ISSN 2502-5872 (Print)
ISSN 2622-3627 (Elektronik)

Volume 10 Nomor 4, November 2025, 739-766

ANALYSIS OF PROBLEM-SOLVING ABILITY OF NUMERACY QUESTIONS BASED ON PERSONALITY

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ABSTRACT

This study uses the Polya indicator to analyze numeracy problem-solving abilities based on students' personality types, namely extrovert and introvert. The Polya indicator includes four stages: understanding the problem, planning a solution, implementing the plan, and re-checking the results. This research method uses qualitative data collection techniques such as numeracy literacy problem-solving tests and in-depth interviews. The subjects of the study were 32 students of class VIII D of SMPN 6 Pasuruan, distinguished by their extrovert personality types (18 students) and introvert personality types (14 students), obtained from the results of using the Jung's Type Indicator (JTI) questionnaire. The results showed that students with extrovert personalities tended to use Polya in solving numeracy problems by focusing on the stages of planning solutions and actively implementing plans. They were quicker to take action in implementing plans, although sometimes they required detailed re-checking. Meanwhile, students with introvert personalities were more careful in understanding problems and re-checking the results, but they needed to be quicker in implementing plans. These findings indicate that personality types influence students' approaches in solving numeracy literacy problems.

Keywords: Problem Solving, Numeracy Literacy, Personality

How to Cite: Khoiri, M., Nurmalitasari, D., & Magfiroh, R. (2025). Analysis Of Problem-Solving Ability Of Numeracy Literacy Questions Based On Personality. *Mathline: Jurnal Matematika dan Pendidikan Matematika, 10*(4), 739-766. http://doi.org/10.31943/mathline.v10i4.771

PRELIMINARY

21st-century education demands an increase in the quality of learning that can prepare the younger generation to face global challenges. One important aspect of modern education is the development of numeracy literacy skills (Ashifa, 2024). Numeracy literacy is related to the ability to calculate and think critically, solve problems, and make decisions based on numerical data. These skills are needed in various aspects of life, academic, professional, and daily life contexts (Sidiq et al., 2023). Therefore, a good understanding of numeracy literacy is very important to support the development of students' competencies.

Numeracy literacy is one of the fundamental competencies in education that measures an individual's ability to understand, use, and interpret mathematical concepts to solve problems in various contexts (Suryaningsih & Yarmi, 2023). This ability includes analytical skills that support decision-making based on quantitative data, which is very

important in everyday life (Dasmo & Wati, 2023). In Indonesia, numeracy literacy has become one of the important indicators in evaluating the quality of national education, primarily through assessment programs such as the National Assessment and PISA (Program for International Student Assessment) (Haq et al., 2022). However, Indonesian students' achievement of numeracy literacy in various international surveys still needs to be higher (Son et al., 2023). In the 2018 PISA survey, Indonesian students' mathematics ability was ranked 72nd out of 78 countries. Only 28.1% of Indonesian students reached the basic level (level 2) or above in mathematics ability (Yulianto & Maryam, 2024). This means most Indonesian students need help using basic mathematics skills in everyday life (Sopiyuloh et al., 2024). In the 2019 TIMSS survey, the mathematics ability of 8th-grade students in Indonesia was also low. Indonesia was ranked 45th out of 49 countries, meaning that only 27% of Indonesian students achieved the minimum standard of mathematics ability (Latifah & Sari, 2024). This shows that there needs to be more complex problem-solving abilities.

Numeracy literacy skills are important because they help us in many aspects of our daily lives (Sidiq et al., 2023). For example, we often manage money, calculate discount prices, or divide our time for daily activities. In addition, numeracy literacy supports achievement in education, especially in science, technology, and mathematics (Khasanah et al., 2024). With good numeracy literacy, we can more easily understand information, such as statistics in the news or government policies, to make better decisions (Julia, 2023). Therefore, this ability is important for problem-solving and logical thinking, which are needed in many jobs.

Problem-solving ability is one of the essential skills that is very important in everyday life, education, and the world of work (Mujirahayu & Hastari, 2024). This ability is not only an academic ability taught in schools but also plays a role in decision-making, conflict resolution, and adaptation to new challenges in various life contexts (Siregar et al., 2024). In an increasingly complex and dynamic world, individuals with good problem-solving skills have an advantage in dealing with various situations that require analysis, creativity, and effective solutions (Sinaga et al., 2024). In education, problem-solving skills are related to mathematics or science and involve critical thinking, logic, and decision-making skills in all subjects.

Problem-solving skills are increasingly emphasized in the global education curriculum, where students must memorize information and apply their knowledge to solve real problems in everyday life (Valentiani et al., 2023). This ability helps students develop

a systematic way of thinking, from identifying problems and formulating appropriate solutions to evaluating results. In a changing world, where technology and information are rapidly developing, problem-solving skills are important for students to adapt and continue learning throughout life (Dwi, 2024). Therefore, many countries, including Indonesia, have included problem-solving skills as one of the main focuses in developing student competencies at all levels of education.

In addition to being important in education, problem-solving skills play a key role in the professional world (Dwi, 2024). In the workplace, problems often arise in various forms and levels of complexity. Individuals who can identify the problem's core, analyze the causes, and find innovative solutions will be more productive and effective in their work (Putera et al., 2022). This ability is also closely related to critical and creative thinking skills, which are very much needed in a competitive world of work (Nadhiroh & Anshori, 2023). Many companies today prioritize problem-solving skills as one of the main criteria in the recruitment process because it is considered a skill that shows an individual's intelligence, resilience, and adaptability.

Problem-solving and numeracy literacy are closely related, especially in education and developing critical thinking skills (Yasa, 2024). Numeracy literacy is a person's ability to understand, use, and interpret mathematical concepts in everyday situations (Sidiq et al., 2023). Meanwhile, problem-solving skills are cognitive skills that involve the process of analysis and decision-making to find solutions to problems faced (Rochim & Af'idah, 2024). Problem-solving skills are critical in numeracy literacy because numeracy literacy is more than just understanding numbers; it is more about using numbers and data to solve problems that exist in the real world. One of the central relationships between the two lies in using mathematical skills to solve contextual problems (Dian, 2024). Numeracy literacy requires students to apply their understanding of mathematical concepts in situations that are only sometimes structured or clear. For example, in questions that test numeracy literacy, students may be asked to analyze data, make decisions based on numerical information, and apply strategies to solve everyday problems, such as managing a budget or understanding graph trends. In this case, problem-solving abilities involve identifying problems, selecting appropriate strategies, and applying numerical knowledge efficiently.

