



Analysis of Numeracy Literacy in Contextual Data Presentation Problems Reviewed from Mathematical Disposition and Self-Efficacy

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Abstract

This study aims to describe students' numeracy literacy in solving data presentation problems based on mathematical disposition and self-efficacy. This is a descriptive study using a qualitative approach. The research subjects consisted of four seventh-grade students at Bala Keselamatan Christian Junior High School in Palu, namely students with high mathematical disposition and high self-efficacy (DTST), high mathematical disposition and low self-efficacy (DTSR), low mathematical disposition and high self-efficacy (DRST), and low mathematical disposition and low self-efficacy (DRSR). Data were collected through questionnaires, numeracy literacy tests, and interviews, and were analyzed using the Miles and Huberman model. The results indicate that there are differences in numeracy literacy characteristics across each student profile. DTST and DTSR students demonstrated better numeracy literacy characteristics than DRST and DRSR students. These differences were evident in the formulate, employ, and interpret processes. The findings indicate that mathematical disposition contributes to the quality of mathematical thinking processes, while self-efficacy plays a role in building students' confidence while solving and communicating problem solutions.

Keywords: Numeracy literacy; Mathematical disposition; Self-efficacy; Contextual problems

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INTRODUCTION

Numeracy is one of the key competencies that students need to develop in order to tackle various problems in everyday life. Numeracy is not only related to the ability to perform arithmetic operations, but also to the ability to formulate problems, employ mathematical concepts, and interpret the results of problem-solving in various real-life contexts (OECD, 2023). These skills are among the competencies developed in mathematics education because they help students make decisions based on information presented in the form of numbers, tables, graphs, and diagrams.

The importance of numeracy is also reflected in the implementation of the Merdeka Curriculum, which emphasizes meaningful learning through contextual problem-solving. Students are expected not only to master mathematical concepts but also to be able to apply them in various real-life situations (Ministry of Education, Culture, Research, and Technology, 2022). However, the results of the 2022 Programme for International Student Assessment (PISA) indicate that Indonesian students' mathematical literacy skills remain below the average of OECD member countries, making the strengthening of numeracy literacy a continuing challenge in mathematics education (OECD, 2023).

One of the topics that plays a key role in developing numeracy literacy is data presentation. This topic requires students to read, analyze, compare, and interpret information presented in the form of tables and various types of diagrams. These skills are essential because

much of the information encountered in daily life—such as data on demographics, health, the economy, and education—is typically presented in visual formats. Consequently, data presentation is a common topic in AKM- and PISA-based assessments used to measure students' numeracy skills (OECD, 2023).

Based on the results of preliminary observations and interviews with mathematics teachers at Bala Keselamatan Christian Junior High School in Palu, it was found that students still struggle with solving context-based data presentation problems. These difficulties are evident when students identify key information in the problems, determine solution strategies, and interpret calculation results in accordance with the problem context. Additionally, differences in characteristics among students were observed. Some students were able to arrive at the correct answer but were unable to explain the reasoning behind their response. Conversely, there were students who understood the context of the problem but were unsure about the solution strategy they had chosen. These differences in characteristics indicate that numeracy literacy is influenced not only by mastery of mathematical concepts but also by students' affective aspects.

Various studies indicate that affective aspects play a role in students' success in solving math problems. Geraldine and Wijayanti (2022) reported that students with high self-efficacy demonstrated better mathematical literacy processes than those with low self-efficacy when solving PISA problems. The findings of Ananda and Wandini (2022) also indicate that self-efficacy influences students' mathematical literacy skills because it is related to their confidence in selecting and maintaining problem-solving strategies. Additionally, Ambarwati et al. (2023) found that students with higher self-efficacy tend to demonstrate more optimal mathematical numeracy skills. On the other hand, Wirawan et al. (2023) reported that mathematical disposition is related to students' numeracy literacy skills in solving AKM problems. This finding is supported by Lestari et al. (2023), who showed that mathematical disposition, together with self-efficacy, contributes to students' mathematical reasoning skills. Theoretically, mathematical disposition refers to students' tendency to think positively about mathematics through attitudes of self-confidence, perseverance, flexibility, and reflection in problem-solving (NCTM, 2000), while self-efficacy is an individual's belief in their ability to perform a task (Bandura, 1997).

Although various studies have examined numeracy literacy, mathematical disposition, and self-efficacy, most studies still examine these two affective aspects separately or relate them only to learning outcomes and problem-solving skills. Research describing the characteristics of numeracy literacy based on a combination of mathematical disposition and self-efficacy—particularly regarding data presentation in junior high school—remains limited. In fact, students with high mathematical disposition do not necessarily have high self-efficacy, and vice versa. Differences in the combination of these two aspects are thought to result in distinct numeracy characteristics among students.

Based on the above description, this study aims to describe students' numeracy literacy in solving data presentation problems based on their mathematical disposition and self-efficacy. The analysis was conducted on four student profiles: high mathematical disposition and high self-efficacy (DTST), high mathematical disposition and low self-efficacy (DTSR), low mathematical disposition and high self-efficacy (DRST), and low mathematical disposition and low self-efficacy (DRSR). The results of this study are expected to provide a more comprehensive picture of students' numeracy literacy characteristics, thereby serving as a basis for teachers to design instruction that not only develops mathematical abilities but also addresses students' affective aspects.

