EDUMATIKA: *Jurnal Riset Pendidikan Matematika* *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

Revealing the Numeracy Skills of Eighth-Grade Students in Solving PISA 2022 Quantity Content Problem

Jihan Adi Pradypta[1], Duano Sapta Nusantara[1, a)], Ranisa Junita[1], Florante P Ibarra[2]

[1]*Universitas Jambi*
Km.15 Jambi-Muara Bulian Street, Mendalo Darat, Jambi Luar Kota, Muaro Jambi, Jambi, Indonesia 36361
[2]*Central Luzon State University*
Maharlika Highway, Science City of Muñoz, Nueva Ecija, Philippines 3120

[a)] duanosaptanusantara@unja.ac.id

Abstract. This study is qualitative descriptive research that aims to describe eighth-grade students' numeracy skills in solving a PISA 2022 quantity content problem. This focus is important because PISA-type tasks require reasoning, quantitative interpretation, and decision-making skills that are essential for students' mathematical literacy in real-life situations. Thirty-two eighth-grade students of a junior high school in Jambi, Indonesia, participated in this study. Data were collected through a written test adapted from the PISA 2022 released items and follow-up interviews with selected students. The results showed that most students demonstrated low numeracy performance, particularly in interpreting information, performing multi-step calculations, and drawing correct conclusions. Only a small number of students were able to meet the expected indicators of numeracy skills. These findings indicate that students have not yet fully met the cognitive demands of PISA quantity tasks. The results highlight the need for instruction that provides more opportunities for students to practice contextual quantitative reasoning. For classroom practice, teachers are encouraged to incorporate multi-step contextual tasks that gradually strengthen students' interpretation, strategy selection, and reasoning abilities. The findings also serve as a basis for further research on developing PISA-type jumping tasks adapted to relevant local contexts to support students' numeracy skills.

Keywords: Junior High School Students; Numeracy Skills; PISA 2022 Task; Quantity Content

Abstrak. Penelitian ini merupakan penelitian deskriptif kualitatif yang bertujuan untuk mendeskripsikan kemampuan numerasi siswa kelas VIII dalam menyelesaikan soal PISA 2022 pada konten *quantity*. Fokus ini penting karena soal tipe PISA menuntut kemampuan menalar, menafsirkan informasi kuantitatif, dan mengambil keputusan, yang merupakan keterampilan esensial dalam literasi matematika siswa. Partisipan penelitian adalah 32 siswa kelas VIII di salah satu SMP negeri di Jambi, Indonesia. Data dikumpulkan melalui tes tertulis yang diadaptasi dari soal rilis PISA 2022 serta wawancara lanjutan dengan siswa terpilih. Hasil penelitian menunjukkan bahwa sebagian besar siswa memiliki kemampuan numerasi yang masih rendah, terutama dalam memahami informasi, melakukan perhitungan bertahap, dan menarik kesimpulan yang tepat. Hanya sedikit siswa yang dapat memenuhi indikator kemampuan numerasi secara lengkap. Temuan ini menunjukkan bahwa siswa belum sepenuhnya memenuhi tuntutan kognitif soal PISA pada konten quantity. Temuan ini menegaskan perlunya pembelajaran yang memberi lebih banyak kesempatan bagi siswa untuk berlatih penalaran kuantitatif secara kontekstual. Secara praktis, guru disarankan untuk menggunakan soal kontekstual bertahap yang dapat memperkuat kemampuan menafsirkan informasi, memilih strategi, dan memberikan alasan. Hasil ini juga menjadi dasar untuk penelitian selanjutnya mengenai pengembangan jumping tasks tipe PISA berbasis konteks lokal yang relevan untuk meningkatkan kemampuan numerasi siswa.

Kata kunci: Kemampuan Numerasi; Konten Quantity; Siswa SMP; Soal PISA 2022

Available online at journal homepage:
http://ejournal.iainkerinci.ac.id/index.php/edumatika
Email: edumatika@iainkerinci.ac.id
DOI: https://doi.org/10.32939/ejrpm.v8i2.6153

EDUMATIKA: *Jurnal Riset Pendidikan Matematika* *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

INTRODUCTION

One of the main contents assessed in the Programme for International Student Assessment (PISA) is quantity, which focuses on students' skills to understand and use quantitative information in various real-life situations (De Bortoli & Underwood, 2025; OECD, 2023; Rizal et al., 2021; Santos et al., 2022). This content does not only evaluate basic calculation skills but also includes the skills to formulate, interpret, and apply mathematical concepts in solving contextual problems (Cayetano & Ibarra, 2024; Fadlila et al., 2022; OECD, 2023; Shafa et al., 2023; Stacey & Turner, 2014). Mastering quantity is therefore fundamental, as it supports logical reasoning and data-based decision-making in everyday life, particularly in economic, transportation, and social contexts (Aquino & Ibarra, 2024; Machromah et al., 2020; Stacey, 2010; Utami et al., 2024; Zulkardi et al., 2021).