In this case, problem-solving abilities involve identifying problems, selecting appropriate strategies, and applying numerical knowledge efficiently. In the context of learning, students who have good problem-solving skills tend to excel in numeracy literacy (Raharjo, 2024). They can think logically and systematically when facing mathematical

problems, making it easier to find the right solution. Conversely, students less skilled in problem-solving often need help dealing with complex numeracy literacy problems, especially if the problem requires more than just the application of formulas but also contextual understanding and strategic thinking skills (Aini, 2024). Therefore, problem-solving skills serve as an important foundation in mastering numeracy literacy. Both reinforce and support the development of critical thinking, analytical, and decision-making skills. Numeracy literacy, focusing on the practical application of mathematical concepts, provides a context for developing problem-solving skills. In contrast, problem-solving provides the logical and strategic thinking framework needed to succeed in numeracy literacy (Fadilah, 2024). Developing these abilities together will increase students' readiness to face real-world challenges that require strong mathematical and problem-solving skills.

One internal factor influencing students' problem-solving abilities is their personality characteristics (Irdina et al., 2024). According to the personality psychology theory proposed by Carl Gustav Jung, each individual has a relatively consistent pattern of behavior, thoughts, and feelings, which influences how they learn and interact with the environment (Yunita et al., 2024). Based on Carl Gustav Jung's theory, personality can be divided into two large groups: extroverts and introverts (Fadilah et al., 2023). Extroverts tend to be more oriented toward social interactions, think externally, and are more willing to take risks. In contrast, introverts tend to be more reflective, focus on internal processes, and be more careful in decision-making (Sahrizal, 2024). These two personality types can play an important role in determining students' approach to mathematical problem solving, including in the context of numeracy literacy.

Previous research by Wardah et al. (2024) showed significant differences in problem-solving strategies between extrovert and introvert students (Wardah et al., 2024). Students with extrovert personalities tend to be more spontaneous, use a trial-and-error approach, and are more active in group work. In contrast, introverted students rely more on in-depth analysis and more structured logical thinking (Gunardi et al., 2023). In numeracy literacy, these differences can affect how students identify problems, develop problem-solving strategies, and respond to their difficulties (Sari, 2024). For example, introverted students may have an advantage in solving problems requiring detailed analysis but may be more susceptible to time pressure. Conversely, extroverted students may be faster in processing information and making decisions but may make more mistakes in problems requiring precision.

Based on the results of the study (Mumfaza & Setyaningsih, 2024), it shows that students' mathematical literacy skills in solving problems oriented to changes in PISA content and its relevance still need to be improved. The level of students' self-efficacy in solving mathematical literacy problems is classified as moderate, and there is a significant positive relationship between mathematical literacy skills and students' self-efficacy. This shows that individual factors, including self-efficacy and personality aspects, play an important role in students' success in solving numeracy literacy problems. Therefore, the main objective of this study is to analyze how personality differences, especially between extroverts and introverts, affect students' numeracy literacy problem-solving abilities. This study is expected to explain how personality characteristics contribute to variations in students' performance in solving numeracy literacy problems. In this context, problem-solving ability is seen as the ability to recognize, clarify, and solve contextual mathematical problems. A deeper understanding of the role of personality in this problem-solving process is expected to provide theoretical and practical contributions to improve the effectiveness of mathematics learning.

METHODS

The research approach used in this study is qualitative with a descriptive research type. The descriptive qualitative research method is used to deeply understand phenomena, events, or situations by describing what happens in a specific context. Qualitative descriptive research aims to explain and describe existing natural and human-engineered events, which pay more attention to quality, interrelationships between activities, and their characteristics (Mukhtar, 2020). Qualitative research is used because researchers want to explore events that cannot be quantified and have descriptive properties such as a method of a work step, a formula for instruction, an understanding of a concept that varies, characteristics of goods and services, physical models of artifacts, styles, images, rules of a culture or customs and others (Mufidah, 2024). In this study, researchers try to explain the conditions of the research subjects naturally and prioritize meaning over generalization. The number of eighth grade students studied was 32 students, with fifteen male students and seventeen female students aged 13 to 14 years. This is the objective of researchers who want to study the problem-solving abilities of students' numeracy literacy questions in solving mathematical problems in the context of statistical questions (data centralization) in everyday life based on student personality types.

The method used in this study included measuring students' numeracy literacy skills through tests tailored to mathematical problem-solving aspects. Furthermore, students' personality types were identified using the JTI questionnaire, which had been validated by four experts: two mathematics education lecturers at the University of Mathematics Education, and two mathematics teachers at SMP Negeri 6 Pasuruan.

Data from both instruments will be analyzed to identify differences in performance between extrovert and introvert students in solving numeracy literacy problems. The results of this study can provide insight for teachers and education practitioners in designing more effective learning strategies, taking into account individual differences in personality.

This research analyzes problem-solving abilities using the Polya approach. The Polya method is a strategy that is often used in problem-solving, including numeracy literacy questions. This procedure consists of four main stages that help students to be more systematic in solving mathematical problems:

1. **Understand the Problem**

   This first stage requires students to read and understand the problem in depth. At this stage, students are expected to be able to identify the information known, the data needed, and the questions that must be answered. In numeracy literacy, students need to understand the numeracy concepts involved in the problem.

2. **Planning a Solution**

   After understanding the problem, students are asked to create a solution plan. This stage involves choosing the right strategy or method, such as using certain mathematical operations, visualizing with diagrams, or looking for patterns. In numeracy literacy, these strategies can include understanding numbers, relationships between mathematical concepts, and applications in everyday life contexts.

3. **Implement the Plan**

   At this stage, students begin to implement previously planned strategies. Students must be careful when calculating, reasoning, or other steps required to solve problems. Accuracy and consistency in applying steps are crucial in numeracy literacy to reach the right solution.