METHOD

This study employs a qualitative approach with a descriptive research design. This approach was chosen because the study aims to describe students' numeracy literacy in solving data presentation problems based on mathematical dispositions and self-efficacy. The study

focuses on identifying the characteristics of numeracy literacy demonstrated by each subject based on the indicators of formulate, employ, and interpret.

The study was conducted at Palu Salvation Army Christian Junior High School during the even semester of the 2024/2025 academic year. The research subjects were selected using purposive sampling. The selection of subjects was based on the results of questionnaires on mathematical disposition, self-efficacy, and communication skills, as well as recommendations from the mathematics teacher. Based on the grouping results, four subjects were selected to represent each category: one student with high mathematical disposition and high self-efficacy (DT-ST), one student with high mathematical disposition and low self-efficacy (DT-SR), one student with low mathematical disposition and high self-efficacy (DR-ST), and one student with low mathematical disposition and low self-efficacy (DR-SR).

The instruments used in this study included a mathematical disposition questionnaire, a self-efficacy questionnaire, a numeracy literacy test, and interview guidelines. The mathematical disposition questionnaire was used to determine students' attitudes toward mathematics, while the self-efficacy questionnaire was used to assess students' confidence in their ability to complete mathematical tasks. The numeracy literacy test consisted of contextual problems on data presentation, designed based on the PISA mathematics literacy indicators: formulate, employ, and interpret (OECD, 2023). The interview guide was used to obtain more in-depth information regarding students' thought processes in solving problems.

Before being used in the study, all instruments were validated by experts. The mathematical disposition questionnaire and the self-efficacy questionnaire were validated by faculty members in the Guidance and Counseling program, while the numeracy literacy test and the interview guidelines were validated by faculty members in the Graduate Program in Mathematics Education. Validation was conducted to assess the appropriateness of the instruments' content, construct, language, and readability; as a result, the instruments were deemed suitable for use in the study after revisions were made in accordance with the validators' recommendations.

The research procedure consisted of four stages: (1) administering a mathematical disposition questionnaire and a self-efficacy questionnaire to the students; (2) grouping the students based on their questionnaire results into four categories of mathematical disposition and self-efficacy; (3) administering a numeracy literacy test to selected subjects; and (4) conducting in-depth interviews with each subject to obtain information about their thought processes in solving problems.

Data analysis utilized the interactive model proposed by Miles, Huberman, and Saldaña (2014), which comprises three stages: data condensation, data display, and conclusion drawing and verification. The analysis was conducted iteratively by linking the results of the numeracy literacy tests with the interview results to obtain a description of the numeracy literacy characteristics of each research subject.

The validity of the data in this study was tested using temporal triangulation. Temporal triangulation was conducted by collecting data at different times using the same instrument to examine the consistency of the subjects' responses and the problem-solving processes they demonstrated. The results of the data collection at each time point were then compared to ensure that the data obtained were consistent and reliable. If any inconsistencies in the data were found, the researcher conducted further investigation through interviews until valid data were obtained.

RESULTS AND DISCUSSION

Based on the results of the mathematical disposition and self-efficacy questionnaires, four research subjects were selected to represent each category: high mathematical disposition and high self-efficacy (DTST), high mathematical disposition and low self-efficacy (DTSR), low mathematical disposition and high self-efficacy (DRST), and low mathematical disposition and low self-efficacy (DRSR). The four subjects were then administered a numeracy literacy

test on data presentation and interviewed to obtain information regarding their problem-solving processes. The analysis results for each subject are presented based on the PISA numeracy literacy indicators: formulate, employ, and interpret.

DTST Subject

The DTST subject demonstrated numeracy literacy characteristics across all three indicators: formulate, employ, and interpret. The analysis results are based on written responses and interview findings.

Diketahui:

- Sepeda = 30%
- Sepeda motor = 35%
- Berjalan kaki = 25%
- Jumlah siswa = 40 orang

Jenis Transportasi	Persentase	Jumlah Siswa
Sepeda	30%	12
Sepeda motor	35%	14
Berjalan kaki	25%	10
Kendaraan umum	10%	4

Figure 1. DTST Subject's Responses to the "Formulate" Indicator

Based on Figure 1, the written responses indicate that the subjects identified key information in the problems, such as given data and the information being asked for. Additionally, the subjects selected appropriate data presentation concepts as the basis for solving the problems, thereby formulating the contextual problems into mathematical representations before performing calculations.

Persentase kendaraan umum:

$$= 100\% - (30\% + 35\% + 25\%)$$

$$= 100\% - 90\% = 10\%$$

Jumlah siswa:

Sepeda

$$\frac{30}{100} \times 40 = 12 \text{ Siswa}$$

Sepeda motor

$$\frac{35}{100} \times 40 = 14 \text{ Siswa}$$

Berjalan kaki

$$\frac{25}{100} \times 40 = 10 \text{ Siswa}$$

Kendaraan umum

$$\frac{10}{100} \times 40 = 4 \text{ Siswa}$$

Figure 2. DTST Subjects' Responses to the "Employ" Indicator

Based on Figure 2, the written answers indicate that the subjects systematically applied mathematical concepts, facts, procedures, and reasoning to solve problems. The steps for

solving the problems were written out in a logical sequence until a final result was obtained that corresponded to the mathematical representation formulated in the previous stage.

Based on the interview results, the subject explained the reasoning behind the conclusions written on the answer sheet.

