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Exploring Numeracy Literacy Skills among High Self-Efficacy Elementary Students: A Qualitative Study

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ABSTRACT

This study aims to explore the numeracy literacy skills of students who have high self-efficacy in solving contextual mathematics problems. This research is important because most previous research has focused more on the quantitative relationship between self-efficacy and numeracy skills. In contrast, qualitative studies that explore in depth the numeracy literacy skills of students with high self-efficacy remain limited. The study used a qualitative approach with two students who were categorised as having high self-efficacy based on validated questionnaire results. Data collection techniques include self-efficacy questionnaires, numeracy literacy tests, and in-depth interviews. The analysis focused on three indicators of numeracy literacy, namely the ability to use mathematical numbers and symbols in the context of daily life, the ability to analyse information in various data representations, and the ability to interpret the results of the analysis for decision-making. The results of the study show that students with high self-efficacy can understand problems well, apply mathematical operations appropriately, read and analyse data presented in tables and diagrams, and draw logical conclusions from the analysis. Although there was variation in the presentation of the completion steps, both subjects demonstrated adequate mastery of the concepts and strategies. These findings indicate that self-efficacy plays an important role in supporting students' numeracy literacy skills. Therefore, strengthening self-efficacy in mathematics learning needs to be considered to help students develop optimal numeracy thinking skills.

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1. INTRODUCTION

Mathematics learning is one of the important focuses in education, especially in the 21st century, when students are expected to have numeracy literacy as an essential competency. Literacy and numeracy are basic skills that will be learned from the beginning of a child's development. Literacy and basic numeracy are pillars of knowledge and capital

production in developing human productivity [1]. Numeracy literacy skills play an important role in shaping the direction of mathematics learning in the 21st century and are among the strategies that support 21st-century skills [2]. Literacy and numeracy skills are one of the important skills that must be improved and developed to advance education in Indonesia [3].

Good numeracy skills allow students to analyse mathematical problem-solving information through various visual media, such as graphs and tables, and to provide scribbles on the problem to simplify solution steps. They can analyse problems using mathematical numbers and symbols, performing direct calculations that produce correct answers, but often do not interpret the results [4].

The results of the 2022 PISA test show that the numeracy literacy skills of the majority of Indonesian students are still at a low level, with around 80% of students below level 2, which is a basic ability [5]. The Program for International Student Assessment (PISA) is an international test taken by 15-year-old students from various countries, including Indonesia. This test assesses students' abilities in reading, math, and science.

Study results by Marhami et al. [2] show that overall Indonesian students in secondary school still have difficulties in using mathematical operations, understanding problems, using strategies, and interpreting the results of PISA model problem solving, which reflect non-optimal numeracy skills. In line with that, Fauzi et al. [3] found that the achievement of mathematical literacy of grade 5 students in Bandung was far behind the government's target.

According to the research by Rakhmawati and Mustadi [4], students' numeracy literacy skills remained in the poor category. Numerical literacy has not been developed in the implementation of the School Literacy Movement (GLS). Basic literacy activities have not been carried out properly.

Low numeracy literacy in Indonesia is a serious challenge that can negatively impact various aspects of national development. Although efforts have been made to improve the quality of education, data show that numeracy literacy in Indonesia remains relatively low. A total of 53.33 per cent of students at the elementary school level have numeracy competencies below the minimum, 59.97 per cent for the junior high school level, and 58.86 per cent of students at the high school level also have numeracy competencies below the minimum limit in 2023 (Ministry of Education, Culture, Research and Technology, 2023).

One of the factors that influences students' numeracy literacy skills is the belief in self-ability called self-efficacy. Self-efficacy is very important to know because it is one of the aspects of psychology that has a significant influence [6]. Perceived self-efficacy is defined as people's beliefs about their ability to produce a specified level of performance that affects events in their lives. Self-efficacy determines how people feel, think, motivate themselves, and behave. Such beliefs produce these diverse effects through four main processes. They include cognitive, motivational, affective and selection processes [7].

Mustofa et al. [8] research, it was stated that self-efficacy plays an important role in improving students' numeracy skills. Students with high confidence (self-efficacy) will find it easy to understand the concept [9]. In line with this, research by Nugraha and Wardono [10] indicates that self-efficacy positively affects numeracy literacy, and that there is a

significant difference in numeracy literacy skills among students with high, medium, and low self-efficacy.

The study by Ridwan et al. [11] shows that students' self-efficacy can significantly improve their numeracy skills, such that the higher the students' self-efficacy, the better their numeracy skills will be. When a person has high self-efficacy, they are more likely to believe they can understand and apply mathematical concepts in everyday situations. This increases their motivation to learn and overcome difficulties in mastering numeracy literacy. On the other hand, individuals with low self-efficacy may feel anxious or afraid of math, thereby hindering their progress in numeracy literacy.

In line with the above, research of Salsabilah and M. Dwi Kurniasi [12] found that students with self-efficacy are high in being able to solve problems related to numeracy literacy skills by providing the right answers. Research by Mellyzar et al. [13] also found that students with higher self-efficacy have higher numeracy literacy skills.