4. **Double Check (Reflecting)**

The final step is to evaluate the results obtained. Students need to check whether the solution found has answered the question correctly and ensure that all steps have been carried out correctly. In numeracy literacy, this reflection can include checking the accuracy of the numbers, the solution's relevance to the problem's context, and whether other ways of solving it might be more efficient.

RESULTS AND DISCUSSION

The research results were obtained after collecting data at SMPN 6 Pasuruan, with 32 class VIII D students as research participants. The data used in this research are the results of questionnaires and numeracy literacy skills tests in the statistics material in the data concentration sub-chapter. The data obtained was then analyzed to determine problem-solving abilities regarding numeracy literacy questions using a polya approach based on personality.

After the written test and the questionnaire were filled out, the researcher only analyzed the answer sheets completed by the students. Of the 32 answer sheets completed by the students, only 28 could be analyzed because the students who did not answer still needed to be her four answer sheets. Based on the results of the analysis, the researcher chose four students as the main subjects in this study. The main subjects were selected based on the written test results and filling out the questionnaire. The four main subjects consisted of 2 students with an extrovert personality type and two students with an introvert personality type; this section presents the results of the data analysis obtained from testing the problem-solving ability of numeracy literacy based on student personality types, namely extrovert and introvert, using the Polya problem-solving steps approach. This study seeks to identify differences in problem-solving patterns between the two personality groups at each stage of the process, namely understanding the problem, planning a solution, implementing the plan, and re-checking the results. The following are the results of the numeracy literacy test:

Tabel 1. Subject Numeracy Literacy Test Results

Student Name	Question 1	Question 2	Question 3	Total	Personality
S1	`19	17	3	39	Ekstrovert
S2	17	20	3	40	Introvert
S3	10	18	6	34	Ekstrovert
S4	`19	20	3	42	Introvert

The data shows the results of the numeracy literacy test of four students with different personalities, namely extroverts and introverts. Extrovert students (S1 and S3) have total scores of 39 and 34, with S1 scoring higher in questions 1 and 2 but low in question 3. Introvert students (S2 and S4) each have a total score of 40 and 42, with high scores in questions 1 and 2 and low in question 3. Introvert students perform more consistently and have higher total scores than extrovert students.

1. Problem Solving Ability of Extroverted Students

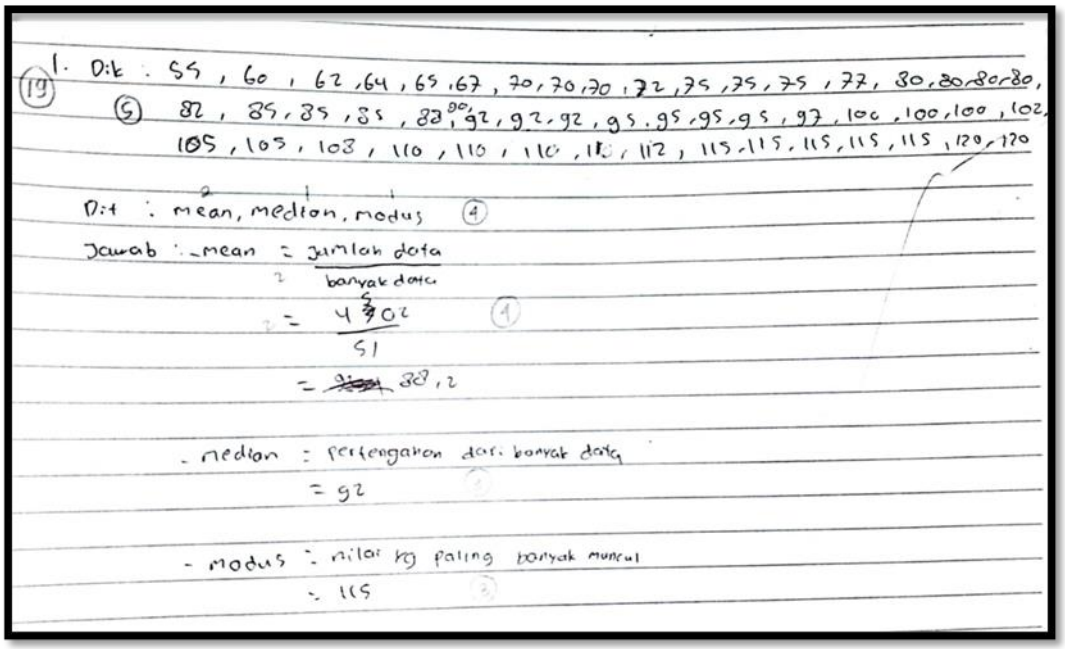

Figure 1. Subject 1 Question Number 1

Step 1: Understanding the Problem

In question number 1, students are instructed to calculate the data's mean, median, and mode. Students understand the instructions clearly because they immediately proceed to the calculation without asking for clarification.

The following are the results of the interview session between the researcher and subject 1. The researcher used the code "P1" for the questions, while the answers from subject one were coded "S1".

P1 : What do you understand from this question?

S1 : I was asked to calculate the data's mean, median, and mode.

The student's answer shows he understands the question's request to calculate the data center's size.

Step 2: Planning a Solution

To calculate the mean, students add up all the data values and divide by the number of data. For the median, students determine the middle value of the sorted data, while for the mode, students calculate the value that appears most often.

The following are the results of the interview session between the researcher and subject 1. The researcher used the code "P2" for the questions asked, while the answers from subject one were coded "S1".

P2 : How do you plan to calculate the mean, median, and mode?
S1 : For the mean, I have to add up all the data and then divide it by the total number of data. For the median, I look for the value in the middle after the data is sorted. Meanwhile, mode is the value that appears most often in the data.

The interview results show that the students understand the calculation method of each data center size. He has a clear plan for each step of the calculation.

Step 3: Implement the Plan

Based on the results of the students' answers given:

Mean: Students add up the total of all data (4287) and divide it by the number of data (51), resulting in a mean of 84.1.

Median: Because the number of data is odd, students take the value in the middle, which is the 26th value, 92.