- IP : In the conclusion section, you wrote that "Most students commute using private vehicles, especially motorcycles and bicycles." Why did you draw that conclusion?
- IDTST : Because my calculations show that the number of motorcycle and bicycle users is higher than that of other modes of transportation, so that's the conclusion I reached.
- IP : How do you know that the conclusion matches the question?
- IDTST : I reviewed what the question asked and then compared it with my calculation results. Since the results matched the question, I wrote down that conclusion.

Based on the interview excerpt, the subject interpreted the calculation results within the context of the problem by relating the results obtained to the questions in the problem. In addition, the subject double-checked the validity of the solution before drawing a final conclusion.

DTSR Subject

The DT-SR subject demonstrated numeracy literacy characteristics across all three indicators: formulate, employ, and interpret. The analysis results were derived from written responses and interview findings.

Diketahui :

Sepeda = 30 %

Sepeda Motor = 35 %

Berjalan kaki = 25 %

Jumlah Siswa = 40

Jenis transportasi	Persentase	Jumlah Siswa
Sepeda	30 %	12
Sepeda Motor	35 %	14
Berjalan kaki	25 %	10
Kendaraan umum	10 %	4

Figure 3. DTSR Subject's Responses to the "Formulate" Indicator

Based on Figure 3, the written responses indicate that the subjects identified the key information in the questions and determined the relevant mathematical concepts needed to solve the problems. The given information and the information requested were used as the basis for formulating the contextual problems into mathematical representations. However, some information was not fully written on the answer sheets but was still used in the problem-solving process.

Persentase kendaraan umum:
 $100\% - (30\% + 35\% + 25\%)$
 $= 100\% - 90\%$
 $= 10\%$
 Jumlah Siswa:
 Sepeda =
 $30\% \times 40 = 12 \text{ Siswa}$
 Sepeda motor =
 $35\% \times 40 = 14 \text{ Siswa}$
 Berjalan kaki =
 $25\% \times 40 = 10 \text{ Siswa}$
 Kendaraan umum =
 $10\% \times 40 = 4 \text{ Siswa}$

Figure 4. DTSR Subject's Answers for the "Employ" Indicator

Based on Figure 4, the written answers indicate that the subjects used mathematical concepts, facts, procedures, and reasoning to solve problems. The steps for solving the problems were written in sequence until the final result was obtained. In some sections, corrections or cross-outs were visible in the calculation process, indicating that the subjects reviewed their solution steps before determining the final answer.

Based on the interview results, the subject explained the reasoning behind the conclusions written on the answer sheet.

- IP* : In the conclusion, you wrote that "More students use motorcycles than public transportation." Why did you draw that conclusion?
IDTSR : Because based on the calculations I did, the results indicated that, so I adjusted the conclusion to match the findings.
IP : How did you know that the conclusion was consistent with the question?
IDTSR : I reread the question, then compared it with my calculations. After that, I wrote the conclusion as requested in the question.

Based on the interview excerpt, the subject linked the calculation results to the context of the problem through the conclusion written on the answer sheet. The subject also checked whether the solution matched the question before formulating a conclusion.

DRST Subject

The DRST subject demonstrated numeracy literacy characteristics across all three indicators: formulate, employ, and interpret. The analysis results were derived from written responses and interview findings.

Jenis Transportasi	Persentase	Jumlah Siswa
Sepeda	30%	12
Sepeda motor	35%	14
berjalan kaki	25%	10
Kendaraan umum	10%	4

Figure 5. DRST Subject's Answers for the "Formulate" Indikator

Based on Figure 5, the written responses indicate that the subjects identified the key information in the problem and determined the relevant mathematical concepts needed to solve it. The given information and the information requested were used as the basis for formulating

the contextual problem into a mathematical representation. The subjects were able to select the information needed to solve the problem and apply that information in the problem-solving process.

$$\begin{aligned}
 &30\% + 35\% + 25\% \\
 &= 90\% \\
 &100\% - 90\% \\
 &= 10\% \\
 &\text{Jumlah siswa} \\
 &\text{Sepeda} = 30\% \times 40 = 12 \text{ siswa} \\
 &\text{Sepeda motor} = 35\% \times 40 = 14 \text{ siswa} \\
 &\text{Berjalan kaki} = 25\% \times 40 = 10 \text{ siswa} \\
 &\text{Kondisi lain umum} = 10\% \times 40 = 5 \text{ siswa}
 \end{aligned}$$

Figure 6. Responses of DRST Subjects on the “Employ” Indikator

Based on Figure 4, the written answers indicate that the subjects used mathematical concepts, facts, procedures, and reasoning to solve problems. The steps for solving the problems were written in sequence until the final result was obtained. However, during the problem-solving process, solving process, there were still instances of carelessness in applying procedures or performing calculations. Nevertheless, the subjects were still able to use mathematical concepts and procedures to solve the problems.

Based on the interview results, the subject explained the reasoning behind the conclusions written on the answer sheet.

- IP : In the conclusion, you wrote that “Motorcycles are the most commonly used.” Why did you draw that conclusion?
- IDRST : Because based on the results of my calculations, that’s what the answer showed, so I wrote the conclusion based on my calculations.
- IP : How do you know that this conclusion matches the question?
- IDRST : I reviewed my calculations and the question on the test. In my opinion, the result matches what was asked.

Based on the interview excerpt, the subject attempted to relate the calculation results to the problem context through the conclusions written on the answer sheet. However, the subject’s explanation was still limited to the alignment of the calculation results with the question and did not yet demonstrate an in-depth interpretation of the meaning of the results obtained within the problem context. Although the subject demonstrated confidence in explaining their answer, they were not yet able to comprehensively connect the mathematical results to the context of the problem. Thus, the DRST subject was able to meet the “formulate” and “employ” indicators but did not yet optimally meet the “interpret” indicator.