The importance of quantity content also extends to the Indonesian education context. It is emphasized through the Academic Ability Test (Tes Kemampuan Akademik/TKA), which assesses students' academic competencies, including logical reasoning and problem-solving skills, aligned with national education standards (Kemendikdasmen, 2024). These competencies parallel the cognitive demands of the PISA quantity content, which likewise requires students to reason with numbers, interpret quantitative information, and apply mathematical concepts in contextual situations. In this regard, quantity content serves not only as a core domain in PISA but also reflects the essential abilities measured in TKA, making it a critical foundation for students' numeracy development in daily life.

However, despite the recognized importance of quantity content in mathematics learning, Indonesian students continue to experience difficulties in this area, as reflected in their PISA results. Indonesia's performance in the Programme for International Student Assessment (PISA) reveals a declining trend in numeracy-related scores, dropping from 386 (2015) to 379 (2018) and further down to 359 (2022) (OECD, 2016, 2019, 2023). More specifically, PISA reports indicate that students' performance in the quantity content is consistently among the lowest compared to other mathematical content areas, particularly in tasks requiring interpretation of numerical information, proportional reasoning, and applying quantitative relationships in real-life contexts (Geiger & Schmid, 2022; Stacey & Turner, 2014). This situation highlights that Indonesian students' mathematical literacy remains far below the OECD average and is among the lowest globally (Efendi et al., 2024; Nusantara et al., 2025; Rhamayanti et al., 2024; Santos et al., 2022).

The consistent decline in performance does not merely indicate students' weaknesses in computation but reflects deeper challenges in reasoning, interpretation, and contextual problem solving (Utami et al., 2024; Zulkardi et al., 2021). Such patterns suggest that students are still struggling to connect mathematical ideas with real-world situations, which is a core expectation of the PISA framework (OECD, 2023). This finding also implies that mathematics instruction in

EDUMATIKA: *Jurnal Riset Pendidikan Matematika* *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

Indonesia may not yet provide sufficient opportunities for developing numeracy skills that are relevant, meaningful, and applicable to daily life (Myrela & Khuzaini, 2024; Susanto et al., 2022).

This decline may be explained by several interrelated factors. Several studies indicate that one of the main causes of Indonesia's low PISA performance is students' difficulty in handling contextual problems requiring higher-order reasoning (Apriliyani et al., 2022). In addition, classroom instruction often remains teacher-centered, providing limited opportunities for students to engage with real-life quantitative tasks or assessment models aligned with international standards. Research further emphasizes the need to integrate PISA-like tasks into learning so that students become familiar with problems requiring reasoning, representation, and mathematical modelling (Aquino & Ibarra, 2024; Nusantara et al., 2021a, 2021b). External factors, such as students' lack of exposure to contextual quantitative problems in daily life, also contribute to the issue (Kandaga, 2024). Given the release of the PISA 2022 results, which show that Indonesia remains among the lowest performers in quantity-related indicators, the need to examine students' abilities using actual PISA 2022 quantity items becomes increasingly urgent. Such examination provides important insights into whether students can meet the reasoning and quantitative interpretation demands expected at the international level.

Several attempts have been made to develop PISA-like tasks for the Indonesian context. For example, Nusantara et al. (2021a) developed tasks based on a COVID-19 transmission map, and the PISAComat introduced by Nusantara et al. (2021b) tested the effectiveness of COVID-19 contextual problems in enhancing students' mathematics literacy. Nusantara et al. (2024) explored the design of digital PISA-like tasks to improve accessibility and engagement in learning. Beyond these works, other researchers have also contributed to the field, such as Juhaevah (2022) who examined students' strategies and common errors in solving PISA-based quantity problems, Tanjung et al. (2023) who emphasized the importance of local context in mathematics literacy problems. These studies provide valuable insights into task design, validation, and student strategies.

However, there remains a lack of research specifically examining students' numeracy skills in solving PISA 2022 questions, particularly within the quantity content area. This gap is important because the updated PISA 2022 framework introduces new constructs and assessment orientations that emphasize reasoning, interpretation, and contextual application, which have not been deeply analyzed in previous studies. The motivation for this research is to gain an in-depth understanding of how students at the school level actually demonstrate numeracy skills when faced with an authentic PISA 2022 quantity task, rather than to evaluate a specific school's official PISA performance. Moreover, most prior studies have focused on designing or validating PISA-like tasks, instead of investigating students' real thinking processes when solving these problems. Therefore, this study aims to analyze students' numeracy skills in solving PISA 2022 questions in the quantity content

EDUMATIKA: *Jurnal Riset Pendidikan Matematika* *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

area and to provide insights that can inform teachers in designing learning experiences that strengthen students' reasoning and quantitative interpretation abilities.