Although various studies have shown a positive relationship between self-efficacy and numeracy literacy skills, most previous studies have focused on quantitative approaches that emphasise the influence of variables. Research that explores in depth the thinking process and numeracy literacy of students based on the level of self-efficacy, especially in students with high self-efficacy, through a qualitative approach, is still relatively limited. In addition, the study of how students with high self-efficacy use strategies, analyse information, and make decisions in solving contextual numeracy literacy problems has not been explained in detail.

In fact, a deep understanding of students' numeracy literacy and high self-efficacy is important for providing an overview of students' mathematical thinking processes and for designing learning that can simultaneously develop numeracy skills and affective aspects of students. Therefore, this research was conducted to fill the research gap through a qualitative approach.

Based on this description, the purpose of this study is to explore the numeracy literacy skills of students with high self-efficacy in solving contextual mathematics problems based on indicators of numeracy literacy skills, namely the ability to use mathematical numbers and symbols, the ability to analyse information in various forms of data representation, and the ability to interpret the results of analysis to make decisions.

2. METHOD

This study uses a qualitative approach. Qualitative research is used to explore and understand human and social problems. The qualitative approach was chosen because this study does not aim to generalise to the population, but rather to gain a deep understanding of the thinking processes, problem-solving strategies, and characteristics of the study subjects' numeracy literacy skills. Therefore, the small number of subjects in qualitative research is considered adequate because the focus of the research lies on the depth of the data, not on the number of participants. The research subjects were selected using a purposive sampling method, consisting of sixth-grade students from an elementary school. Based on the self-efficacy questionnaire results, two students with high self-efficacy scores were selected as the main research subjects. The selection of two subjects was carried out to

enable the researcher to explore the data in greater depth through the analysis of test answers and interviews. Data collection techniques are in the form of non-tests and tests. The instruments used are questionnaires to measure students' self-efficacy, written test instruments in the form of numeracy literacy questions totalling 3 description questions, which experts have validated to measure numeracy literacy skills, and interviews.

Data analysis in this study was carried out in a qualitative descriptive manner through several stages, namely data reduction, data presentation, and conclusion drawn. The data from written tests and interviews were analysed using a coding framework based on indicators of numeracy literacy. In the initial stage, the researcher conducted open coding to identify forms of numeracy skills that emerged from the subjects' answers and interview results. Furthermore, data categorisation was carried out based on three indicators of numeracy literacy skills, namely: (1) the ability to use mathematical numbers and symbols to solve contextual problems, (2) the ability to analyse information in various forms of data representation, and (3) the ability to interpret the results of the analysis to make decisions. After that, the data are interpreted to provide an overview of students' numeracy literacy skills and high self-efficacy.

The validity of the data in this study was established through triangulation of sources. Source triangulation is carried out by comparing data from self-efficacy questionnaires, numeracy literacy test results, and interview responses to ensure data consistency.

The research procedure began with the distribution of self-efficacy questionnaires, which underwent validation by expert validators. Indicator self-efficacy used in this study refers to the indicator self-efficacy according to Fadhila [14]:

Table 1. Self-Efficacy Indicators

Dimensions	**Indicator**
Magnitude/Level	1. Have optimism in answering tasks or questions
	2. Have a good perception of academic competence
Strength	1. Have an effort to complete tasks or problems related to the material
	2. Have commitment and determination to complete tasks or problems
	3. Have resilience and composure in completing tasks or problems in various conditions
General	1. Responding to diverse situations and conditions in a positive way
	2. Be guided by previous life experience/information as a step in doing a task

Based on the indicators in Table 1, the questionnaire data will be processed, and the self-efficacy results will be classified into three categories: High, Medium, and Low.

Table 2. *Self-Efficacy Category Guidelines*

Self-Efficacy	Score
Low	$X < \underline{X} - \frac{1}{2}\,SD$
Medium	$\underline{X} - \frac{1}{2}\,SD \leq X < \underline{X} + \frac{1}{2}\,SD$
Height	$\underline{X} + \frac{1}{2}\,SD \leq X$

From these categories, each subject was selected for the category with self-efficacy high to work on the instruments for the numeracy literacy skills test. The numeracy skills indicators used in this study are (1) able to use a wide variety of numbers and symbols related to basic mathematics to solve problems in a wide variety of everyday life contexts; (2) able to analyze information displayed in various forms (graphs, tables, charts, diagrams and so on); (3) interpret the results of such analyses to predict and make decisions [15]. After completing the written test instrument, the researcher will conduct interviews with the subjects to obtain results, which will be presented in the form of a description of the subjects' numeracy literacy skills and high self-efficacy.

3. RESULTS AND DISCUSSION

3.1. Results

From Table 2, three categories are obtained based on the score formula: self-efficacy students with a high classification (score≥ 66), the medium category (score 54-63), and the low category (score < 54). From these results, 2 students were selected who represented the high self-efficacy category, with the name codes S1 and S2.

1. Numeracy Literacy skills Indicator: Able to use a wide variety of numbers and symbols related to basic mathematics to solve problems in a wide variety of daily life contexts.