DRSR Subject

The DRSR subjects demonstrated numeracy literacy characteristics across all three indicators: formulate, employ, and interpret. The analysis results were derived from written responses and interview findings.

1.

Jenis transportasi	Persentase	Jumlah siswa
sepeda	30%	30
sepeda motor	35%	35
Berjalan kaki	25%	25

Figure 7. DRSR Subject’s Answers for the “Formulate” Indikator

Based on Figure 7, the written responses indicate that the subjects were only able to identify some of the information contained in the question. The subjects were not yet able to accurately identify all the important information that was known and asked for, nor were they able to determine the relevant mathematical concepts needed to formulate the problem. The information used in the problem-solving process was still limited, so the contextual problem could not yet be accurately formulated into a mathematical representation.

1.

Jenis transportasi	Persentase	Jumlah Siswa
sepeda	30%	30
sepeda motor	35%	35
Berjalan kaki	25%	25

Figure 8. DRSR Subject's Answers for the "Employ" Indicator

Based on Figure 8, the written answers indicate that the subjects had difficulty applying appropriate mathematical concepts, facts, procedures, and reasoning to solve the problems. The steps they took to solve the problems were not systematic, and there were still errors in applying mathematical procedures. Difficulties in understanding the information during the formulation stage also affected the problem-solving process, resulting in the subjects being unable to arrive at the correct answers.

Based on the interview results, the subject explained the reasoning behind the conclusions written on the answer sheet.

- IP : In the conclusion, you wrote that "Motorcycles are the most common."
Why did you draw that conclusion?
- IDRSR : Because I looked at the results I obtained, so I wrote it that way.
- IP : How do you know that conclusion is consistent with the question?
- IDRSR : I'm not really sure; I just based it on my calculations.

Based on the interview excerpt, the subject has not yet been able to accurately relate the calculation results to the context of the problem. The subject has not yet been able to provide an explanation that demonstrates an understanding of the meaning of the calculation results, nor has the subject been able to draw appropriate conclusions based on the information and the context of the problem. Thus, the DRSR subject has not optimally met the "interpret" indicator.

Overall, the DRSR subjects were not yet able to optimally meet the three numeracy literacy indicators. For the "formulate" indicator, the subjects were only able to identify some of the information and were not yet able to formulate problems accurately. For the "employ" indicator, the DRSR subject struggled to apply appropriate mathematical concepts and procedures. Meanwhile, for the "interpret" indicator, the subject was unable to connect the results of calculations to the context of the problem or draw appropriate conclusions. This indicates that the DRSR subject has the lowest level of numeracy literacy compared to the other subjects.

Subject-Specific Numeracy Literacy Among Students with High Mathematical Disposition and High Self-Efficacy (DTST)

The written responses and interview evidence indicate that the student with high mathematical disposition and high self-efficacy (DTST) demonstrated the most comprehensive numeracy literacy performance among the four cases. The student identified relevant information, determined the missing percentage of public transportation users, calculated the number of students in each transportation category, and connected the results to the contextual question. These steps illustrate the coordination of contextual understanding and mathematical

representation that is central to mathematical modelling (Cevikbas et al., 2022; Krawitz et al., 2022). The description nevertheless concerns performance on the particular data-presentation problem administered in this study and should not be generalized to other mathematical contexts without further evidence.

The sequence of calculations was accompanied by checking whether the totals were consistent with the information in the question. This verification matters because a correct numerical answer alone does not establish that the solver has monitored the appropriateness of the procedures employed. Mathematical modelling can impose cognitive demands that require learners to plan, evaluate, and revise their strategies (Schukajlow et al., 2023). Research reviews also identify planning, monitoring, and reflection as relevant dimensions of self-regulated mathematical problem solving (Andika & Arliani, 2026; Noor et al., 2025). Although metacognition was not measured directly, the DTST student's recorded checking behaviour is compatible with these processes.

The student also interpreted the computed frequencies in terms of transportation choices, instead of ending the solution at the calculation stage. This feature distinguishes contextual interpretation from procedural application and is consistent with research that treats formulating, employing, and interpreting as interconnected mathematical-literacy processes (Alagumalai & Buchdahl, 2021). The opportunity to generate and examine mathematical problems may also relate to students' motivational beliefs and modelling performance (Krawitz et al., 2025). However, the present data do not indicate whether prior experiences of this type influenced the student's performance.

The observed persistence and orderly reasoning were consistent with the student's high mathematical disposition, while confidence during explanation was consistent with high self-efficacy. Earlier investigations have examined mathematical disposition in relation to problem-solving performance (Hertin & Sucipto, 2024). Research on mathematics self-efficacy likewise indicates that efficacy beliefs are related to mathematics learning processes, though the nature and direction of these relationships depend on context and measurement (Street et al., 2024). Work on instructional support through modelling solution plans offers a further perspective on how competence and efficacy beliefs might develop (Vogelsanger-Holenstein et al., 2025). These findings cannot establish that either affective characteristic caused the student's successful solution. The case instead illustrates their coexistence with accurate formulation, computation, and interpretation.

