in three 30 cm drawings and one 10 cm drawing. Student C also repeated the drawing downward, resulting in five 20 cm drawings. Student C then counted the number of right-facing geese: 6 rows to the side and 10 rows down, resulting in a total of 60 right-facing geese. Similarly, for left-facing geese, the student counted 7 rows to the side and 10 rows down, resulting in a total of 70 left-facing geese. Figure 6 shows the student performing the correct mathematical calculation. Student C correctly applied the concept of multiplication, determining that the number of right-facing geese differs from the number of left-facing geese. Figure 6 demonstrates the student's ability to formulate, employ, and interpret (and evaluate).

The students' answer to Problem 2

In problem 2, 18 students were able to formulate the problem. They were able to observe the batik motif pattern when n = 1 and n = 2, and the number of flowers and durian fruit images changed according to the pattern. Seventeen students were able to employ the problem. They were able to use data from the images when n = 1 and n = 2 to ensure the model was correct, and they were able to fill in the requested data in the table correctly. Furthermore, 16 students interpreted that there is a relationship between the number of durian fruit images and the number of flower images, which can be determined using a formula. Some student answers to problem 2 are presented in Figures 7 and 8.



n	Jumlah gambar durian pecah	Jumlah gambar bunga
1	1	4
2	2	8
3	4	12
5	8	16
7	16	20

Bagaimana strategimu untuk mengisi tabel di atas? Tunjukkan perhitungan matematismu.

Dengan memangkatkan bilangan pecahan yang telah tersedia. Dan menjumlahkan bilangan tersebut.

Translation:

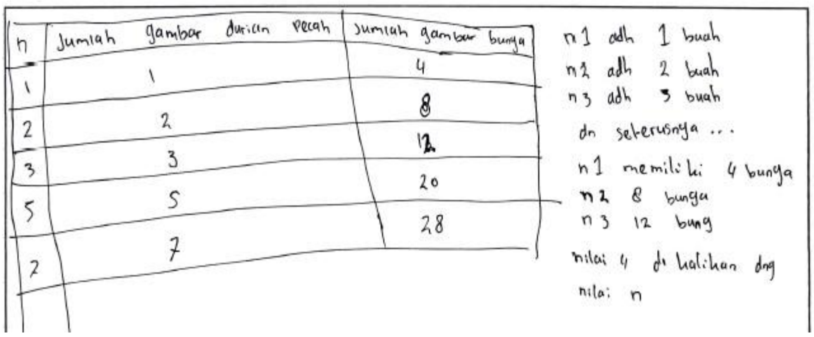
n	Number of durian picture	Number of flower picture
1	1	4
2	2	8
3	4	12
5	8	16
7	16	20

By raising the fractional numbers that are available to the power and adding the numbers.

Figure 7. Student D's answer

Figure 7 shows that student D was unable to identify the pattern displayed in the image. Student did not pay attention to the number of broken durians and flowers when n = 1 and n = 2. When n = 3, the student wrote that the number of broken durians was 4. However, based on the available images, the number written in n is the same as the number of broken durians. Furthermore, the student failed to connect n with the broken durians and flowers. The student observed a pattern between the rows. In the column for the number of broken durians, the student added the numbers in each row to themselves. In the first row, the number of broken durians was 1. The student assumed that the value of 2 in the second row was 1 + 1 = 2. Therefore, in the following rows, the student added 2 + 2 = 4 (third row), 4 + 4 = 8 (fourth row), and 8 + 8 = 16 (fifth row), without paying attention to the value of n at all. Likewise in the flower picture column, students always add 4 because they see that in the first row the number is 4 and the second row is 8, students assume that 4 + 4 = 8, so in the next row students also add 8 + 4 = 12 (third row), 12 + 4 = 16 (fourth row), and 16 + 4 = 20 (fifth row), without paying attention to the value of n. Figure 7 shows that students do not formulate, employ, and also do not interpret.

To further clarify the student's reasoning underlying the written response, the interview results were analysed. Based on the interview, Student D had difficulty identifying the pattern and the relationship between the number of broken durians and flower images. The student relied on a simple addition strategy by adding numbers in each row and assumed a constant increase without considering the role of $n$in the pattern. Furthermore, the student did not evaluate whether the obtained results were consistent with the given representation, indicating difficulties in formulating the problem, employing appropriate procedures, and interpreting the solution. In addition, there are some that students can answer correctly, as in Figure 8.