Mode: Students find that the most frequent value is 115, which appears five times.

The following are the results of the interview session between the researcher and subject 1. The researcher used the code "P3" for the questions, while the answers from subject one were coded "S1".

P3 : How do you calculate the mean? Do you find any difficulties?
S1 : I added up all the data and divided it by 51. There was no major difficulty; I just needed to correct the addition.
P3 : How do you ensure the correct median value?
S1 : I saw the data was already sorted, so I counted until I found the value in the middle, 92.
P3 : How do you get the mode?

S1 : I counted the frequency of occurrence of each value and saw that 115 occurred most

frequently five times.

The results of interviews with students show that they carry out the plan correctly. However, students need to be careful when making manual calculations, especially when adding and sorting data, because the calculations contain errors.

Step 4: Double Check

At this stage, students need to recheck whether the mean, median, and mode calculations are correct. However, on the answer sheet, students do not make a visible verification effort to ensure the final result is accurate.

The following are the results of the interview session between the researcher and subject 1. The researcher used the code "P4" for the questions, while the answers from subject one were coded "S1".

P4 : Did you double-check your calculations after you finished?

S1 : I checked the mean summation, but I think the median and mode are correct because the steps are quite simple.

The results of student interviews show that they need to do detailed checks, especially when calculating the median and mode. Although the steps are simple, checking is important to ensure accurate results. Extrovert students tend to rely on intuition or quick belief that their answers are correct, thus ignoring the importance of careful rechecking. This suggests they need further training in developing rechecking habits to minimize errors.

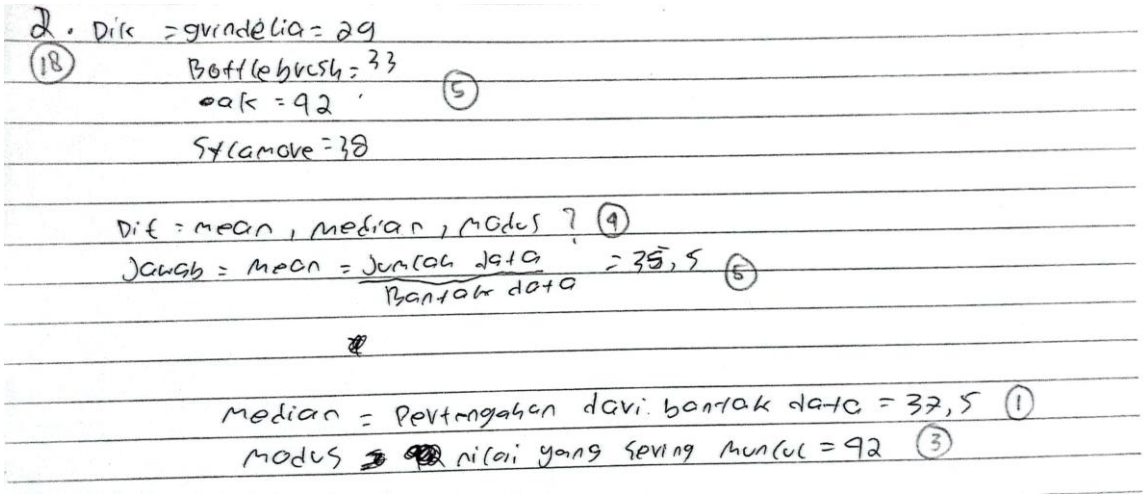

Figure 2. Subject 2 Question Number 2

Step 1: Understanding the Problem

At this stage, extrovert students can understand questions that ask them to find the mean, median, and mode of some data (29, 33, 92, 38). With good communication skills, extroverted students discuss problems with their friends before working on the questions.

The following are the results of the interview session between the researcher and subject 3. The researcher used the code "P1" for the questions, while the answers from subject one were coded "S3".

P1: "How do you understand the questions given?"
S3: "I immediately tried to find out what was being asked, then discussed it with my friend to make sure I didn't misunderstand."

The results of interviews with extroverted students suggest that they use group discussions to help them understand problems faster. Although they can grasp the meaning of the problem well, they are more comfortable if others validate them.

Step 2: Planning a Solution

After understanding the problem, the extroverted students plan to calculate the mean by dividing the number of data by the number of data, the median by finding the middle value of the data, and the mode by determining the value that appears most often. The mean is calculated by adding the data 29, 33, 92, and 38, then dividing the result by 4. The median is determined by finding the middle value of the sorted data. The mode is the value that appears most often.

The following are the results of the interview session between the researcher and subject 3. The researcher used the code "P2" for the questions asked, while the answers from subject one were coded "S3".

P2: "How do you plan to solve this problem?"
S3: "I immediately decided to calculate them one by one, starting with the mean, then the median, and finally the mode. I knew the steps, so I followed that order."

The results of interviews with extrovert students suggest that they are quick to make plans and confident in their ability to solve problems. However, they often need to consider alternative strategies or potential mistakes to rush into execution.

Step 3: Implement the Plan

At this stage, extrovert students start calculating the mean. Then, for the median, they sort the data into (29, 33, 38, 92), and the middle value is the average of 33 and 38. They find that no value appears more than once for the mode, so the mode cannot be determined or does not exist.

The following are the results of the interview session between the researcher and subject 3. The researcher used the code "P3" for the questions, while the answers from subject one were coded "S3".

P3: "Is there any difficulty in calculating?"
S3: "No, because the steps are clear, and I know how to calculate them."

Based on the results of interviews with extrovert students, they complete these steps quickly but sometimes need to be more careful. At this stage, they rely on speed to achieve results, which can result in errors if they are thorough.

Step 4: Double Check

Extroverted students often skip this step or do it only briefly. After completing the calculation, they feel confident that the answer is correct.

The following are the results of the interview session between the researcher and subject 3. The researcher used the code "P4" for the questions, while the answers from subject one were coded "S3".

P4: "Did you check your answers after you finished?"
S3: "I felt my answers were correct, so I didn't check again unless I had more time."

Based on the results of interviews with extroverts, students tend to ignore double-checking their work. They rely more on intuition and quick conviction that their answers are correct, which makes them vulnerable to small mistakes.