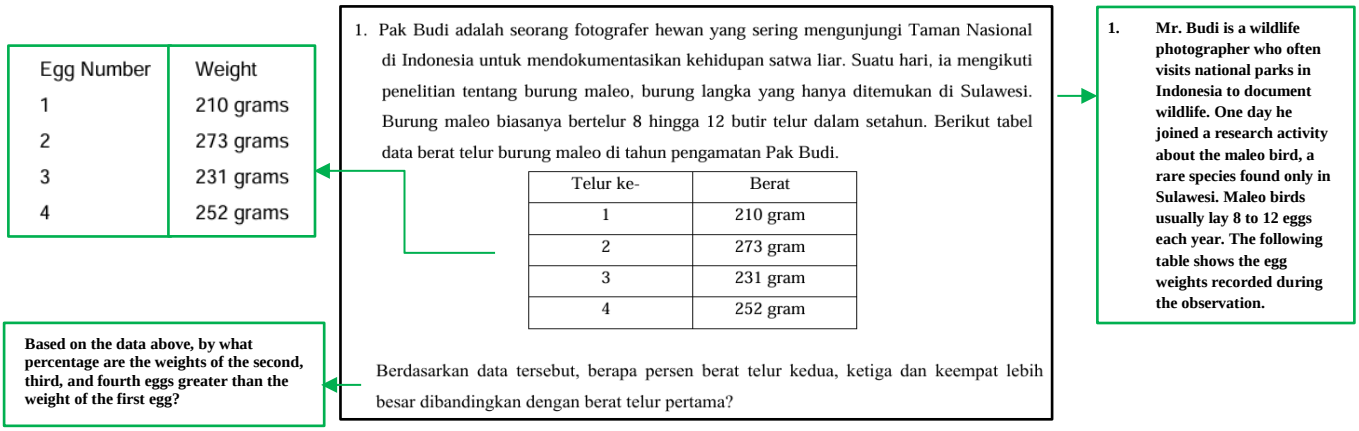


Figure 1. Numeracy literacy test question number 1

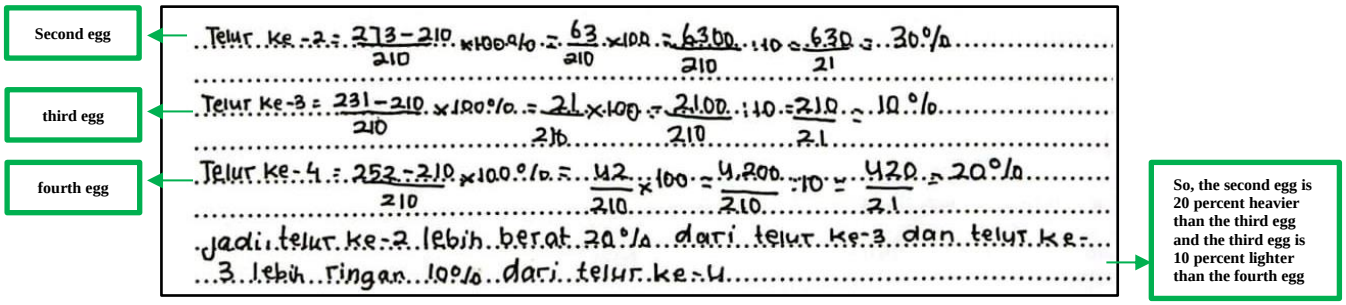
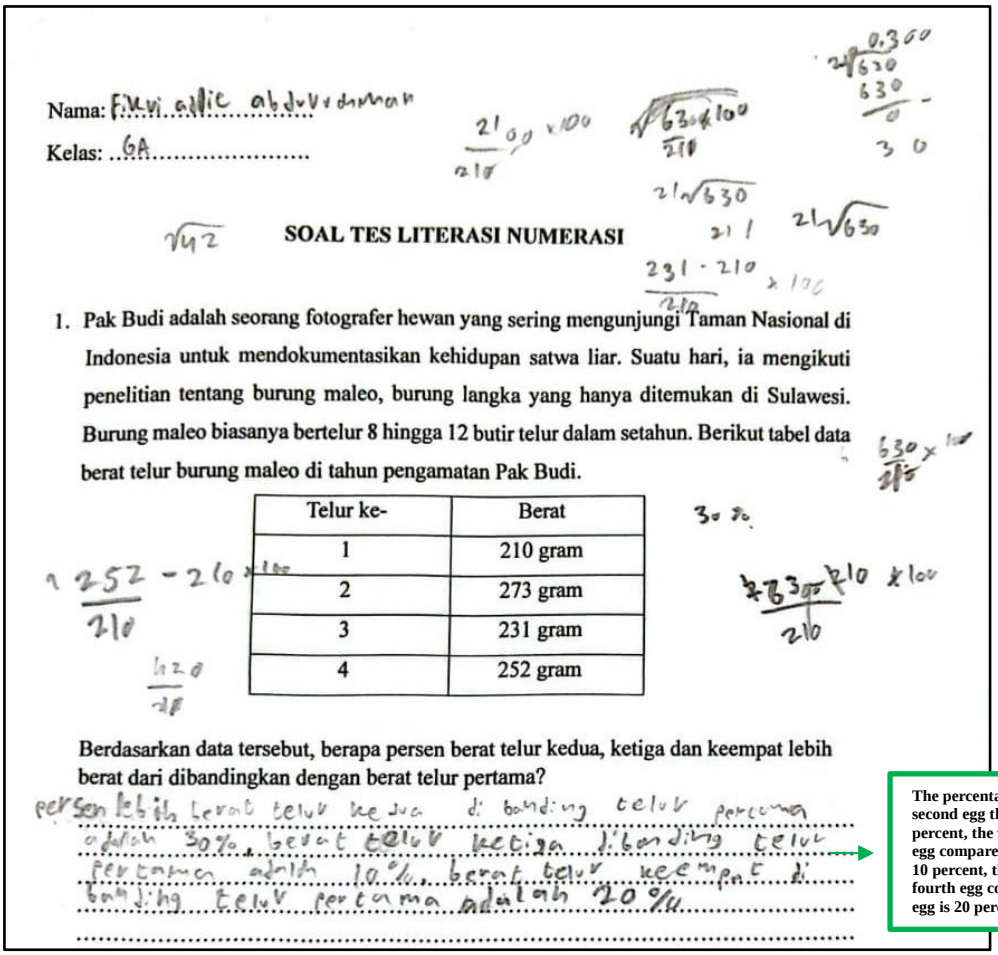