METHOD

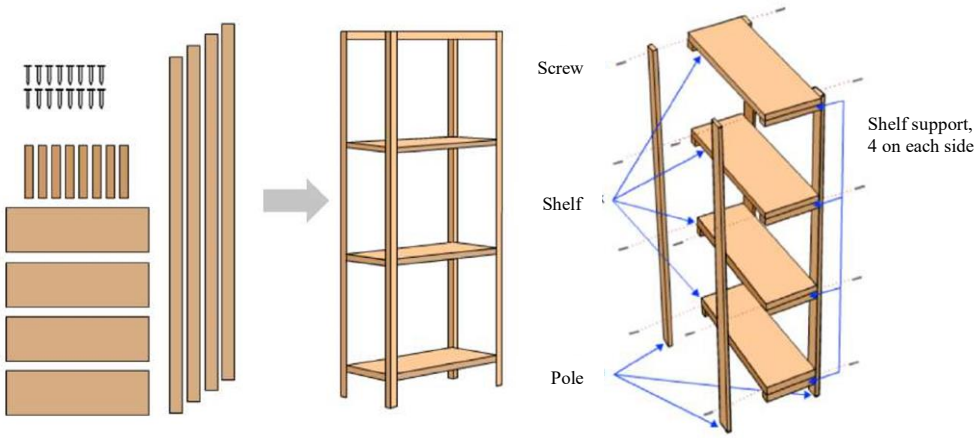
This research applied a descriptive method with a qualitative approach. The purpose of the study was to analyze students' numeracy skills in solving PISA-based mathematics problems on the quantity content. The study was conducted on September 4, 2025, with a sample of 32 eighth-grade students of a state junior high school in Jambi Province. Eighth-grade students were selected because they have studied the prerequisite concepts needed to attempt the PISA 2022 quantity problem, including ratio, proportional reasoning, basic operations involving quantities, and interpreting information presented in tables and diagrams. These competencies align with the curriculum for Grade VIII and provide sufficient foundation for solving the PISA-type task used in this research.

The research instruments consisted of a written test and interviews. The written test comprised an essay-type question adapted from the PISA 2022 released mathematics items on the quantity content (translated version), while the interviews were conducted with three selected students to gain deeper insight into their reasoning processes and the factors influencing their problem-solving approaches. The researchers used a PISA 2022 released item in the quantity content titled "Shelf Unit" as a numeracy skills test instrument. The problem was taken directly from the official released PISA 2022 items without any modification to its context, structure, or difficulty level, and it was presented to the students in English as in the original source. The context of the problem was occupational, and its difficulty was classified at level 4.

The numeracy skills test item requires students to analyse information presented in both pictures and tables. The pictures show the components of a bookshelf and how these components are assembled into a complete shelf unit, while the tables provide data about the number of components required for one unit and the available stock in the company. Students are asked to determine the maximum number of complete shelf units that can be assembled based on the available stock. This requires students to compare quantities, perform calculations, and apply logical reasoning to identify the limiting factor among the available components. Here is the item given to the students.

EDUMATIKA: Jurnal Riset Pendidikan Matematika *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

Shelf Unit Problem (PISA 2022). *A company sells bookshelves that need to be assembled. The parts of the bookshelf that are inside the box and the assembled unit are shown below.*



The parts of the shelf needed to package one complete unit of the shelf are shown in the table below.

Part of the shelf	***The number of shelves per box***
Screw	*16*
Pole	*4*
Shelf	*4*
Shelf support	*8*

The stock of available shelf components in the company is displayed in the table below.

Part of the shelf	***Available Stock***
Screw	*1964*
Pole	*382*
Shelf	*392*
Shelf support	*830*

Based on the available stock of shelf components, what is the maximum number of complete shelf units that can be packaged? Show your working process.

A. 95
B. 98
C. 111
D. 122

The written test was administered first to obtain students' final answers and determine their levels of achievement. Based on the total test scores and the clarity of their written responses, students' numeracy abilities were categorized into three levels: high, medium, and low. After this classification, three representative students—one from each category—were purposively selected to illustrate different levels of numeracy performance. To maintain confidentiality, the selected students were coded as S1 (high), S2 (medium), and S3 (low). The guideline for categorizing students' abilities was adapted from Nurhayati et al. (2022), as presented in Table 1.

Table 1. Guidelines for Categorizing Students' skills

Score Interval	**Category**
$score > 70$	High
$40 \leq score \leq 70$	Medium
$score < 40$	Low

EDUMATIKA: Jurnal Riset Pendidikan Matematika *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

Table 1 presents the criteria for grouping students' numeracy abilities based on their average scores in solving PISA 2022 quantity content questions. The classification results were then used to determine three representative students for further in-depth analysis in each performance category.

After the categorization and selection process, semi-structured interviews were conducted with the three selected students. This interview format allowed flexibility in exploring their reasoning processes, focusing on how they interpreted the information in the problem, selected appropriate strategies, and justified their final answers. The interviews were carried out to validate and complement the students' written responses by providing deeper insight into their thought processes.

Students' responses were subsequently analyzed based on the numeracy skill indicators for quantity content. The analytical framework for these indicators was adapted from Han et al. (2017) as presented in Table 2.

Table 2. Indicators of Numeracy Skills in Quantity Content

Code	Numeracy Skill Indicators
NS1	Applying various numbers and mathematical symbols to solve practical problems in diverse real-life contexts.
NS2	Analyzing information presented in different formats (such as graphs, tables, charts, and similar representations).
NS3	Utilizing the interpretation of analytical results to make predictions and informed decisions.

Table 2 presents the indicators of students' numeracy skills in quantity content. The indicators cover three main aspects, such as applying various numbers and mathematical symbols to solve practical problems in diverse real-life contexts (NS1), analyzing information presented in different formats (such as graphs, tables, charts, and similar representations) (NS2), and utilizing the interpretation of analytical results to make predictions and informed decisions (NS3).