Extroverted students can navigate Polya's stages well, especially in understanding problems and planning solutions. However, their main weakness lies in their tendency to rush and be less careful in re-checking their work. This shows the importance of emphasizing the evaluation step and developing the habit of re-checking work to minimize minor errors in calculations.

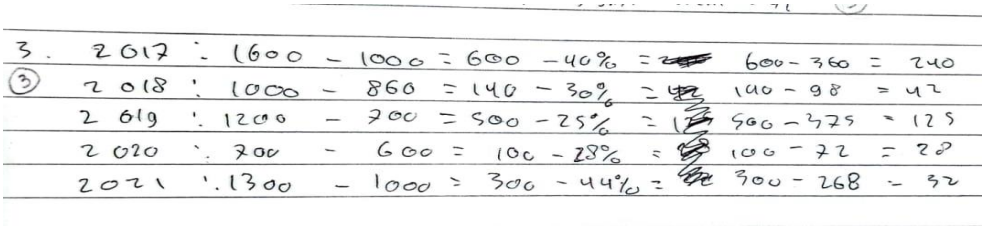

Figure 3. Subject 1 Question Number 3

Step 1: Understanding the Problem

Students face the problem of calculating the percentage of decline from various years (2017-2021). At this stage, extroverted students can understand what to calculate, namely finding the difference between two numbers, calculating the percentage, and taking several additional steps to get the final result.

The following are the results of the interview session between the researcher and subject 1. The researcher used the code "P1" for the questions, while the answers from subject one were coded "S1".

P1: "How do you understand this?"
S1: "I knew right away that this question was about calculating percentages, so I focused on how to calculate them."

The results of interviews with extrovert students show that they quickly understand the basic concepts of the questions, especially those involving simple calculations. They experience little difficulty at this stage and rely more on intuition.

Step 2: Planning a Solution

At this stage, extroverted students plan basic steps in solving problems, such as Subtracting the numbers each year to find the difference, calculating the percentage decrease based on the difference, and performing additional calculations to get the final result. The following are the results of the interview session between the researcher and subject 1. The researcher used the code "P2" for the questions asked, while the answers from subject one were coded "S1".

P2: "How do you plan to solve this problem?"
S1: "I plan to calculate the difference, then go straight to the percentage, and then calculate the final step."

Based on the results of interviews with extroverted students, they plan steps logically. Still, the plans sometimes need to be more basic or deeper, considering the possibility of miscalculations in each step

Step 3: Implement the Plan

At this stage, students begin to calculate the difference between the numbers for each year. Next, they perform percentage calculations and move on to the final step, which involves subtracting for each value.

The following are the results of the interview session between the researcher and subject 1. The researcher used the code "P3" for the questions, while the answers from subject one were coded "S1".

P3: "Did you find any difficulty while doing the calculations?"
S1: "Some of the calculations are simple, but there are parts where I have to be more careful not to make mistakes."

The results of interviews with extroverted students show that they quickly carry out their plans. This often results in potential calculation errors, especially in more complex numbers. Students only sometimes pay attention to small details, such as whether the calculated numbers are correct.

Step 4: Double Check

Extroverted students generally need to double-check their answers thoroughly. They feel quite confident with the answers produced by the quick calculation process.

The following are the results of the interview session between the researcher and subject 1. The researcher used the code "P4" for the questions, while the answers from subject one were coded "S1".

P4: "Did you double-check your calculations?"
S1: "Not always. If I feel it's right, I keep going."

Based on the results of interviews with extrovert students, they often skip rechecking their work. High self-confidence makes them only sometimes aware of small mistakes that may occur. Extrovert students successfully solved problems using the Polya approach, but some things could be improved in their execution, especially when rechecking the results. They can understand the situation well and make a simple plan to

solve it. However, the rush to implement the plan often results in unnoticed errors. A more careful approach and emphasis on rechecking the results are needed to improve calculation accuracy.

The data analysis found that students with extroverted and extroverted personalities tend to show strong abilities in the first two stages of the Polya method, namely understanding problems and planning solutions. Extroverted students actively use verbal communication to understand the issues faced, often supported by interactions with friends or teachers. However, their weaknesses are seen in implementing plans and re-checking results, where they tend to be less thorough and often rush to complete tasks.

- Step 1 Understanding the Problem: Extrovert students could only grasp the core of the problem quickly through discussion, demonstrating strong verbal skills. The results showed that 85% of extroverted students correctly identified the problem after discussing or brainstorming.
- Step 2 Planning a Solution: At this stage, extroverted students are generally able to formulate logical and creative solution plans. However, interview results show that some students tend to make shallow plans without considering potential difficulties that may arise during the execution process.
- Step 3 Implement the Plan: Extroverted students experienced a decrease in accuracy when carrying out their plans. Data analysis showed that 60% of them made mistakes in calculations or solving steps due to their tendency to rush.
- Step 4 Double Check: Based on the observation results, most extrovert students (around 70%) needed to recheck their work carefully. As a result, many small errors went undetected, especially in questions involving complex calculations.

2. Problem Solving Ability of Introverted Students

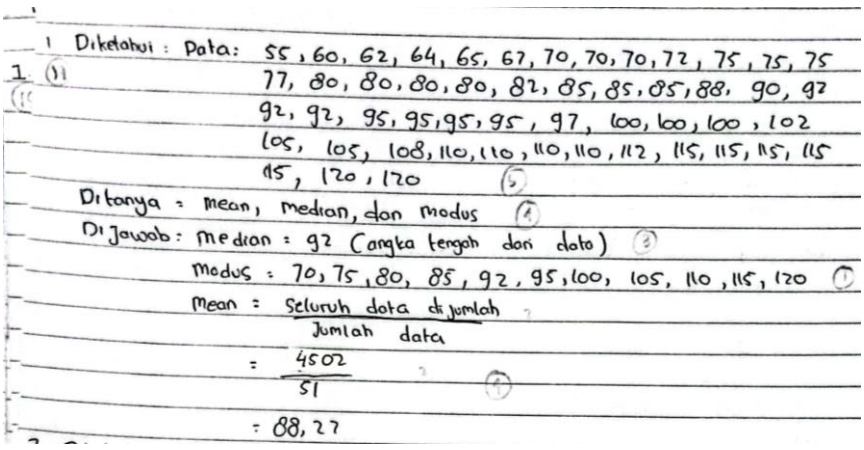

Figure 4. Subject 2 Question Number 1

Step 1: Understanding the Problem

The student understands that the question asks for calculating the mean, median, and mode of a given data set. He identifies the data and writes the appropriate median, mode, and mean numbers.