Figure 2. Answer to S1 question number 1

Based on Figure 2, S1 can solve the given problems correctly. S1 can analyse the information in the image and draw the right conclusions. As follows:

Researcher	:	*Do you understand question number 1? What do you think question number 1 asks?*
S1	:	*Looking for the percentage of the first egg, the second egg, the third egg and the fourth egg compared to the first egg*
Researcher	:	*What are your steps in doing the questions so that you find the answer?*
S1	:	*I look for the second egg first, then the weight of the second egg minus the weight of the first egg, then the result is divided by the weight of the first egg, and then multiplied by 100 per cent to find the percentage.*

In the interview with the S1 subject, it can be concluded that the subject can explain the results of understanding the problem in the given question quite well. This is in line with research [16], which shows that when students' self-efficacy is high, students' mathematics learning outcomes are also high and high mathematics learning outcomes show that students' understanding of problems is also high, so that good understanding can greatly affect students' numeracy literacy skills. Subjects understand the completion steps well. S1 explained that the calculation was done by looking for the difference in egg weight, dividing it by the weight of the first egg, then multiplying it by 100% to obtain a percentage.



Nama: Fivi aulia abdurrahman

Kelas: 6A

SOAL TES LITERASI NUMERASI

1. Pak Budi adalah seorang fotografer hewan yang sering mengunjungi Taman Nasional di Indonesia untuk mendokumentasikan kehidupan satwa liar. Suatu hari, ia mengikuti penelitian tentang burung maleo, burung langka yang hanya ditemukan di Sulawesi. Burung maleo biasanya bertelur 8 hingga 12 butir telur dalam setahun. Berikut tabel data berat telur burung maleo di tahun pengamatan Pak Budi.

Telur ke-	Berat
1	210 gram
2	273 gram
3	231 gram
4	252 gram

Berdasarkan data tersebut, berapa persen berat telur kedua, ketiga dan keempat lebih berat dari dibandingkan dengan berat telur pertama?

persen lebih berat telur kedua di banding telur pertama adalah 30%, berat telur ketiga dibanding telur pertama adalah 10%, berat telur keempat di banding telur pertama adalah 20%

The percentage heavier of the second egg than the first egg is 30 percent, the weight of the third egg compared to the first egg is 10 percent, the weight of the fourth egg compared to the first egg is 20 percent

Figure 3. Answer S2 question number 1

Based on Figure 3, the S2 subject can solve the problem correctly, but does not write down the steps in sequence. Subjects randomly write the counting process and the counting operations used in solving the problem. As follows:

Researcher	:	*If you understand, could you explain the problem with question 1?*
S2	:	*The question is, what is the percentage difference between the weight of the first egg and the other eggs?*
Researcher	:	*What are your steps in doing the questions so that you find the answer?*
S2	:	*The first step is to find the percentage; we start by finding the difference. For example, in the second egg, we subtract the weight of the first egg from the second egg's weight.*
Researcher	:	*Why do the second, third and fourth eggs all have to be divided by 210 in your answer?*
S2	:	*Because the question is asked to compare with the weight of the first egg*
Researcher	:	*Then, after that, it is multiplied by 100 per cent for what?*
S2	:	*To find the percentage*

Based on the interview, the S2 subject can perform basic mathematical operations to solve the problem and explain the rationale for using the weight of the first egg as a reference in the calculation of percentages. This is in line with the research of Fauzanah et al. [17], which found that students with high numeracy skills can write and pronounce basic mathematical numbers and symbols correctly, without errors, indicating that students tend to use symbolic representations.