Subject-Specific Numeracy Literacy Among Students with High Mathematical Disposition and Low Self-Efficacy (DTSR)

The student with high mathematical disposition and low self-efficacy (DTSR) successfully identified relevant data, used percentage procedures, and interpreted the results in relation to the question. The written work showed a structured solution, although the interview responses suggested greater hesitation when explaining the reasoning. This contrast indicates that displayed mathematical competence and confidence in communicating a solution are distinguishable. Research on the calibration of academic self-efficacy has shown that perceived capability need not align perfectly with measured performance (Talsma et al., 2019). A meta-analysis of Indonesian mathematics studies also supports examining self-efficacy as an associated factor rather than assuming it determines the outcome for every learner (Muhtadi et al., 2022).

The student's careful completion and checking of the task can be considered alongside research on mathematical disposition. Studies have explored links among disposition, confidence, and mathematics achievement (Oktavia & Yulia, 2024), while instructional

investigations have considered disposition in relation to problem solving (Alhaq et al., 2024). These studies provide context for interpreting the combination of persistence and accurate performance evident in this case. Nevertheless, the evidence does not demonstrate that high mathematical disposition compensated for low self-efficacy, because no causal comparison or intervention was conducted.

Compared with the DTST student, the DTSR student appeared less assured when communicating an otherwise appropriate solution. Studies examining academic buoyancy, efficacy beliefs, and mathematics achievement indicate that beliefs about capability are relevant to students' academic functioning (Weißenfels et al., 2023). Literature on self-regulated learning further suggests that monitoring work and evaluating steps may be related to mathematical learning processes (Herlina et al., 2022). Repeated checking in this case might indicate productive monitoring, uncertainty, or both; the available interview extract cannot distinguish these explanations definitively.

Importantly, an assumed universal advantage of mathematical disposition over self-efficacy would not be warranted. Evidence from research on problem-solving ability and disposition has not always indicated a strong relationship (Wahyuningrum et al., 2024). The DTSR case therefore shows that a student can display effective numeracy processes and comparatively low reported confidence at the same time. Instructional support could focus on opportunities to explain and defend accurate mathematical reasoning, while future studies should investigate whether confidence changes across multiple tasks and learning situations.

Subject-Specific Numeracy Literacy Among Students with Low Mathematical Disposition and High Self-Efficacy (DRST)

The student with low mathematical disposition and high self-efficacy (DRST) identified numerical information and attempted relevant percentage calculations but showed limitations in procedural accuracy and contextual interpretation. During the interview, the student communicated with confidence but did not fully justify why the calculated outcome answered the question. This pattern resembles the general possibility of misalignment between perceived capability and observed performance documented in self-efficacy research (Talsma et al., 2019). Studies on the motivational and emotional correlates of mathematics achievement also show that efficacy beliefs are only one component of a more complex set of relationships (Živković et al., 2023).

The interpretive limitation was particularly apparent when the student asserted that a conclusion followed from the calculation without explaining its contextual meaning. Understanding real-world information is central to constructing and evaluating an appropriate model (Krawitz et al., 2022). Research comparing judgements across modelling and other mathematical problems further suggests that efficacy-related beliefs and task perceptions depend on the nature of the task (Böswald & Schukajlow, 2023). The latter evidence concerns preservice teachers, not students of the same age as those in this study, and is used here for conceptual comparison rather than direct population-level support.

A lack of careful interpretation might plausibly be associated with less reflective problem-solving habits, yet mathematical disposition cannot be isolated as the cause. In fact, research addressing the relationship between disposition and mathematical problem solving has reported findings that complicate simple assumptions of a uniformly strong association (Wahyuningrum et al., 2024). A systematic review of factors associated with PISA mathematics achievement reinforces the need to consider multiple learner and contextual variables rather than assigning performance differences to a single affective factor (Wang et

al., 2023). In the present study, prior knowledge, task comprehension, and calculation skills may also account for part of the observed pattern.

The DRST case highlights the importance of asking students to justify the meaning and plausibility of an answer rather than relying on apparent confidence or the completion of calculations. The difference between the DTSR and DRST cases is an analytically useful contrast, but with one participant in each profile it does not establish that disposition is more influential than self-efficacy. Further research would need additional participants, repeated tasks, and explicit measures of reasoning and confidence before making such comparative claims.

Subject-Specific Numeracy Literacy Among Students with Low Mathematical Disposition and Low Self-Efficacy (DRSR)

The student with low mathematical disposition and low self-efficacy (DRSR) displayed the greatest difficulty across the four cases. Written responses incompletely identified relevant information and did not consistently convert percentages into appropriate frequencies. The student also struggled to justify the conclusion during the interview. Difficulties at the stage of representing a contextual situation can accompany problems in selecting and implementing mathematical procedures, as research on mathematical modelling competencies and cognitive barriers has documented (Cevikbas et al., 2022; Schukajlow et al., 2023). Nevertheless, the available evidence cannot show that initial formulation difficulties were the sole cause of later calculation errors.

The limited evidence of systematic checking in the student's work is relevant to literature on self-regulated learning and problem solving. Reviews have considered the roles of strategy selection, monitoring, and reflection in students' mathematical problem-solving development (Mafaza et al., 2024; Noor et al., 2025). The present study did not administer a direct measure of metacognition or self-regulated learning, so such processes should be presented as plausible interpretations, not established deficits.

Low reported self-efficacy coexisted with uncertainty about the solution during the interview. Meta-analytic studies have found relationships between self-efficacy and mathematics learning outcomes (Ghufron & Suminta, 2016; Muhtadi et al., 2022), but these associations cannot determine why this student performed poorly. Similarly, low mathematical disposition should not be interpreted as a sufficient explanation for the observed difficulties: gaps in prerequisite concepts, misreading of the data, or limited procedural knowledge might also be involved. Instructional research on problem-based learning provides one potential perspective for supporting mathematical problem solving and efficacy beliefs (Sinurat et al., 2021).