The data analysis was conducted using a qualitative descriptive technique following the stages proposed by Miles & Huberman (1994), namely data reduction, data display, and conclusion drawing. The students' written responses and interview transcripts were analyzed based on the three numeracy skill indicators (NS1, NS2, and NS3) to identify patterns of reasoning, errors, and levels of achievement. To ensure data validity, triangulation was applied by comparing the results of written tests, interview data, and documentation of students' work. The written test results provided information about students' final answers and level of achievement, while the documentation of students' work captured the step-by-step reasoning, strategies, and errors made during problem solving. The consistency between these sources was used to confirm the accuracy and credibility of the findings.

RESULTS AND DISCUSSION

The results of students' numeracy skills on the PISA 2022 quantity content can generally be observed in Table 3. The table shows that students' numeracy skills are varied, but most of them fall into the

EDUMATIKA: Jurnal Riset Pendidikan Matematika *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

low category. This indicates that the majority of students still face difficulties in solving problems with the quantity content.

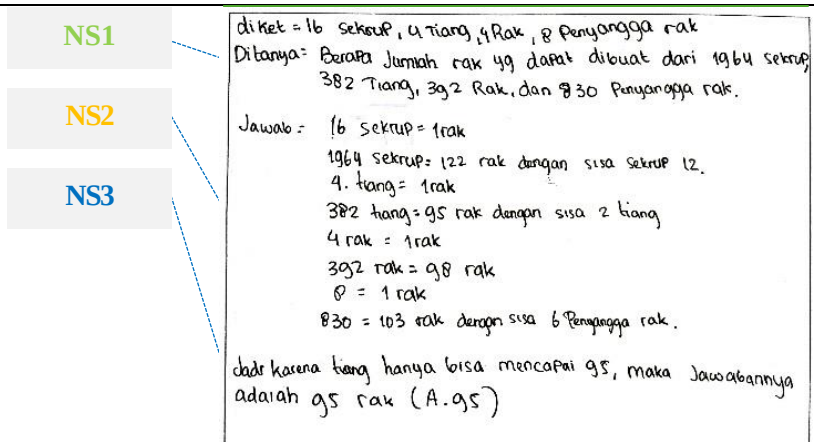
Table 3. The Results of The Students' Numeracy Skills Test in Solving PISA 2022 Question on Quantity Content

Category	Number of Students	Percentage
High	3	9%
Medium	5	16%
Low	24	75%

Table 3 presents the results of students' numeracy skills test on the PISA 2022 quantity content. The findings reveal that students' numeracy performance in this content area remains generally low. This suggests that most students still experience difficulties in interpreting quantitative information and applying mathematical reasoning to real-world problems. Therefore, it can be concluded that, in general, students' numeracy skills in the quantity content are still at a low level. The following section provides an analysis of representative student responses to this numeracy skills test item, covering each performance category.

High Category (S1)

Figure 2 shows S1's response that demonstrates the ability to solve a numeracy problem systematically and accurately.



English Version
(NS1) Given: 16 screws, 4 poles, 4 shelfs, 8 shelfs support
Question: How many one complete shelf units can be made from 1964 screws, 382 poles, 392 boards, and 830 supports?
(NS 2) Answer:

- 16 screws = 1 complete shelf unit
  1964 screws = 122 complete shelf units, with 12 screws remaining
- 4 poles = 1 complete shelf unit
  382 poles = 95 complete shelf units, with 2 poles remaining
- 4 shelfs = 1 complete shelf unit
  392 shelfs = 98 complete shelf units
- 8 shelf supports = 1 complete shelf unit
  830 = 103 complete shelf units, with 6 shelf supports remaining

(NS3) Since the number of poles only allows for 95 complete shelf units, the final answer is 95 complete shelf units (A. 95).

Figure 2. S1's solution to numeracy skills test on PISA 2022 quantity content "Shelf Unit"

EDUMATIKA: *Jurnal Riset Pendidikan Matematika* *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

The student first identified that 16 screws, 4 poles, 4 shelfs, and 8 shelf supports are required to form one complete shelf unit. Based on this information, the student calculated the maximum number of units from each component. From 1964 screws, 122 complete shelf units could be made with 12 screws remaining; from 382 poles, 95 complete shelf units could be made with 2 poles remaining; from 392 shelfs, 98 complete shelf units could be made; and from 830 shelf supports, 103 complete shelf units could be made with 6 shelf supports remaining.

From these calculations, the student concluded that the maximum number of complete shelf units is 95, since the number of poles serves as the limiting factor. This response shows that the student fulfilled NS1 by applying mathematical numbers and symbols to solve a real-life contextual problem, NS2 by analyzing numerical data systematically, and NS3 by utilizing the analytical results to draw a logical and accurate conclusion. Therefore, the student's response reflects a high level of numeracy ability. Therefore, S1 obtained a score of 6 points out of a maximum of 6.

To strengthen the analysis of students' written responses, the researcher also conducted interviews with several students representing each category of numeracy skills. These interviews aimed to further explore students' thought processes in solving the problem and to verify the alignment between their written answers and the reasoning behind them. The interview results provide a more comprehensive picture of the strategies used by students in answering the PISA 2022 Shelf Unit problem. The following excerpt presents an interview with S1.