2. *Numeracy Literacy skills Indicator: Able to analyse information displayed in various forms (graphs, tables, charts, diagrams and so on)*

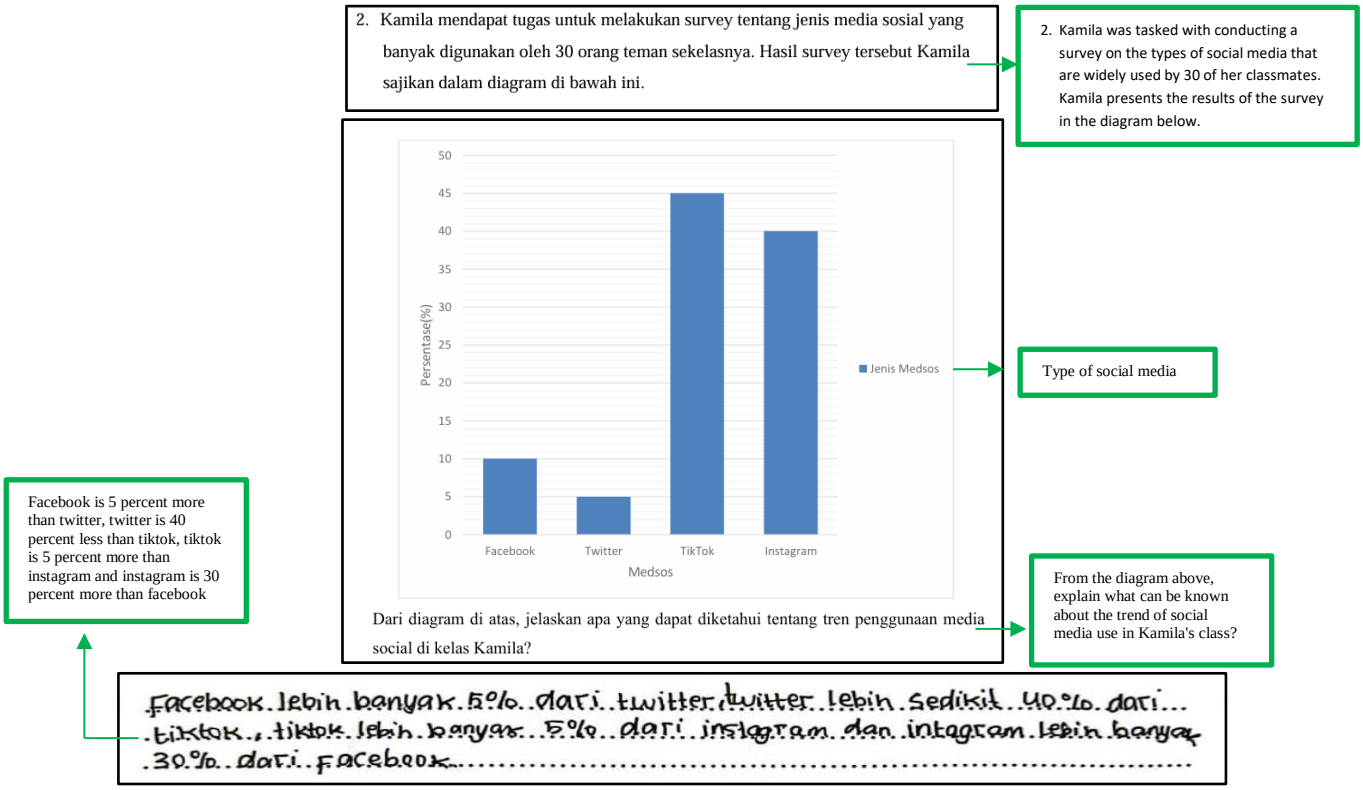


Figure 4. Answer to S1 question number 2

Figure 4 Shows that S1 can analyse the information displayed in a bar chart. S2 writes the results of his analysis in the form of a percentage difference between the two social media. As follows:

Researcher	:	*What picture is in question?*
S1	:	*Bar chart*
Researcher	:	*What was the first thing observed on the bar chart?*
S1	:	*Vertical and horizontal axis lines*
Researcher	:	*How to use this information to answer questions?*
S1	:	*Read the bar diagram. Seen by Facebook 10%, Twitter 5%, TikTok 45%, then Instagram 40% means she is 40%.*

Based on the interview results, S1 found that the diagram type listed in the question was a bar diagram. S1 connects the information obtained from the horizontal axis with its vertical axis. S1 can also extract relevant information from the table and incorporate it into the answer to the question.