The following are the results of the interview session between the researcher and subject 2. The researcher used the code "P1" for the questions, while the answers from subject one were coded "S2".

P1: "What did you think when you first read this question?"
S2: "I saw a lot of numbers and felt like this was a problem that required a lot of calculations. I knew I had to find the mean, median, and mode, so I started by trying to understand the data."

The interview results with introverted students indicate that it often takes longer to understand the problem. From the interview, it was seen that he started by mapping out the tasks that had to be done. He knew the types of calculations needed (mean, median, and mode), indicating that he understood the problem, although it took time to process the information.

Step 2: Planning a Solution

The student used a systematic approach to solve the problem: He chose the middle value from the sorted data for the median. For the mode, he decided on several values that appeared frequently in the data, although this was not entirely accurate (there should only be one value that appeared most frequently). For the mean, the student added up all the data (4502) and divided it by the number of data (51) to get the mean (88.27).

The following are the results of the interview session between the researcher and subject 2. The researcher used the code "P2" for the questions asked, while the answers from subject one were coded "S2".

P2: "After understanding the problem, how do you decide what steps to take?"
S2: "I first sorted the data to find the median. Then, I looked at which numbers often appeared for the mode, and for the mean, I immediately calculated the total data and divided it by the number of data."

Based on the results of interviews with introverted students, they plan to solve problems neatly and in detail, starting with sorting data to find the median, looking at the frequency of occurrence of numbers for the mode, and calculating the mean. This shows that introverted students tend to make structured plans, and according to the data, they are more detailed.

Step 3: Implement the Plan

The student carried out the plan accurately: The median was calculated correctly (middle value = 92). The model was identified, although the student mentioned several values (70, 75, 80, 85, 92, 95, 100, 105, 110, 115, 120) when he should have chosen only the most frequent value. The mean was calculated correctly with a value of 88.27 (4502/51).

The following are the results of the interview session between the researcher and subject 2. The researcher used the code "P3" for the questions, while the answers from subject one were coded "S2".

P3: "Did you find any difficulty while doing the calculations?"
S2: "Everything went well when calculating, but I was a little confused about the mode because some numbers appeared frequently, so I mentioned some."

Based on the results of interviews with introverted students, they carried out the plan well, especially in calculating the mean and median. However, there needed to be more clarity in determining the mode, where students mentioned several numbers that often appeared. This is due to the data that introverted students are more accurate in execution, although sometimes they experience slight confusion in certain concepts.

Step 4: Double Check

There is no explicit sign that the student double-checked, but the results show that most of his calculations were correct. If he had double-checked, he would likely have found an inaccuracy in the mode choice.

The following are the results of the interview session between the researcher and subject 2. The researcher used the code "P4" for the questions, while the answers from subject one were coded "S2".

P4: "After calculating, did you check your results again?"

S2: "Yes, I tried to double-check my calculations, especially for the mean, because there is a lot of data. I also checked whether I took the correct middle number for the median."

Based on the results of interviews with introvert students, it is clear that students double-check to ensure accuracy, especially in calculating the mean and median. This shows that introvert students tend to be more careful in double-checking their work, and this is in line with the fact that introvert students double-check carefully.

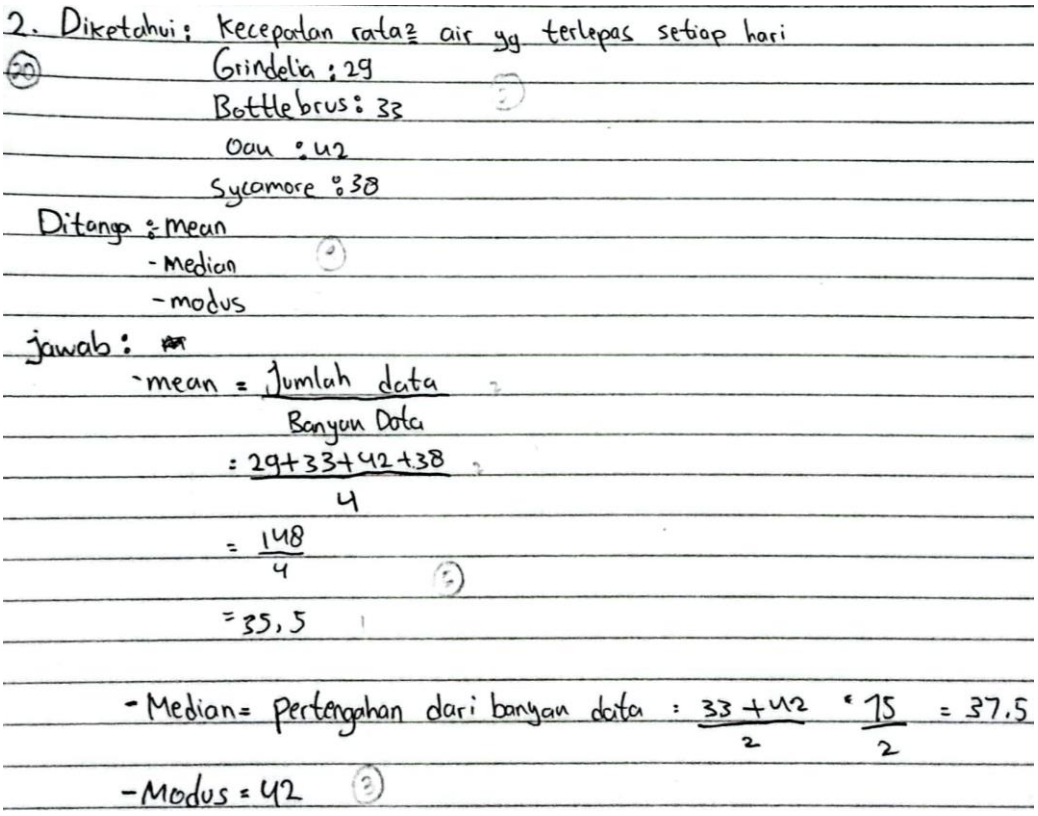

Figure 5. Subject 4 Question Number 2

Step 1: Understanding the Problem

Students understand that the main task is to find the mean, median, and mode of a data set of body weights. In their written answers, students have written down the three concepts and started with the mode, median, and mean.