R : Why did you first write down the number of components needed for one complete shelf unit?

S1 : Because I wanted to make sure that each unit requires the same amount, so I wrote down the needs per one complete shelf units first.

R : After that, how did you determine the maximum number of complete shelf units that can be made?

S1 : I divided the stock of each component by the amount required. Then I chose the smallest result as the limiting factor, because that component would run out first.

R : Why is the final result 95 complete shelf units?

S1 : Because among all the components, the side poles had the smallest stock. So, the maximum is only 95 complete shelf units, even though other components are still left over.

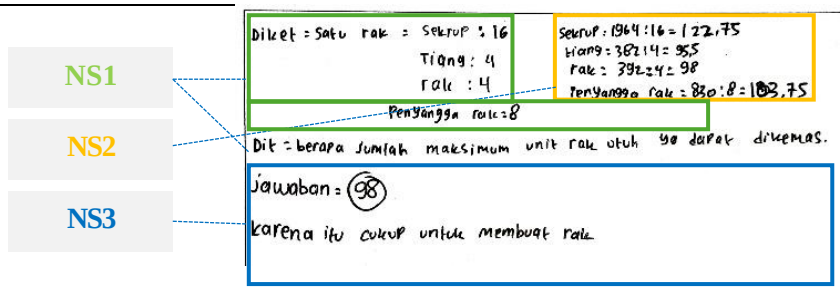
Based on the interview, S1 demonstrated a systematic strategy in solving the *Shelf Unit* problem. He began by writing down the number of components required for one complete shelf unit (16 screws, 4 poles, 4 boards, and 8 supports). He then divided the available stock of each component by the required amount and compared the results to determine the limiting factor. From his calculations, he concluded that only 95 complete shelf units could be made, since the poles limited

EDUMATIKA: Jurnal Riset Pendidikan Matematika *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

the production, even though other components were still left. This indicates that S1 successfully fulfilled NS1 (applying mathematical symbols and numbers appropriately), NS2 (analyzing data from tables and diagrams), and NS3 (interpreting the results to make a logical conclusion).

Medium Category (S2)

Figure 3 shows S2's response to the "Shelf Unit" item in the numeracy skills test. The student first identified that 16 screws, 4 poles, 4 shelves, and 8 supports are required to form one complete shelf unit. Based on this information, the student calculated the possible number of units from each component. From 1964 screws, 122.75 complete shelf units could be made; from 382 poles, 95.5 complete shelf units could be made; from 392 shelves, 98 complete shelf units could be made; and from 830 supports, 103.75 complete shelf units could be made.



English Version
(NS1) Given: 1 complete shelf unit = 16 screws, 4 poles, 4 shelfs, 8 shelfs support
Question: What is the maximum number of complete shelf units that can be assembled?
(NS2) Answer:
- screws = 1964 : 16 = 122,75
- poles = 382 : 4 = 95,55
- shelfs = 392 : 4 = 98
- shelf support = 830 : 8 = 103,75

(NS3) Final Answer = **98**
Because that amount is sufficient to make complete shelf units.

Figure 3. S2's solution to numeracy skills test on PISA 2022 quantity content "Shelf Unit"

From these calculations, however, the student incorrectly concluded that the maximum number of complete shelf units is 98, which was inconsistent with the limiting factor shown in the previous calculations. This response indicates that the student fulfilled NS1 by applying mathematical numbers and symbols to solve a real-life contextual problem and NS2 by analyzing numerical data systematically. Nevertheless, the student did not fulfil NS3 because the conclusion was inaccurate. Therefore, S2 obtained a score of 4 points out of a maximum of 6.

R : How did you understand the information from the table and picture in the problem?
S2 : First, I wrote down the number of components needed for one complete shelf unit, then I divided the stock by the requirement for each component.
R : After that, how did you determine the final result?

EDUMATIKA: *Jurnal Riset Pendidikan Matematika* *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

S2 : I looked at the calculation results and then chose the component that I thought was the limiting factor for the number of one complete shelf units.

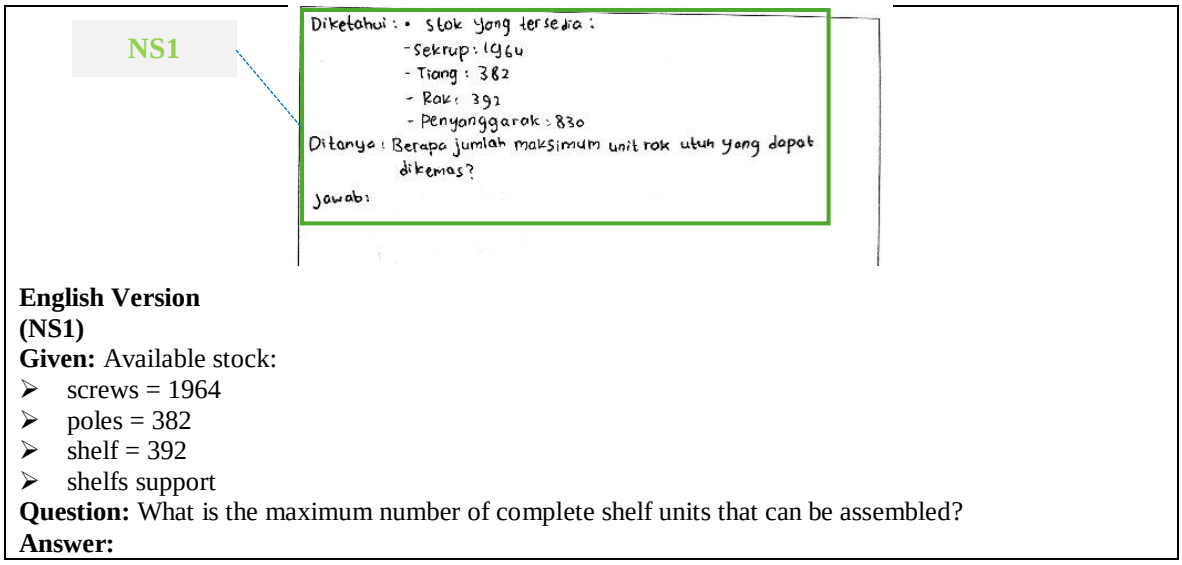
R : So, in your opinion, how many complete shelf units can be made?