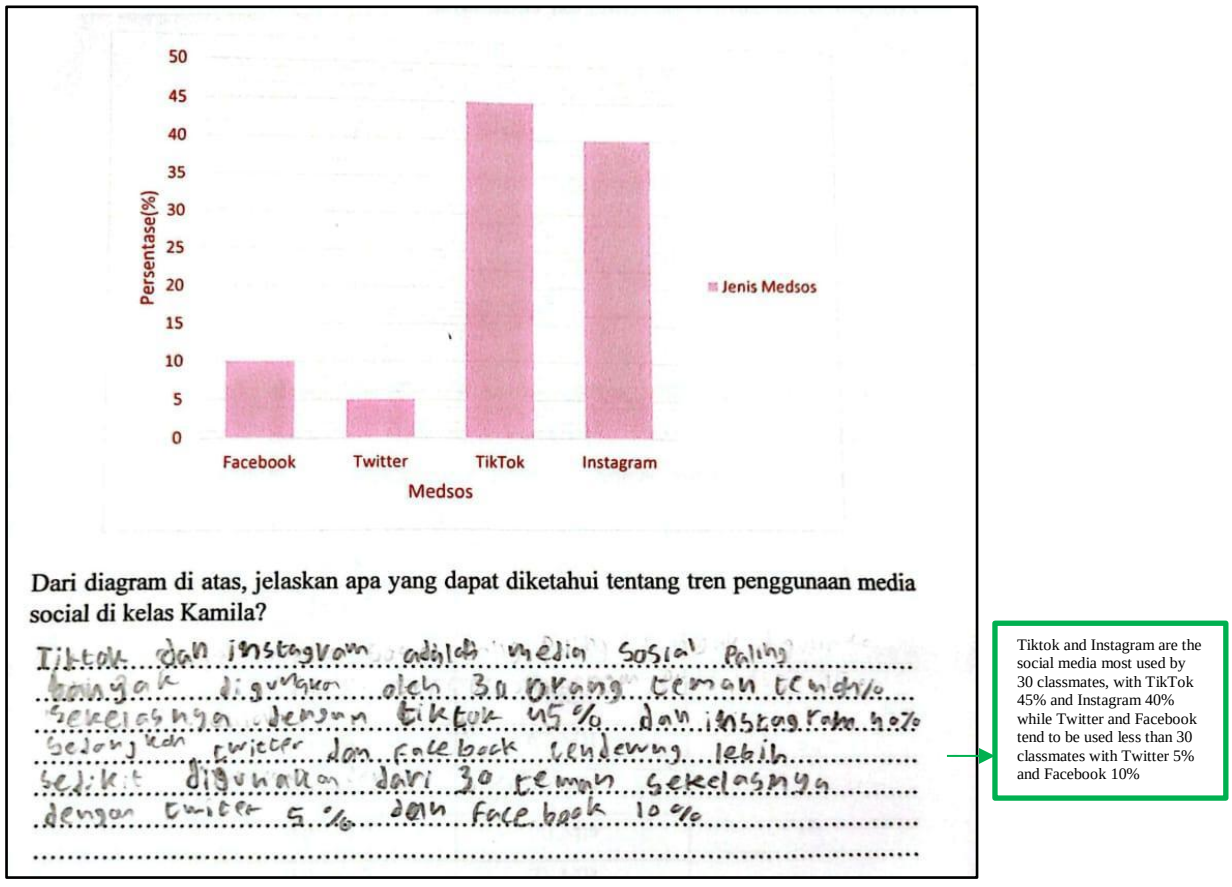


Figure 5. Answer to S2 question number 2

Based on Figure 5**,** it can be seen that S2 can write down the information he knows from the bar chart. S2 can analyse information displayed in a bar chart well. As follows:

Researcher	:	*What picture is shown on question sheet number 2?*
S2	:	*Diagram.*

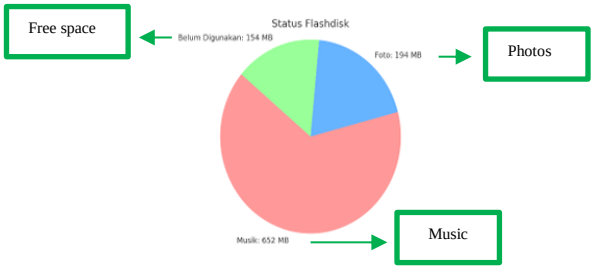
Researcher	:	*What diagram?*
S2	:	*Bar chart*
Researcher	:	*What was the first thing you observed in that diagram?*
S2	:	*I noticed that the highest percentage is TikTok and Instagram, which are the most used social media platforms.*
Researcher	:	*Tell us how you used this stem salt to answer the question.*
S2	:	*TikTok and Instagram are the most used social media among 30 of his friends, with TikTok at 45% and Instagram at 40%. At the same time, Twitter and Facebook tend to be lower, with Twitter at 5% and Facebook at 10%.*

In the interview, S2 can explain that the diagram shown in the question is a type of bar diagram. S2 looked at the bar chart by starting with the highest percentage of social media, then concluded that TikTok and Instagram were the most used, while Twitter and Facebook were the least used. S2 can read and then interpret the data on the bar chart well. This is in line with research [18], which states that students with high self-efficacy can meet numeracy literacy indicators, such as analysing information displayed in graphs, tables, charts, and diagrams.

3. *Numeracy Literacy skills Indicator: Interpret the results of information analysis displayed in various forms (graphs, tables, charts, diagrams and so on) to predict and make decisions*

3. Flashdisk adalah perangkat penyimpanan komputer berukuran kecil dan dapat dibawa kemana-mana. Ahmad memiliki flashdisk yang menyimpan musik dan foto. Flashdisk tersebut berkapasitas 1 GB (1000 MB). Grafik di bawah ini menunjukkan status flashdisk saat ini.

3. A flash drive is a small computer storage device that can be carried anywhere. Ahmad has a flash drive that stores music and photos. The flash drive has a capacity of 1 GB (1000 MB). The graph below shows the current status of the flash drive.