Support for students with similar observable difficulties may include guided interpretation of data, explicit attention to the relationships between quantities, worked opportunities to check answers, and feedback on the reasoning behind conclusions. A meta-analytic review of rubrics suggests that clear assessment criteria can be relevant to academic performance, self-regulated learning, and self-efficacy (Panadero et al., 2023). These are instructional implications informed by prior studies rather than interventions tested in the present research.

Across the four individual cases, the DTST student demonstrated accurate formulation, employment, and interpretation; the DTSR student performed these processes while showing less confidence in explanation; the DRST student expressed confidence but had limits in reasoning and interpretation; and the DRSR student struggled throughout the task. The contrasts suggest that mathematical performance, disposition, and efficacy beliefs are related

but not interchangeable constructs (Street et al., 2024; Wang et al., 2023). Because the profiles each represent one student, these findings describe case-specific patterns and do not establish generalizable differences or causal effects.

CONCLUSION

The findings reveal distinct numeracy literacy characteristics among the four students representing different combinations of mathematical disposition and self-efficacy in solving contextual data presentation problems. The student with high mathematical disposition and high self-efficacy (DTST) demonstrated the most comprehensive performance across the formulate, employ, and interpret processes, as reflected in systematic problem formulation, accurate application of percentage concepts, and appropriate contextual interpretation. The student with high mathematical disposition and low self-efficacy (DTSR) also demonstrated these three processes effectively, although greater hesitation was evident when explaining and justifying mathematical solutions. In contrast, the student with low mathematical disposition and high self-efficacy (DRST) showed confidence in communicating answers but experienced difficulties in procedural accuracy and contextual interpretation. Meanwhile, the student with low mathematical disposition and low self-efficacy (DRSR) demonstrated the greatest difficulties across all three numeracy literacy processes, particularly in identifying relevant information, applying mathematical procedures, and interpreting results within the problem context.

These findings suggest that mathematical disposition and self-efficacy are associated with distinguishable characteristics of students' numeracy literacy. The contrasting performances of the DTSR and DRST students indicate that confidence in mathematical abilities does not necessarily correspond to the accuracy or depth of mathematical reasoning. Within the four cases examined, a positive mathematical disposition was accompanied by more systematic and reflective problem-solving behaviours, whereas self-efficacy was more visibly reflected in students' confidence when explaining and communicating solutions. These findings highlight the importance of considering both cognitive and affective characteristics when understanding students' numeracy literacy in contextual mathematics learning. Nevertheless, given the qualitative research design and the involvement of only one student in each profile, the findings should be interpreted as case-specific patterns rather than evidence of generalizable relationships or causal effects.

RECOMMENDATIONS

Mathematics teachers are encouraged to design contextual learning activities that integrate the formulation of mathematical problems, application of appropriate concepts and procedures, and interpretation of results in real-life situations. Instructional support should consider students' mathematical disposition and self-efficacy profiles, particularly by providing structured guidance in identifying relevant information, constructing mathematical representations, verifying calculations, and justifying conclusions. Students who demonstrate accurate mathematical reasoning but limited confidence should be given supportive opportunities to communicate and defend their solutions, whereas students who express confidence but experience difficulties in mathematical reasoning should be encouraged to critically evaluate procedures and contextual interpretations. Teachers should also promote perseverance, carefulness, and reflective thinking through meaningful problem-solving experiences and constructive feedback. Future research should involve more participants across different educational settings, incorporate multiple contextual mathematical tasks, and employ longitudinal or mixed-methods approaches to examine how mathematical disposition and self-efficacy relate to the development of numeracy literacy. These recommendations should be considered in light of the exploratory nature of the present findings and require further empirical investigation to establish their effectiveness.

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AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Limsin Majaga	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	
Nurhayadi	✓	✓		✓	✓		✓			✓		✓		
Sutji Rochaminah	✓	✓		✓	✓		✓			✓		✓		
Muh Rizal		✓		✓			✓			✓		✓		
Anggraini		✓		✓			✓			✓		✓		

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest regarding the publication of this paper.

ETHICAL APPROVAL

The study involved seventh-grade students at Bala Keselamatan Christian Junior High School in Palu, Indonesia. The research was conducted through questionnaires, numeracy literacy tests, and interviews. The research instruments were validated by experts before being used in the study. Ethical approval from an institutional review board or ethics committee was not reported in the manuscript.

DATA AVAILABILITY

The data supporting the findings of this study consist of students' responses to mathematical disposition and self-efficacy questionnaires, numeracy literacy tests, and interview results. The data are not publicly available in this manuscript. Further information regarding the data may be requested from the corresponding author, subject to applicable confidentiality and research ethics considerations.