S2 : I think the total is 98, because that number has no remaining.

S2 applied a similar initial approach by writing the requirements for each unit and calculating the possible number of units from each component. However, he made an error in drawing the final conclusion. Although his calculations showed that the poles were the limiting factor, he instead chose 98 units as the final answer, arguing that this number left no remainder. This suggests that Student B achieved NS1 (using mathematical symbols) and NS2 (systematically analyzing data) but failed in NS3 (interpreting results to make an accurate decision).

Low Category (S3)

Figure 4 shows S3's response to the "Shelf Unit" item in the numeracy skills test. The student identified the available stock of components, namely 1964 screws, 382 poles, 392 shelfs, and 830 shelf supports. However, the student did not proceed to calculate how many complete shelf units could be assembled from each component, nor did they analyze the limiting factor.



English Version
(NS1)
Given: Available stock:
- screws = 1964
- poles = 382
- shelf = 392
- shelfs support

Question: What is the maximum number of complete shelf units that can be assembled?
Answer:

Figure 4. S3's solution to numeracy skills test on PISA 2022 quantity content "Shelf Unit"

As a result, the response only demonstrated NS1, the ability to apply basic mathematical numbers and symbols to represent the given information. The student did not fulfil NS2, since there was no analysis of the data presented in the table and picture, and did not fulfil NS3, as no conclusion was drawn. Therefore, S3 obtained a total score of 2 points out of a maximum of 6.

R : What did you understand from the "Shelf Unit" problem?

S3 : I only knew how many parts were needed for each unit. That's all I wrote.

EDUMATIKA: *Jurnal Riset Pendidikan Matematika* *e-ISSN 2620-8911*
Volume 8, Issue 2, November 2025 *p-ISSN 2620-8903*

R : Why didn't you continue calculating the number of one complete shelf units that could be made?

S3 : I was confused about how to use the table, so I didn't continue the calculation.

R : In that case, why didn't you just write a final answer?

S3 : Because I was confused about how to use the table, so I left it blank.

S3 only listed the available stock of components but did not proceed to calculate the number of units. He admitted being confused about how to use the table, so he decided not to continue. As a result, he only demonstrated NS1 (representing information in numerical form) but did not fulfil NS2 (analysing data) or NS3 (interpreting results to draw a conclusion). This indicates that S3's numeracy skills remain at a low level, with difficulties emerging from the early stage of problem modelling.

The results of this study show that the majority of students' numeracy skills in solving the PISA 2022 quantity content question remain at a low level, with only 9% categorized as high, 16% as medium, and 75% as low. This finding aligns with previous research that highlights Indonesian students' difficulties in handling PISA-like mathematics problems, particularly those requiring reasoning and contextual interpretation (Juhaevah, 2022; Santos et al., 2022; Shafa et al., 2023; Stacey & Turner, 2014; Utami et al., 2024).

Students in the high category demonstrated the ability to meet all three numeracy skill indicators proposed by Han et al. (2017). They were able to apply mathematical symbols correctly, analyze tabular and diagrammatic data, and draw logical conclusions to determine the maximum number of shelf units. This suggests that these students possess adequate reasoning skills to connect quantitative information with real-life contexts, as also emphasized by Zulkardi et al. (2021) and Machromah et al. (2020).

Meanwhile, students in the medium category could apply mathematical symbols and perform calculations accurately but struggled with the third indicator—making decisions based on their analysis. This reflects findings from Apriliyani et al. (2022), who argued that Indonesian students tend to be procedurally strong but conceptually weak in drawing conclusions, especially when problems involve higher-order reasoning (Cayetano & Ibarra, 2024; Stacey, 2010).

On the other hand, most students fell into the low category, where they were only able to partially identify the mathematical requirements but failed to analyze or interpret the given information. Their inability to connect mathematical representations to conclusions supports the findings of Myrela & Khuzaini (2024), who noted that many junior high school students face difficulties in translating contextual problems into mathematical reasoning steps (Santos et al., 2022; Stacey & Turner, 2014).