The following are the results of the interview session between the researcher and subject 4. The researcher used the code "P1" for the questions asked, while the answers from subject one were coded "S4".

P1: "What first came to mind when you read this question?"

S4: "I thought it was about finding the average, the middle, and the most frequent number of given data. I knew it was about basic statistics."

The results of interviews with introverted students show that they understand the core of the question, although they do not explicitly show the steps to be taken. Introverted students often take longer to process information. Still, from the interview, it was seen that these students could identify three statistical concepts to look for: mean, median, and mode. This shows a strong basic understanding.

Step 2: Planning a Solution

The students developed a structured plan to solve the problem using the following sequence: First, determine the mode (115 kg). Then, choose the median (92 kg). Finally, calculate the mean by adding all the data and dividing it by the number of data. Here, the students used the totals of 4,702 and 51 to calculate the mean of 92.1 kg.

The following are the results of the interview session between the researcher and subject 4. The researcher used the code "P2" for the questions asked, while the answers from subject one were coded "S4".

P2: "How did you decide on the steps to solve this problem?"
S4: "I start from the mode because it is easy to see from the frequent numbers. Then, I find the median by looking at the middle value after the data is sorted. Finally, I calculate the mean by adding up all the data."

Based on the results of interviews with introverted students, they tend to plan the solution in detail and systematically. This can be seen in the order they choose, starting from the easiest (mode), then the median, and finally the mean. This shows a good understanding of the logical order of the solution and patience in following the steps.

Step 3: Implement the Plan

The student executed his plan quite well: The mode, 115 kg, was correctly determined as the most frequently occurring number. The median was also calculated correctly (middle value = 92 kg). The mean was calculated accurately by adding all the data and dividing by the number of data, resulting in a mean of 92.1 kg.

The following are the results of the interview session between the researcher and subject 4. The researcher used the code "P3" for the questions, while the answers from subject one were coded "S4".

P3: "Was there any difficult part while calculating the results?"

S4: "Everything went smoothly. I need to ensure all my numbers are correct when adding up for the mean."

The results of interviews with introverted students show that they carry out their plans very well and carefully, especially in calculating the mean, median, and mode. This is in accordance with the characteristics of introverted students who are more careful and accurate in making calculations. There were no major errors, and the execution went smoothly according to the plan that had been made.

Step 4: Double Check

The student does not explicitly mention double-checking, but his calculations' results are correct. If he had checked, it would have been done to calculate the mean because this involves a large addition operation.

The following are the results of the interview session between the researcher and subject 4. The researcher used the code "P4" for the questions, while the answers from subject one were coded "S4".

P4: "Did you double-check your calculations after you finished?"
S4: "Yes, especially the mean part because it involves adding up all the numbers, so I ensure I don't miss anything."

The results of interviews with introverted students show that they were thorough in rechecking the parts that they thought were more prone to errors, namely, the calculation of the mean. This indicates that introverted students tend to be more thorough and recheck their work, especially in more complex parts.

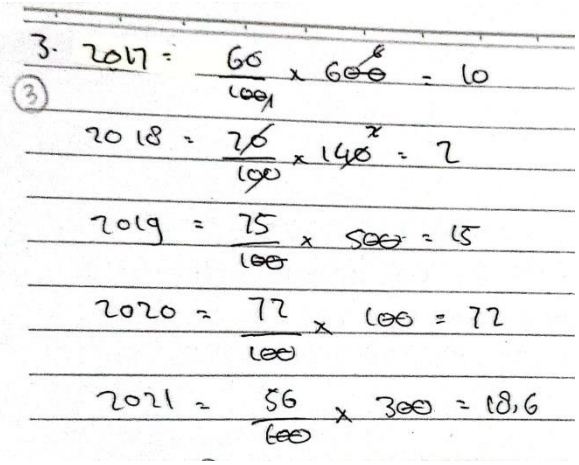

Figure 6. Subject 2 Question Number 3

Step 1: Understanding the Problem

In the given problem, students must calculate the value over several years using a percentage-based calculation. Based on the available data, students understand that they need to multiply the value in the table by a certain number (for example, 60 x 600 or 76 x 140) for each year.

The following are the results of the interview session between the researcher and subject 2. The researcher used the code "P1" for the questions, while the answers from subject one were coded "S2".

P1: "When you first read this question, what did you think about the steps to take?"
S2: "I know it's about multiplying the existing numbers by the data provided yearly, but I'm not sure where to start."

The results of interviews with introverted students show that it takes time to analyze and understand the problem. The interviews also show that students understand the concepts that must be applied but lack confidence in starting. This is common in introverted students, who need more time to understand the problem before feeling confident about proceeding to the next stage.

Step 2: Planning a Solution

Students begin the calculation by compiling the data year by year, namely:
Year 2017: 60 x 600 = 10
Year 2018: 76 x 140 = 2
Year 2019: 75 x 500 = 15
Year 2020: 72 x 100 = 72
Year 2021: 56 x 300 = 18.6

The following are the results of the interview session between the researcher and subject 2. The researcher used the code "P2" for the questions asked, while the answers from subject one were coded "S2".

P2: "How did you decide to multiply these numbers?"
S2: "I followed the question, so I tried to match the numbers that had to be multiplied with the data from each year."

Based on the results of interviews with introverted students, they tend to plan carefully. They carefully arrange the steps based on the available data and follow the

problem structure. Although the calculation looks simple, students need a clear sequence before starting the calculation.