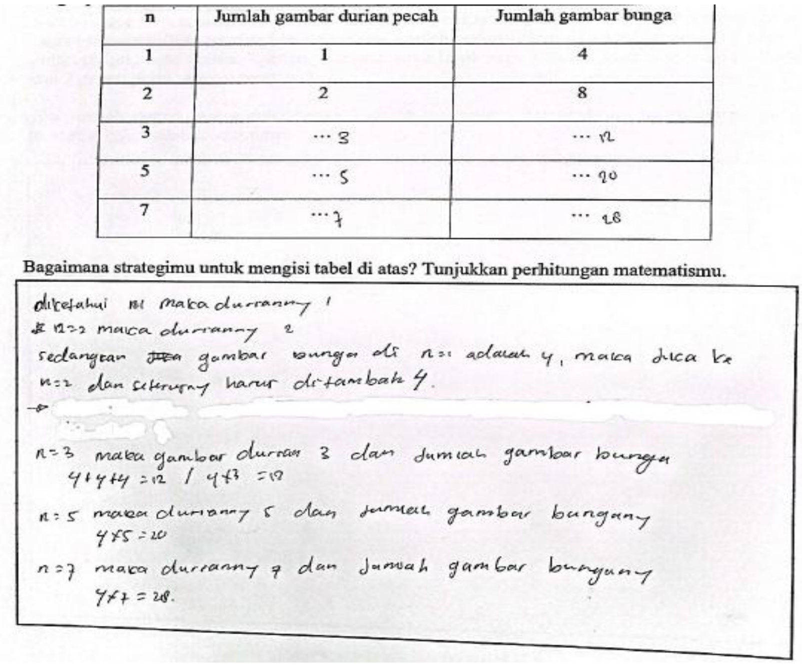
n	Jumlah gambar durian pecah	Jumlah gambar bunga
1	1	4
2	2	8
3	3	12
5	5	20
2	7	28

n1 adh 1 buah
n2 adh 2 buah
n3 adh 3 buah
dn seterusnya ...
n1 memiliki 4 bunga
n2 8 bunga
n3 12 bung
nilai 4 di kalikan dng nilai n

Translation:
n1 is 1 fruit, n2 is 2 fruit, n3 is 3 fruit, and so on.

n1 has 4 flowers, n2 has 8 flowers, n3 has 12 flowers.
The value of 4 is multiplied by the value of n.

(a)



n	Jumlah gambar durian pecah	Jumlah gambar bunga
1	1	4
2	2	8
3	... 3	... 12
5	... 5	... 20
7	... 7	... 28

Bagaimana strategimu untuk mengisi tabel di atas? Tunjukkan perhitungan matematismu.

diketahui n1 maka duriannya 1
n=2 maka duriannya 2
sedangkan gambar bunga di n=1 adalah 4, maka jika ke n=2 dan seterusnya harus ditambah 4.
n=3 maka gambar durian 3 dan jumlah gambar bunga
4+4+4=12 / 4x3=12
n=5 maka duriannya 5 dan jumlah gambar bunganya
4x5=20
n=7 maka duriannya 7 dan jumlah gambar bunganya
4x7=28.

Translation:
If n = 1, then there is 1 durian.
If n = 2, then there are 2 durians.
If n = 1, then there are 4 flower images. If n = 2 and so on, then 4 must be added.

If n = 3, then there are 3 durian images, and the number of flower images is 4 + 4 + 4, or 4 x 3 = 12.
If n = 5, then there are 5 durians, and the number of flower images is 4 x 5 = 20.
If n = 7, then there are 7 durians, and the number of flower images is 4 x 7 = 28.

(b)

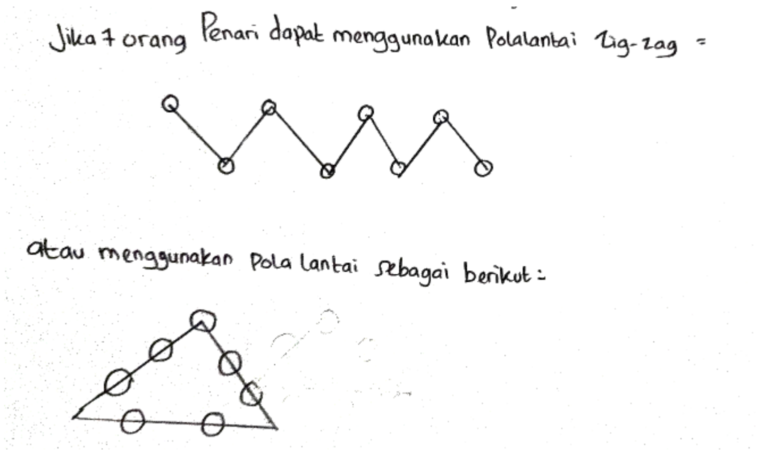
Figure 8. (a) Answers of student E; (b) Answer of student F