These results highlight the urgent need to integrate PISA-like problems into regular classroom practice. By doing so, students can become familiar with reasoning-based, contextual problems, which are often absent in traditional teacher-centered instruction (Cayetano & Ibarra, 2024; Geiger & Schmid, 2022; Nusantara et al., 2021b, 2021a, 2025). Additionally, designing problems that adopt local contexts could increase students' engagement and help them connect mathematics with their environment, for example by recognizing tourism potential and learning mathematics through tourism (Tanjung et al., 2023). In the Indonesian context, this aligns with the Academic Ability Test (*Tes Kemampuan Akademik* in bahasa), which also emphasizes logical reasoning and problem-solving as core competencies assessed nationally (Kemendikdasmen, 2024).

Overall, the findings suggest that while a small number of students can already demonstrate strong numeracy skills, most remain at the basic level. Without pedagogical interventions that emphasize reasoning, representation, and decision-making, Indonesian students will continue to struggle in meeting international standards such as PISA.

CONCLUSION

This study concludes that students' numeracy skills in solving the PISA 2022 quantity content question remain generally low, as many students struggled to interpret information, perform multi-step calculations, and draw correct conclusions, with only a few meeting all three numeracy indicators. Considering the limited number of participants, further research with larger and more diverse samples is required to strengthen the generalizability of the findings and to explore the fundamental factors contributing to students' low numeracy performance, including instructional practices and task characteristics used in classrooms. These results also emphasize the potential of developing PISA-type jumping tasks embedded in local contexts as alternative assessment tools, while teachers are encouraged to incorporate more contextual, multi-step quantitative problems to help students gradually build stronger reasoning and interpretation skills.

ACKNOWLEDGEMENTS

This research was supported by the DIPA Universitas Jambi 2025, Contract Number: SP DIPA 139-03.2.693426/2025, under the Beginner Lecturer Research Scheme. The author gratefully acknowledges the Mathematics Teacher and the grade VIIIA students at Junior High School 7 Muaro Jambi for their valuable contributions and active participation.

REFERENCES

Apriliyani, Z., Istihapsari, V., & Istiandaru, A. (2022). Analisis kemampuan berpikir kreatif matematis siswa SMP ditinjau dari kemandirian belajar. *Jurnal Riset Pendidikan Dan Inovasi Pembelajaran Matematika (JRPIPM)*, *6*(1), 58–77. https://doi.org/10.26740/jrpipm.v6n1.p58-77

Aquino, A. S., & Ibarra, F. P. (2024). Correlational analysis on mathematical disposition and mathematical

achievement among selected senior high school students at San Jose City National High School. *Journal of Higher Education Theory and Practice*, *24*(11), 113–132. https://doi.org/10.33423/jhetp.v24i11.7413

Cayetano, H., & Ibarra, F. P. (2024). Projecting learning styles and metacognitive awareness as predictors of problem-solving abilities in mathematics among elementary pre-service teachers. *Journal of Higher Education Theory and Practice*, *24*(12), 8–26. https://doi.org/10.33423/jhetp.v24i12.7462

De Bortoli, L., & Underwood, C. (2025). *PISA 2022. A closer look at mathematics in Australia*. https://doi.org/10.37517/978-1-74286-786-1

Efendi, R., Kismiantini, & Krisnamurti, A. W. (2024). Analysis of PISA 2018 results in Indonesia: Perspective of ICT resources, books, grade repetition and school background. *AIP Conference Proceedings*, *2622*(1), 80014. https://doi.org/10.1063/5.0133360

Fadlila, N., Wijaya, A., & Hilmi, I. (2022). Quantity content: Developing mathematics PISA-like problems with independence day contest context. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *6*(2), 425. https://doi.org/10.31764/jtam.v6i2.7475

Geiger, V., & Schmid, M. (2022). A critical turn in numeracy education and practice. *Frontiers in Education*, *2011*. https://doi.org/10.3389/feduc.2024.1363566

Han, W., Susanto, D., Dewayani, S., Pandora, P., Hanifah, N., Miftahussururi, Nento, M. N., & Akbari, Q. S. (2017). *Materi Pendukung Literasi Numerasi*. Kemdikbud.

Juhaevah, F. (2022). Developing mathematics problems using local wisdom context of Maluku to improve students' numeracy. *Jurnal Elemen*, *8*(1), 323–339. https://doi.org/10.29408/jel.v8i1.4524

Kandaga, T. (2024). Pemahaman konsep matematika siswa MTs dalam model discovery learning berbantuan aplikasi quizizz. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *4*(1), 57–67. https://doi.org/10.51574/kognitif.v4i1.1221

Kemendikdasmen. (2024). *Tes Kemampuan Akademik (TKA)*. Pusat Asesmen Pendidikan, Kemendikbudristek. https://pusmendik.kemendikdasmen.go.id/tka/

Machromah, I. U., Harun, S., Prayitno, J., Faiziyah, N., & Sri Fatmasari, L. W. (2020). Designing PISA-like mathematics task to assess students' mathematical literacy. *Universal Journal of Educational Research*, *8*(10), 4986–4995. https://doi.org/10.13189/ujer.2020.081072

Miles, M. B., & Huberman, A. M. (1994). *Qualitative and Data Analysis*. SAGE Publications.