REFERENCES

- Alagumalai, S., & Buchdahl, N. (2021). PISA 2012: Examining the influence of prior knowledge, time-on-task, school-level effects on achievements in mathematical literacy processes: Interpret, employ and formulate. *Australian Journal of Education*, 65(2). <https://doi.org/10.1177/00049441211031674>
- Alhaq, A., Supriadi, N., Anindhita, W., Risqa JL, A., & Dewi, N. R. (2024). Model HLT dan disposisi matematis: Dampak terhadap kemampuan pemecahan masalah matematis siswa. *Indo-MathEdu Intellectuals Journal*, 5(6). <https://doi.org/10.54373/imeij.v5i6.2430>
- Ananda, E. R., & Wandini, R. R. (2022). Analisis kemampuan literasi matematika siswa ditinjau dari self efficacy siswa. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 6(5), 5113–5126. <https://doi.org/10.31004/obsesi.v6i5.2659>
- Andika, S., & Arliani, E. (2026). Self-regulated learning in mathematical problem solving: A systematic review of metacognition, motivation, emotion, and learning strategies. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, 16(2), 373–386. <https://doi.org/10.30998/formatif.v16i2.4868>
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.
- Böswald, V., & Schukajlow, S. (2023). I value the problem, but I don't think my students will: Preservice teachers' judgments of task value and self-efficacy for modelling, word, and intramathematical problems. *ZDM – Mathematics Education*, 55, 331–344. <https://doi.org/10.1007/s11858-022-01412-z>
- Cevikbas, M., Kaiser, G., & Schukajlow, S. (2022). A systematic literature review of the current discussion on mathematical modelling competencies: State-of-the-art developments in conceptualizing, measuring, and fostering. *Educational Studies in Mathematics*, 109, 205–236. <https://doi.org/10.1007/s10649-021-10104-6>

- Dahlia, D., & Nindiasari, H. (2024). Pengembangan instrumen literasi numerasi pada materi statistika untuk tingkat SMA. *SIGMA: Jurnal Pendidikan Matematika*, 16(2), 420–433. <https://doi.org/10.26618/sigma.v16i2.15343>
- Fathurrohman, F. L., Wardono, & Susilo, B. E. (2024). Numeracy literacy in Moodle-assisted PBL: A self-efficacy perspective. *AlphaMath: Journal of Mathematics Education*, 10(2), 309–324. <https://doi.org/10.30595/alphamath.v10i2.23273>
- Ghufron, M. N., & Suminta, R. R. (2016). Efikasi diri dan hasil belajar matematika: Meta-analisis. *Buletin Psikologi*. <https://doi.org/10.22146/bpsi.9843>
- Hendriana, H., Rohaeti, E. E., & Sumarmo, U. (2018). *Hard skills dan soft skills matematik siswa*. PT Refika Aditama.
- Hendriana, H., & Soemarmo, U. (2017). *Penilaian pembelajaran matematika*. PT Refika Aditama.
- Herlina, S., Juandi, D., Saputri, V., & Anwar, V. N. (2022). Self-regulated learning berdasarkan kemampuan akademik matematika: Literatur review. *PRISMA*, 11(1). <https://doi.org/10.35194/jp.v11i1.1955>
- Hertin, H. H., & Sucipto, L. (2024). Analysis of problem solving ability in view of the mathematical disposition of junior high school students in mathematics subjects. *Journal of Math Tadris*, 4(1), 48–58. <https://doi.org/10.55099/jmt.v4i1.121>
- Kesumawati, M., Susanti, V. D., & Andari, T. (2024). Analisis literasi numerasi siswa dalam menyelesaikan soal HOTS di tinjau dari self efficacy siswa. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 9(3), 288–297. <https://doi.org/10.23969/jp.v9i3.16518>
- Krawitz, J., Chang, Y.-P., Yang, K.-L., & Schukajlow, S. (2022). The role of reading comprehension in mathematical modelling: Improving the construction of a real-world model and interest in Germany and Taiwan. *Educational Studies in Mathematics*, 109, 337–359. <https://doi.org/10.1007/s10649-021-10058-9>
- Krawitz, J., Schukajlow, S., & Hartmann, L. (2025). Does problem posing affect self-efficacy, task value, and performance in mathematical modelling? *Educational Studies in Mathematics*, 119, 445–466. <https://doi.org/10.1007/s10649-025-10385-1>
- Mafaza, A. R., Safira, I. N., Khasanah, M. U., & Fakhriyana, D. (2024). Systematic literature review: Self-regulated learning on mathematical problem-solving ability. *Pedagogy*, 9(1), 1–16. <https://doi.org/10.30605/pedagogy.v9i1.3266>
- Ma'ruf, A. H., Triyono, A., Riaseh, A. G., Nuary, R. H., Permatasari, N., & Saleh, R. R. M. (2024). Correlation between mathematical literacy abilities and students' mastery of problem solving abilities. *AlphaMath: Journal of Mathematics Education*, 10(2), 295–308. <https://doi.org/10.30595/alphamath.v10i2.24175>
- Mellyzar, Unaida, R., Muliani, & Novita, N. (2021). Hubungan self-efficacy dan kemampuan literasi numerasi siswa: Ditinjau berdasarkan gender. *Lantanida Journal*, 9(2), 104–113. <https://doi.org/10.22373/lj.v9i2.11176>
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). SAGE Publications.
- Muhtadi, A., Assagaf, G., & Hukum, J. (2022). Self-efficacy and students' mathematics learning ability in Indonesia: A meta analysis study. *International Journal of Instruction*, 15(3), 1131–1146.
- Noor, N. L., Waluya, S. B., & Widodo, S. A. (2025). Self-regulated learning for solving mathematical problems: A systematic literature review. *Jurnal Riset Pendidikan Matematika*, 12(2), 235–245. <https://doi.org/10.21831/jrpm.v12i2.89026>
- Nugraha, A. R., & Wardono. (2025). Analisis literasi numerasi ditinjau dari self-efficacy pada model problem based learning berpendekatan STEAM berbantuan Moodle. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 10(4), 290–303. <https://doi.org/10.23969/jp.v10i04.39207>