Figure 8 shows that students can identify patterns and relationships between the number of durian fruit images and the number of flowers. In Figure 8 (a), student E writes that the number n equals the number of "fruit." The fruit referred to by student E is durian. Students E can formulate the problem into a mathematical model, perform calculations correctly, and discover that to determine the number of flowers, multiply *n* by 4. Similarly, in Figure 8 (b), student F can determine that to determine the number of flowers, always add $4n$ times. Figure 5 shows that students can formulate the problem, apply the concept correctly, and interpret it to determine the formula used to determine the number of flowers.

Figure 8 shows that the students were able to identify the pattern and the relationship between the number of durian images and flower images. The students recognised that the value of n represents the number of durian and flower images increases regularly by four for each value of n. This indicates that the students successfully formulated the problem by identifying relevant information and representing the relationship in a mathematical form. In applying mathematical procedures, the students correctly determined the number of flower images by multiplying the value of n by four, demonstrating an appropriate use of mathematical operations. Furthermore, the students were able to interpret the obtained results by explaining the pattern and generalising the rule used to determine the number of flower images. These findings indicate that the students successfully carried out the formulate, employ, and interpret processes in solving the problem.

The students' answer to Problem 3

In problem 3, 18 students were able to identify important information in the problem and translate it into a mathematical problem (formulate). 12 students were able to draw a sketch correctly and use the concept of symmetry to determine the positions of the dancers (employ). 7 students were able to interpret by linking it back to the dancer's concept that there are tepak siri bearers, bodyguards, and umbrella bearers who must also be in formation (interpret). Some students' answers to question number 3 are presented in Figures 9, 10, and 11.



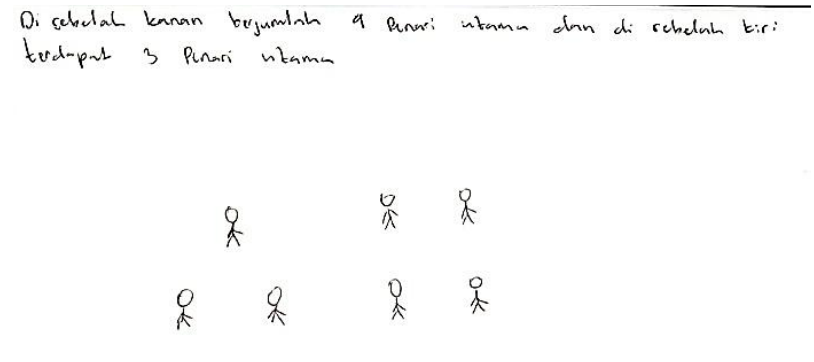
Translation:
If there are seven dancers, you can use a zigzag floor pattern.

or use the following floor pattern.

Figure 9. Student G's answer

Figure 9 presents student G's response in determining the dancers' positions using a zigzag floor pattern and an alternative triangular formation. Based on the written work, student G attempted to represent the dancers' arrangement visually by drawing possible floor patterns. This indicates that student G tried to translate the contextual situation into a visual mathematical representation. However, the representation produced did not correspond to the important information stated in the problem, particularly regarding the number of main dancers. From the perspective of the formulate process, the student showed an initial attempt to identify the context by representing the dancers' positions using diagrams. The student recognised that the problem involves spatial arrangement and pattern formation. Nevertheless, the student failed to identify the key constraint of the problem, namely that there are seven main dancers. As a result, the mathematical model constructed did not accurately reflect the problem situation. This indicates that the student had not fully selected relevant information or structured the situation into an appropriate mathematical representation. In terms of the employ process, the student attempted to apply a strategy by constructing a zigzag and triangular pattern. However, the implementation of the procedure was not consistent with the problem requirements, as the zigzag representation resulted in eight dancers instead of seven. This shows that although the student attempted to use a mathematical strategy, the procedure was not applied systematically and was not based on a correct model. Furthermore, in the interpret process, the student did not verify whether the obtained arrangement satisfied the conditions of the problem. There was no indication that the student evaluated or justified the correctness of the solution. The absence of checking behaviour suggests that the student was unable to interpret the mathematical result in relation to the real situation described in the problem.