Myrela, A. C., & Khuzaini, N. (2024). Analisis kemampuan siswa kelas xi dalam menyelesaikan soal literasi numerasi materi turunan. *Pedagogy: Jurnal Pendidikan Matematika*, *10*(2), 132–143. https://doi.org/10.47662/pedagogi.v10i2.749

Nurhayati, N., Asrin, A., & Dewi, N. K. (2022). Analisis kemampuan numerasi siswa kelas tinggi dalam penyelesaian soal pada materi geometri di SDN 1 Teniga. *Jurnal Ilmiah Profesi Pendidikan*, *7*(2b), 723–731. https://doi.org/10.29303/jipp.v7i2b.678

Nusantara, D. S., Zulkardi, Z., & Putri, R. I. I. (2021a). Designing PISA-like mathematics problem using a COVID-19 transmission map context. *AIP Conference Proceedings*, *2438*(1), 020005. https://doi.org/10.1063/5.0071596

Nusantara, D. S., Zulkardi, Z., & Putri, R. I. I. (2021b). Designing PISA-like mathematics task using a COVID-19 context (Pisacomat). *Journal on Mathematics Education*, *12*(2), 349–364. https://doi.org/10.22342/jme.12.2.13181.349-364

Nusantara, D. S., Zulkardi, Z., & Putri, R. I. I. (2024). Students' strategies in solving PISA-like mathematics problems on change and relationship content. *AIP Conference Proceedings*, 020043. https://doi.org/10.1063/5.0201003

Nusantara, D. S., Zulkardi, Z., & Putri, R. I. I. (2025). Investigating Students' Mathematical Argumentation Ability in Solving PISA-like Mathematics Tasks on Change and Relationships . *Mathematics Education Journal*, *19*(4 SE-Articles), 807–826. https://jpm.ejournal.unsri.ac.id/index.php/jpm/article/view/504

OECD. (2016). PISA 2015 Results (Volume I): Excellence and Equity in Education. *OECD Publishing*. https://doi.org/10.1787/9789264266490-en

OECD. (2019). PISA 2018 Results (Volume I): What Students Know and Can Do. *OECD Publishing*.

https://doi.org/10.1787/5f07c754-en

OECD. (2023). *PISA 2022 Results (Volume I): The State of Learning and Equity in Education* (PISA). OECD. https://doi.org/10.1787/53f23881-en

Rhamayanti, Y., Siregar, R. N., Khomeni, A., & Harahap, H. H. (2024). Pelatihan pembelajaran kolaboratif jumping task berbasis bahasa matematis tapsel untuk meningkatkan kompetensi 6C abad 21 siswa SD Negeri 100601 Pintu Padang. *KOMUNITA: Jurnal Pengabdian Dan Pemberdayaan Masyarakat*, *3*(2), 252–267. https://doi.org/10.60004/komunita.v3i2.108

Rizal, Y. A., Zubainur, C. M., & Yusrizal. (2021). The validity of PISA equivalent mathematical problems based on content quantity. *AIP Conference Proceedings*, *2331*(1), 20022. https://doi.org/10.1063/5.0045498

Santos, R. A., Collantes, L. M., Ibañez, E. D., Ibarra, F. P., & Pentang, J. T. (2022). Innate mathematical characteristics and number sense competencies of junior high school students. *International Journal of Learning, Teaching and Educational Research*, *21*(10), 325–340. https://doi.org/10.26803/ijlter.21.10.18

Shafa, S., Zulkardi, Z., & Putri, R. I. I. (2023). Students' creative thinking skills in solving PISA-like mathematics problems related to quantity content. *Jurnal Elemen*, *9*(1), 271–282. https://doi.org/10.29408/jel.v9i1.6975

Stacey, K. (2010). *Mathematics teaching and learning to reach beyond the basics*. https://consensus.app/papers/mathematics-teaching-and-learning-to-reach-beyond-the-stacey/f1e787639c9c52dab5711ba12ea1822a/

Stacey, K., & Turner, R. (2014). *Assessing mathematical literacy : the PISA experiemce*. https://consensus.app/papers/assessing-mathematical-literacy-the-pisa-experiemce-stacey-turner/26ef195035ba5f2fb7036d42049129fe/

Susanto, E., Susanta, A., & Rusdi, R. (2022). Pelatihan penyusunan instrumen tes matematika online berbasis PISA bagi guru matematika SMP Bengkulu. *JPM: Jurnal Pengabdian Masyarakat*, *2*(3), 114–120. https://doi.org/10.47065/jpm.v2i3.330

Tanjung, A. L., Zulkardi, Z., & Putri, R. I. I. (2023). The development of PISA-like problems using immunity context during pandemic. *Jurnal Elemen*, *9*(1), 31–48. https://doi.org/10.29408/jel.v9i1.6152

Utami, M. R. P., Zulkardi, & Putri, R. I. I. (2024). Student's critical thinking skills in solving PISA-like mathematics questions on quantity content. *AIP Conference Proceedings*, *3052*(1), 20024. https://doi.org/10.1063/5.0201029

Zulkardi, Nusantara, D. S., & Putri, R. I. I. (2021). Designing PISA-like task on uncertainty and data using Covid-19 context. *Journal of Physics: Conference Series*, *1722*(1). https://doi.org/10.1088/1742-6596/1722/1/012102