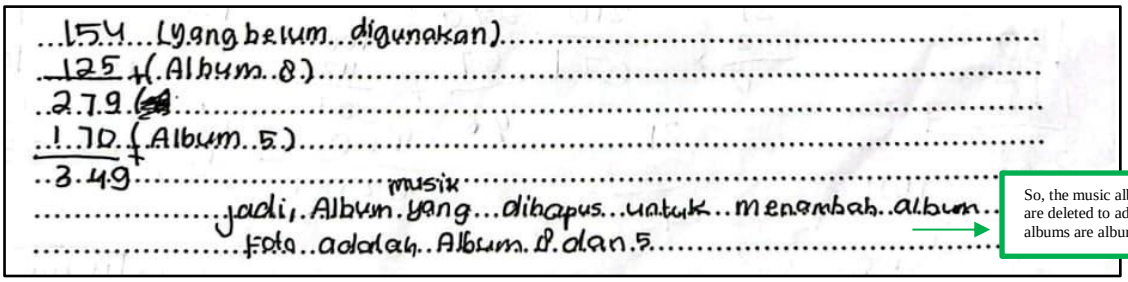
Ahmad ingin mentransfer album foto 320 MB ke flasdisknya, tetapi ruang kosong pada flashdisk tidak cukup. Meskipun dia tidak ingin menghapus foto yang ada, dia dengan senang hati menghapus hingga dua album musik. Flashdisk Ahmad memiliki ukuran album music yang tersimpan di dalamnya sebagai berikut.

Ahmad wanted to transfer the 320 MB photo album to his flash drive, but there was not enough free space on the flash drive. Although he didn't want to delete the existing photos, he was happy to delete up to two music albums. Ahmad's flash disk has the following size of music albums stored in it.

Album	Ukuran
Album 1	50 MB
Album 2	85 MB
Album 3	90 MB
Album 4	67 MB
Album 5	70 MB
Album 6	90 MB
Album 7	75 MB
Album 8	125 MB

Dengan menghapus paling banyak dua album musik, mungkinkah Ahmad memiliki cukup ruang di flashdisk untuk menambah album foto? Tunjukkan perhitungan untuk mendukung jawaban Anda.

By deleting at most two music albums, could Ahmad have enough space on the flash drive to add photo albums? Show calculations to support your answers.



So, the music albums that are deleted to add photo albums are albums 8 and 5

Figure 6. Answer S1 question number 3

Figure 6 shows that S1 can interpret the results of data analysis presented in tables and pie charts to predict and make decisions. S1 uses the data in the table, namely album 8 and album 5 data, to solve the problem. As follows:

Researcher : *What picture is in question number 3?*
S1 : *Circles and tables*
Researcher : *Which data do you use to solve problem number 3?*

S1 : *The data from both the tables and the pie charts. The unused data is 154MB; I take the data from the eighth album (125MB) and add it to 279. After this, I add up again with the fifth album, 120MB to 349MB.*

Based on the interview results, S1 made a logical decision by analysing the pie chart to determine how much of the flash drive's storage was still unused. S1 can explain and justify the decision taken, using evidence from calculations and explanations during the interview.

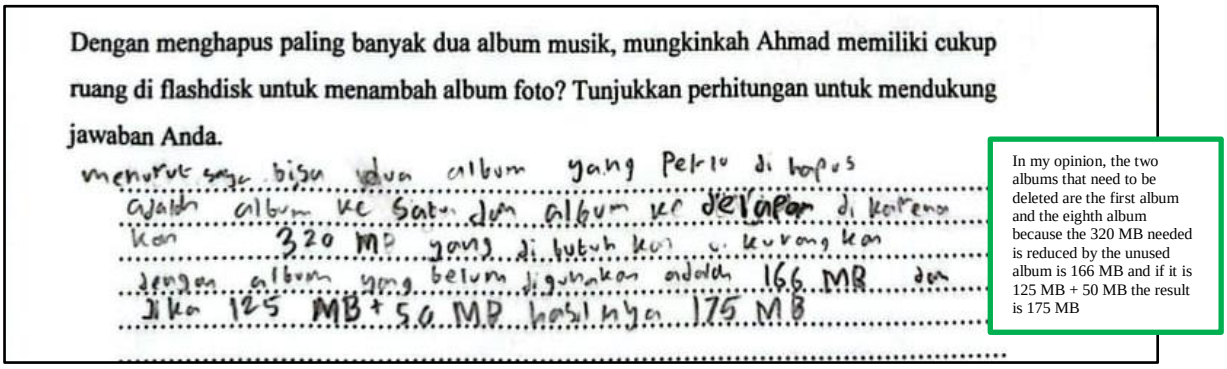


Figure 7. Answer to S2 question number 3

Based on Figure 7, S2 can interpret the pie chart and table analyses to make logical decisions. S2 can write an explanation of the decision to delete the first and eighth albums, along with their calculations. As follows:

Researcher : *Which data can you take into account to make a decision?*

S2 : *If I think this one already has 154MB, well, you only need 320MB. I did not find the 320 MB fit, so I overdid it a bit. So, I deleted the eighth album and the first album, which reduced the total in 175MB, and that, when added to the unused albums, is enough to fill 320MB.*

Based on the interview results, S2 analysed the space on the flash drive and made the correct decision based on the data in the diagrams and tables. S2 chose to delete the first and eighth albums because the total capacity obtained was considered sufficient to meet the storage requirement of 320 MB. The explanation justifies the decision, as research [19] shows that students with high self-efficacy are better able to interpret, apply, and evaluate mathematical results to explain or justify conclusions rationally.