The interview results revealed that student G understood the task as determining a possible floor pattern for arranging the dancers, but did not focus on the requirement regarding the number of main dancers. Student G stated that the zigzag and triangular patterns were chosen because they appeared suitable for arranging dancers in a formation. When asked about the number of dancers in the zigzag pattern, student G realised that the arrangement exceeded seven but assumed that the additional position could still be acceptable. Student G also reported not rechecking whether the arrangement met the problem conditions. These responses indicate that student G experienced difficulty in identifying relevant information, constructing an appropriate mathematical model, and verifying the solution, which confirms the findings from the written response. Other student's answer are presented in Figure 10.



Translation:
On the right there are 4 main dancers and on the left there are 3 main dancers.

Figure 10. Student H's answer

Figure 10 presents student H's response in determining the positions of the seven main dancers. Based on the written answer, the student identified the information given in the problem by recognising that the task required determining the positions of seven dancers. The student then represented the situation by drawing the dancers' arrangement and dividing them into two groups, with four dancers on the right and three on the left. This shows that the student was able to formulate the problem by identifying relevant information and representing the contextual situation into a visual model. However, the arrangement produced was asymmetrical. The student did not consider the balance of the formation or apply the concept of symmetry required to determine the correct positions of the dancers. The strategy used only ensured that the total number of dancers was seven without applying appropriate mathematical concepts, indicating that the student was not able to employ suitable mathematical procedures to solve the problem correctly. In addition, the student did not recheck or evaluate whether the arrangement matched the conditions of the problem, showing difficulty in interpreting the solution in relation to the given context.

The interview results revealed that student H determined the arrangement by simply dividing the seven dancers into two groups so that the total number matched the problem requirement. The student explained that four dancers were placed on the right and three on the left without considering the balance of the formation. When asked about symmetry or verification of the answer, the student stated that the arrangement was considered correct as long as the total number of dancers was seven. These responses confirm that the student could identify and represent the problem situation but experienced difficulty in applying relevant concepts and evaluating the correctness of the solution. Other students' answers are presented in Figure 11.

Translation:
Main female dancer
Carrying a betel-leaf tray
Male dancer with an umbrella
Male dancer as a guard

Figure 11. Student I's answer

Figure 11 presents student I's response in determining the positions of the dancers. Based on the written answer, student I identified the types and roles of dancers involved, such as the main female dancer, betel-leaf bearer, umbrella bearer, and guard. The student then represented the arrangement by drawing the dancers' positions and organizing them in a balanced and symmetrical formation. This shows that the student was able to formulate the problem by identifying relevant information and translating the contextual situation into an appropriate representation. Furthermore, student I determined the correct number of dancers and arranged their positions proportionally, demonstrating an understanding of the concept of symmetry in the formation. The student applied this concept appropriately to construct a balanced arrangement, indicating that the student was able to employ relevant mathematical ideas in solving the problem. Student I also related the arrangement to the context of the dancers' roles and ensured that the formation fulfilled the problem requirements. This shows that the student was able to interpret the solution in accordance with the given situation. Overall, the response indicates that the student successfully formulated the problem, employed appropriate strategies, and interpreted the results correctly.

The interview results showed that student I understood the information provided in the problem by identifying the roles and positions of each dancer in the formation. Student I explained that the arrangement was made by considering the number of dancers and ensuring that their positions were balanced and symmetrical. Student I also stated that additional dancers, such as the umbrella bearer and guard, were included to complete the formation according to the context of the problem. When asked about the solution, student I was able to explain the reasoning used and confirmed that the arrangement had been checked to ensure it met the problem requirements. These responses support the written answer, showing that the student understood the problem situation, applied relevant concepts, and verified the correctness of the solution

Discussion

The results of the study indicate differences in students' mathematical literacy achievement across each mathematical process: formulate, employ, and interpret and evaluate. Based on Table 3, the relatively high performance in the formulate process indicates that students are able to identify relevant information and construct mathematical representations. This finding is consistent with previous studies (Ekawati et al., 2020; Wijaya et al., 2015), which report that students tend to perform better in the formulation stage than in interpretation. This may be influenced by the use of familiar local contexts, which support students' initial understanding of the problem situation. This finding indicates that most students were able to identify relevant information and formulate mathematical problems within the context of PISA-type questions in the Jambi context. This ability aligns with the definition of formulating in the PISA mathematical literacy framework, which emphasizes the ability to recognize mathematical structures in real-world situations and represent them in mathematical models (OECD, 2018).