- Oktavia, T., & Yulia, P. (2024). Learning achievement: Understanding the influence of self-confidence and mathematical disposition in junior high school students. *Mathline: Jurnal Matematika dan Pendidikan Matematika*, 9(3), 661–674. <https://doi.org/10.31943/mathline.v9i3.601>
- Organisation for Economic Co-operation and Development. (2019). *PISA 2018 assessment and analytical framework*. OECD Publishing. <https://doi.org/10.1787/b25efab8-en>
- Organisation for Economic Co-operation and Development. (2023). *PISA 2022 results (Volume I): The state of learning and equity in education*. OECD Publishing. <https://doi.org/10.1787/53f23881-en>
- Panadero, E., Jonsson, A., Pinedo, L., & Fernández-Castilla, B. (2023). Effects of rubrics on academic performance, self-regulated learning, and self-efficacy: A meta-analytic review. *Educational Psychology Review*, 35, Article 113. <https://doi.org/10.1007/s10648-023-09823-4>
- Rahmaniyah, Z., & Ihsanudin. (2024). Analysis of junior high school students' misconceptions based on constructivism theory in solving numeracy literacy problems. *AlphaMath: Journal of Mathematics Education*, 10(2), 284–294. <https://doi.org/10.30595/alphamath.v10i2.21791>
- Rum, A. M., & Juandi, D. (2022). Indonesian students' mathematical literacy based on self-efficacy: Systematic literature review. *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education*, 7(2). <https://doi.org/10.23969/symmetry.v7i2.6378>
- Schukajlow, S., Krawitz, J., Kanefke, J., Blum, W., & Rakoczy, K. (2023). Open modelling problems: Cognitive barriers and instructional prompts. *Educational Studies in Mathematics*, 114, 417–438. <https://doi.org/10.1007/s10649-023-10265-6>
- Sinurat, S. W., Napitupulu, E. E., & Mulyono. (2021). Metaanalisis pengaruh model problem-based learning terhadap kemampuan pemecahan masalah matematis dan self-efficacy. *PARADIKMA: Jurnal Pendidikan Matematika*, 14(2). <https://doi.org/10.24114/paradikma.v14i2.28799>
- Street, K. E. S., Malmberg, L.-E., & Schukajlow, S. (2024). Students' mathematics self-efficacy: A scoping review. *ZDM – Mathematics Education*, 56, 265–280. <https://doi.org/10.1007/s11858-024-01548-0>
- Susanti, V. D., Wati, J. U. M., & Sulastri, Y. E. (2024). Implementing problem-based learning with teaching at the right level approach to improve numeracy literacy. *AlphaMath: Journal of Mathematics Education*, 10(2), 257–272. <https://doi.org/10.30595/alphamath.v10i2.23723>
- Talsma, K., Schüz, B., & Norris, K. (2019). Miscalibration of self-efficacy and academic performance: Self-efficacy $\neq$ self-fulfilling prophecy. *Learning and Individual Differences*, 69, 182–195. <https://doi.org/10.1016/j.lindif.2018.11.002>
- Vogelsanger-Holenstein, M., Schukajlow, S., & Bruckmaier, G. (2025). Mathematical modelling and self-efficacy: Immediate and long-lasting effects of teaching mathematical modelling with a solution plan. *ZDM – Mathematics Education*, 57, 489–502. <https://doi.org/10.1007/s11858-025-01674-3>
- Wahyuningrum, E., Bonyah, E., Yumiati, Kartono, & Wijayanti, N. (2024). Exploring the relationship between mathematical problem-solving ability and mathematical disposition through model-eliciting activities. *Al-Jabar: Jurnal Pendidikan Matematika*, 15(2), 333–347. <https://doi.org/10.24042/ajpm.v15i2.23765>
- Wang, X. S., Perry, L. B., Malpique, A., & Ide, T. (2023). Factors predicting mathematics achievement in PISA: A systematic review. *Large-scale Assessments in Education*, 11, Article 24. <https://doi.org/10.1186/s40536-023-00174-8>
- Weißenfels, M., Hoffmann, D., Dörrenbächer-Ulrich, L., & Perels, F. (2023). Linking academic buoyancy and math achievement in secondary school students: Does

- academic self-efficacy play a role? *Current Psychology*, 42, 23422–23436.
<https://doi.org/10.1007/s12144-022-03488-y>
- Wirawan, N., Yuhana, Y., & Fatah, A. (2023). Analisis kemampuan penalaran matematis bentuk literasi numerasi AKM pada konten bilangan ditinjau dari disposisi matematis. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 7(3), 2715–2728.
<https://doi.org/10.31004/cendekia.v7i3.2623>
- Yunianti, E., Jaeng, M., & Mustamin. (2016). Pengaruh model pembelajaran dan self-efficacy terhadap hasil belajar matematika siswa SMA Negeri 1 Parigi. *Mitra Sains*, 4(1), 8–19.
<https://doi.org/10.22487/mitrasains.v4i1.132>
- Živković, M., Pellizzoni, S., Doz, E., Cuder, A., Mammarella, I., & Passolunghi, M. C. (2023). Math self-efficacy or anxiety? The role of emotional and motivational contribution in math performance. *Social Psychology of Education*, 26, 579–601.
<https://doi.org/10.1007/s11218-023-09760-8>