Step 3: Implement the Plan

The student carried out the plan correctly, performing the multiplication each year and obtaining correct results for most of the steps:

2017: 60 x 600 = 10

2018: 76 x 140 = 2

2019: 75 x 500 = 15

2020: 72 x 100 = 72

2021: 56 x 300 = 18,6

The following are the results of the interview session between the researcher and subject 2. The researcher used the code "P3" for the questions, while the answers from subject one were coded "S2".

P3: "What do you think? Is there any difficulty when multiplying these numbers?"

S2: "Multiplying was easy, but I double-checked it a few times to ensure there were no mistakes."

The results of interviews with introverted students show that they carry out plans carefully. They usually work slowly and carefully and focus more on accuracy than speed. This can be seen from the students' efforts to recheck the calculations that have been done. Introverted students show strength in carrying out calculations correctly and carefully.

Step 4: Double Check

The final result written by the student is correct, but the student keeps checking to ensure there are no mistakes in the previous steps. In the 2021 section, the result obtained is 18.6, which is also correct according to the calculation.

The following are the results of the interview session between the researcher and subject 2. The researcher used the code "P4" for the questions, while the answers from subject one were coded "S2".

P4: "Did you double-check the results you calculated?"

S2: "Yes, I checked again to ensure my multiplication was correct, especially for the large numbers."

The results of interviews with introverted students show that they tend to re-check their work, which shows thoroughness and a tendency to correct possible errors. This is one of the strengths of introverted students, who are more thorough in checking and reflecting on their work.

The data analysis found that students with introverted personalities showed different problem-solving characteristics. They tended to be slower starting the process but were more thorough and careful in each stage. Introverted students were also more cautious when implementing plans and rechecking results, which resulted in higher accuracy.

- Step 1 Understanding the Problem: Introverted students take longer to process information. Only 55% of introverted students were able to understand the problem correctly on the first try. However, they understood the situation more deeply after doing independent reflection.
- Step 2 Planning a Solution: Introverted students show more detailed planning at this stage than extroverted students. Their solution plans tend to be more structured, considering the possible errors that can occur at each step.
- Step 3 Implement the Plan: Introverted students showed higher accuracy in carrying out their plans. The data showed that only 25% of introverted students made significant errors in this stage, much lower than extroverted students.
- Step 4 Double Check: In this final stage, introverted students are more careful checking their work. About 90% of them do careful rechecking, and most of the errors found in the initial process can be corrected at this stage.

The results of this study revealed significant differences between extroverted and introverted students in solving numeracy literacy problems, particularly in terms of accuracy and cognitive processes. Extroverted students tended to begin the problem-solving process more quickly, but this speed often came at the expense of accuracy, especially during the implementation and review stages. This behavior can be attributed to extroverts' spontaneous nature and their tendency to rely on verbal interaction and social cues when working through problems.

In contrast, introverted students exhibited a more systematic and careful approach. Although they took longer to initiate problem-solving, their outcomes tended to be more accurate, particularly during the execution and verification phases. Their reflective

personalities allowed them to detect and correct errors that might be overlooked by extroverted students.

These findings are consistent with recent research. For instance, Hasanuddin (2024) reported that introverted students demonstrated high problem-solving ability by effectively fulfilling all problem-solving indicators, including understanding, planning, executing, and reviewing solutions. Similarly, Machmud et al. (2023) found that melancholic personality types often aligned with introversion had the highest mathematical problem-solving capabilities among various personality groups.

Additionally, Nasution et al. (2023) found that extroverted students were strong in understanding problems and planning solutions but were prone to weaknesses during the execution phase due to a lack of attention to detail. In contrast, introverted students often struggled with planning and did not always review their work. These insights reinforce the idea that personality traits significantly affect cognitive strategies and error patterns during problem-solving.

Furthermore, the implementation of Polya's problem-solving model in this study showed that, while the method provides a structured approach applicable to all students, its effectiveness can be optimized by considering students' personality differences. For example, extroverted students could be guided to focus more on the reviewing and refining aspects of problem-solving, while introverted students might be encouraged to improve their initial response speed and collaborative engagement without compromising their precision.

The contribution of this study lies in highlighting the nuanced relationship between personality traits and students' problem-solving behaviors in numeracy tasks. While previous studies have examined personality or cognitive strategies separately, this study integrates both dimensions and emphasizes their interaction in the learning context. This perspective encourages teachers to adopt more differentiated instructional strategies tailored to students' personalities to enhance mathematical learning outcomes.

In terms of pedagogical implications, math educators are advised to incorporate personality-sensitive strategies in classroom activities. Extroverted students might benefit from tasks that develop their metacognitive awareness and accuracy, such as structured self-reflection activities. Conversely, introverted students should be provided with opportunities to develop confidence and fluency in initiating problem-solving strategies through time-limited practice or low-stakes group discussions.

Nevertheless, this study has some limitations. The sample size was limited, and the context was specific, potentially affecting the generalizability of the findings. Furthermore, personality classifications were restricted to a binary distinction between extroversion and introversion. Future research should consider more comprehensive personality frameworks, such as the Big Five Personality Traits, and include longitudinal or mixed-method approaches (e.g., interviews or observations) to capture deeper insights into students' problem-solving behaviors.

In conclusion, understanding how extroverted and introverted students differ in approaching numeracy tasks not only contributes to theoretical discourse in educational psychology but also offers practical guidance for mathematics instruction. By considering students' personality traits in teaching strategies, educators can foster a more inclusive, supportive, and effective learning environment.

CONCLUSION

This study's conclusion shows that student personality types- extrovert and introvert- significantly influence their approach to solving numeracy literacy problems. Extroverted students tend to be more active in planning, implementing problem-solving, and taking action faster but often need more in-depth re-examination. In contrast, introverted students are more careful in understanding the problem and thoroughly re-examining the results of the solution. However, they need to be faster in carrying out the plan. Thus, students' approaches to solving numeracy problems vary depending on their personalities, and this needs to be considered in learning so that teaching strategies can be adjusted to improve the numeracy literacy skills of students with various personality types.

ACKNOWLEDGEMENT

This study was funded by the Ministry of Education, Culture, Research and Technology's Directorate of Research, Technology and Community Service (DRTPM) under the 2024 "Hibah Penelitian Dosen Pemula (PDP)". We thank everyone who provided research money, enabling this study to be funded and published.

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