However, despite relatively good formulating skills, there was a decline in achievement in the employability process, with an average of only 52.78% of students able to apply mathematical concepts and procedures correctly. This indicates that not all students who successfully formulate problems are able to proceed to the stage of applying appropriate strategies and calculations. This finding aligns with research findings that indicate a gap between modeling and procedural application is a common phenomenon in students' mathematical literacy, particularly in non-routine contextual problems (Gustiningsi et al., 2022; Kolar & Hodnik, 2021). In this context, student errors often arise from inappropriate strategy selection or inaccuracies in operating the constructed mathematical model (Gustiningsi et al., 2025).

The interpret and evaluate process demonstrated the lowest achievement compared to the other two processes, with an average of only 34.72% of students able to interpret and evaluate results contextually. This data confirms that most students stop at the stage of obtaining a numerical answer without linking the calculation results to the problem context. Interpretation and evaluation are complex stages because they require reflective skills, critical reasoning, and mathematical communication (Jablonski, 2023). Students' low interpret and evaluate processes are caused by difficulties in interpreting results accurately, drawing clear and contextual conclusions, a tendency to misinterpret solutions, and limitations in communicating mathematical results in everyday language. This ultimately results in incomplete or inappropriate answers to the problem. Students are also not accustomed to double-checking their answers (Siregar et al., 2021; Utami & Hakim, 2023; Wahab A et al., 2024).

Research also shows that using local cultural and environmental contexts can increase student engagement and facilitate the formulation process, but does not fully optimize students' interpretation processes (Gustiningsi et al., 2023; Iswari et al., 2025; Jiang et al., 2025). Other studies also suggest that real-world context-based tasks play a crucial role in shaping students' mathematical problem-solving processes (Leiss et al., 2024; Santos-Trigo, 2024). The findings of this study indicate that the Jambi context helps students understand problem situations, but the ability to interpret and evaluate solutions remains a major challenge.

The implications of these findings are crucial for mathematics learning in schools. Teachers need to design lessons that not only emphasize procedural solutions but also train students to reflect on results, assess the reasonableness of solutions, and communicate mathematical meaning in real-world contexts (Burkhardt et al., 2024; Lit et al., 2026; Medeiros et al., 2019). PISA-like practice questions based on the local context of Jambi can be used strategically to train the three mathematical literacy processes in a balanced way, so that students are not only able to calculate, but also understand and evaluate the resulting solutions.

Conclusion

The students' mathematical literacy in solving context-based problems in Jambi varies across the three mathematical processes: formulate, employ, and interpret and evaluate. First, the findings show that most students were able to formulate real-world problems into mathematical representations. Students generally succeeded in identifying relevant information and translating contextual situations into mathematical forms, although some still showed inconsistencies in structuring complete mathematical models. Second, students demonstrated moderate ability in employing mathematical concepts and procedures. While many students were able to apply basic mathematical operations, difficulties were observed in selecting appropriate strategies and executing procedures accurately, particularly in non-routine problems. Third, students showed significant difficulties in interpreting and evaluating their mathematical solutions. Most students were unable to connect their numerical results to the given context, evaluate the reasonableness of their answers, or communicate conclusions meaningfully. This indicates that the main barrier in students' mathematical literacy lies in the interpretative and evaluative stages rather than in basic computational skills.

These findings imply that mathematics instruction needs to place a stronger emphasis on developing students' interpretative and evaluative abilities through meaningful, context-based problems and explicit support for reasoning and reflection. Such practices are essential to promote comprehensive mathematical literacy beyond procedural competence. However, this study is limited by its qualitative design and relatively small number of participants, which may affect the generalizability of the findings. In addition, the focus on a specific cultural context may limit its applicability to other settings. Therefore, future research is recommended to involve larger and more diverse samples, as well as to design instructional interventions that explicitly target the development of interpretation and evaluation processes in mathematical literacy.

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