3.2. Discussion

The results showed that both subjects with high self-efficacy showed consistent numeracy literacy skills in the three indicators used, namely the use of mathematical numbers and symbols in the context of daily life, information analysis in various data representations, and interpretation of analysis results for decision-making. These findings show that self-efficacy not only plays a role in increasing students' confidence but also influences students' cognitive engagement in understanding and solving numeracy problems in depth.

In the first indicator, namely the ability to use numbers and mathematical symbols to solve contextual problems, S1 and S2 can identify important information, choose appropriate calculation operations, and apply the concept of percentages correctly. However, there are differences in how problems are presented. S1 shows a more systematic and complete strategy, while S2 tends to write the process in a shorter, less sequential manner, even though the answers obtained remain correct. These differences show that students with high self-efficacy can exhibit different completion strategies. This shows that high *self-efficacy* not only contributes to the accuracy of calculations but also to students' courage in adopting solution strategies. Recent research shows that self-efficacy is positively related to math problem-solving skills and affects students' success in completing math tasks independently [20]. This ability reflects mastery of basic numeracy, integrated with understanding the problem context, as is characteristic of numeracy literacy, which emphasises the application of mathematical concepts in real-world situations, as described in the international mathematical literacy framework [21].

In the indicator of the ability to analyse information in visual representations, both subjects were able to read and interpret the data effectively. S1 focuses more on identifying the diagram's structure by observing the horizontal and vertical axes, while S2 is quicker to identify the dominant information, such as the highest and lowest percentages, before concluding. This variation in strategy shows flexibility in thinking, supported by confidence in processing visual information. Self-efficacy is known to influence how students choose strategies and maintain thought processes when faced with tasks that require data analysis [22]. The ability to read and interpret data is an important aspect of numeracy literacy because it requires integrating symbolic understanding and logical reasoning.

In the indicator interpreting the analysis results for decision-making, both subjects were able to use the information in the diagram and table to determine a logical solution. S1 tends to use stages to ensure adequate storage space, while S2 performs strategic estimation by considering the album combination deemed most effective. These differences show that high self-efficacy encourages students to persist in their thought processes until they find solutions that can be accounted for, even though the strategies used differ.

Overall, the responses of both subjects indicated that self-efficacy drives self-regulation in solving numeracy problems. Students with high self-confidence tend to be more thorough in understanding problems, are willing to try strategies, and can explain the reasons behind their answers. In the context of numeracy literacy, these conditions allow students not only to reach the correct answer but also to understand the meaning and mathematical relevance of the solution. This is in line with the research of Marisa et al. [23], which indicates a relationship between numeracy literacy skills, self-efficacy, and student learning outcomes.

Thus, students' numeracy literacy skills with *high self-efficacy are reflected not only in the accuracy of the results but also in the quality of their thought processes, analysis strategies, and* ability to justify decisions. This indicates that the development of numeracy literacy needs to be accompanied by strengthening affective aspects, especially self-efficacy, so that students can optimise their mathematical thinking potential in various life contexts. This also shows that there is a positive relationship between numeracy literacy skills and

self-efficacy, as shown in research by Sefiany and Arliani [24], which found that students with higher self-efficacy achieve higher scores in numeracy than those with lower self-efficacy. Nurtiana and Adirakasiwi [25] reported a significant relationship between numeracy literacy skills and students' self-efficacy.

Overall, the results of the study show that students with high *self-efficacy* can understand the problems in the problem, observe tables and diagrams well to obtain information, and draw conclusions based on the results of data analysis in diagrams and tables. This is because it is influenced by a strong desire for students to master mathematics well. As reported by Wedastuti [26], students' numeracy literacy, along with high self-efficacy in completing HOTS-oriented exercises, enables them to formulate questions, turn problems into mathematical models, and provide conclusions based on their understanding.

The relatively small number of subjects limited the study, as it involved only two students with high self-efficacy. In addition, research is conducted in specific contexts and materials, so the results cannot be generalised widely. However, the qualitative approach used allows researchers to obtain a deeper understanding of students' thinking processes and the characteristics of their numeracy literacy skills with high self-efficacy. Therefore, further research is suggested to involve more subjects with different self-efficacy categories in order to obtain a more comprehensive picture of the relationship between self-efficacy and numeracy literacy skills.

4. CONCLUSION

Based on the study's results, students with high self-efficacy are able to meet the three indicators of numeracy literacy skills: using mathematical numbers and symbols, analysing information in various forms of data representation, and interpreting analysis results to make decisions. Despite differences in strategy and the collapse of the solution, both subjects demonstrated the ability to understand the problem, choose the appropriate strategy, and provide a logical explanation for their answers.

The results of this study show that self-efficacy plays an important role in supporting students' numeracy literacy skills, especially in building confidence, perseverance, and courage in solving contextual mathematics problems. Therefore, mathematics learning needs to focus not only on the cognitive aspect, but also on strengthening students' self-efficacy so that numeracy literacy skills can develop optimally.

This research is still limited to the number of subjects and specific research contexts. Therefore, further research is recommended to involve more subjects with diverse self-efficacy categories and use different contexts and levels of education in order to obtain a more comprehensive picture of students' numeracy literacy skills.

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