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Mathematical Literacy Levels of Students in Solving AKM-Type Numeracy Problems Based on Rational and Artisan Personality Types

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ABSTRACT

Mathematical literacy is one of the important skills that students must have in order to deal with problems in daily life. Students' achievement of mathematical literacy can be affected by various factors, especially internal factors such as personality type. This study aims to analyze students' achievement of mathematical literacy in solving AKM numeracy problems based on rational and artisan personality types. This study used a descriptive qualitative method. The research subjects were 9 eighth-grade junior high school students with rational personality type and 8 students with artisan personality type. The instruments used were AKM numeracy test questions, Keirsey personality type questionnaire, interview guidelines, indicator rubrics, recording devices, and researcher notes. The data used were the subjects' written test results in solving AKM numeracy questions, researcher notes, and the results of interviews between the researcher and the subjects. The data analysis techniques used were data collection, data reduction, data presentation, and conclusion. The results of the study showed that subjects with the rational personality type were able to achieve mathematical literacy levels of one subject at level 4, one subject at level 5, and seven subjects at level 6. Meanwhile, students with artisan personality types achieved mathematical literacy levels of two subjects at level 3, two subjects at level 5, and four subjects at level 6. The main factor behind these differences in achievement is the thinking characteristics of each personality type. Another factor that also contributes to these differences in mathematical literacy levels is the learning experiences of each student.

Keywords: *Mathematical Literacy Level, AKM Numeracy, Personality Type*

Level Literasi Matematis Siswa dalam Menyelesaikan Soal Numerasi Bertipe AKM Berdasarkan Tipe Kepribadian Rational dan Artisan

ABSTRAK

Kemampuan literasi matematis menjadi salah satu kemampuan penting yang harus dimiliki siswa untuk menghadapi permasalahan dalam kehidupan sehari-hari. Pencapaian level literasi matematis siswa dapat dipengaruhi oleh berbagai faktor, salah satunya dari faktor internal yaitu tipe kepribadian. Penelitian ini bertujuan untuk menganalisis ketercapaian level literasi matematis siswa dalam menyelesaikan soal numerasi AKM ditinjau dari tipe kepribadian rational dan artisan. Penelitian ini menggunakan metode kualitatif deskriptif. Subjek penelitian yang diambil adalah siswa SMP Kelas VIII sebanyak 9 subjek untuk tipe kepribadian rational dan 8 subjek untuk tipe kepribadian artisan. Instrumen yang digunakan adalah soal tes numerasi AKM, angket tipe kepribadian Keirsey, pedoman wawancara, rubrik indikator, alat rekam, dan catatan peneliti. Data yang digunakan adalah hasil tes tertulis subjek dalam menyelesaikan soal numerasi AKM, catatan peneliti, dan hasil wawancara antara peneliti dengan subjek. Teknik analisis data yang digunakan adalah mengumpulkan data, reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian adalah subjek dengan tipe kepribadian rational mampu mencapai level literasi matematis sebanyak satu subjek pada level 4, satu subjek pada level 5, dan sebanyak tujuh subjek pada level 6. Sementara itu, siswa dengan tipe kepribadian artisan mencapai level literasi matematis sebanyak dua subjek pada level 3, dua subjek pada level 5, dan empat subjek pada level 6. Faktor yang utama yang menjadi perbedaan capaian ini adalah karakteristik berpikir dari masing-masing kepribadian tersebut. Faktor lain yang juga mendukung perbedaan ketercapaian level literasi matematis ini adalah pengalaman belajar dari masing-masing siswa.

Kata Kunci**:** *Level Literasi Matematis, Numerasi AKM, Tipe Kepribadian*

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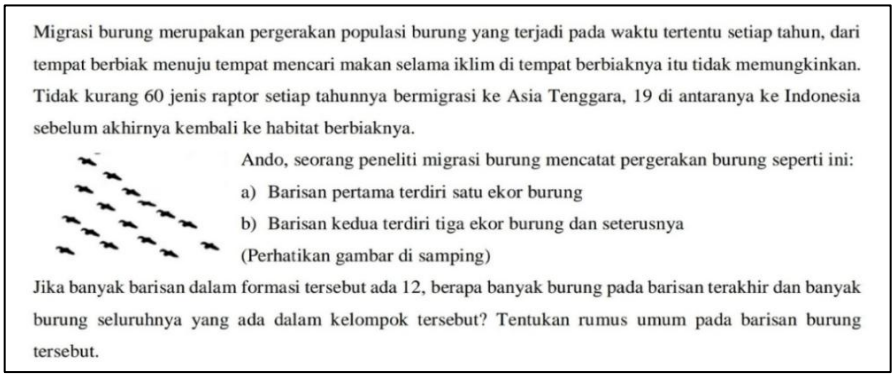
1. Introduction

Due to the rapid development of information technology and education, the demand for critical thinking and problem-solving skills has become increasingly high. In daily life, it is not enough for individuals to just understand theory, but they are also required to be able to apply it logically and critically in solving contextual problems. One competency that is expected to develop this ability through learning is mathematical literacy. Mathematical literacy is an individual's ability to understand, formulate, apply, and interpret mathematical concepts in various real-life situations (OECD, 2019). The OECD categorizes this mathematical literacy ability into six levels. Level 1 indicates the ability to use existing knowledge to solve problems with available information, level 2 interprets problems and solves them using basic formulas, level 3 correctly executes a sequence of steps and chooses the right strategy, level 4 chooses methods and integrates them into different representations, level 5 uses models to solve complex problems, and level 6 uses reasoning to solve mathematical problems.

The results of the PISA study, which is conducted every three years, show that Indonesian students' mathematical literacy skills are still relatively low. Based on the results of the 2022 PISA survey, Indonesia ranked 70th out of 81 countries surveyed by PISA (OECD, 2023). This indicates that Indonesian students are still not well prepared to face global numeracy challenges. In Indonesian education, mathematical literacy skills are one of the aspects that are measured in the *Asesmen Kompetensi Minimum* (Minimum Competency Assessment), commonly known as AKM (Kemendikbud, 2021). AKM measures students' ability to understand and solve problems based on real-life contexts. Numeracy questions in AKM not only require calculation skills, but also include the ability to understand contextual information, construct mathematical models, reason, and draw appropriate conclusions from calculation results. However, various studies show that many students still have difficulty solving numeracy questions, especially on the topic of arithmetic sequences, which often appear in AKM questions with real-life contexts. As revealed in the research results of Septiahani, Melisari, and Zanthy (2020), the level of student completion of sequence and series questions is still relatively low. This is in line with Hardiyanti (2016), which states that many students have difficulty in determining the steps to solve row and series problems, including determining the n^{th} formula and the value of the first term.



Migrasi burung merupakan pergerakan populasi burung yang terjadi pada waktu tertentu setiap tahun, dari tempat berbiak menuju tempat mencari makan selama iklim di tempat berbiaknya itu tidak memungkinkan. Tidak kurang 60 jenis raptor setiap tahunnya bermigrasi ke Asia Tenggara, 19 di antaranya ke Indonesia sebelum akhirnya kembali ke habitat berbiaknya.

Ando, seorang peneliti migrasi burung mencatat pergerakan burung seperti ini:

a) Barisan pertama terdiri satu ekor burung

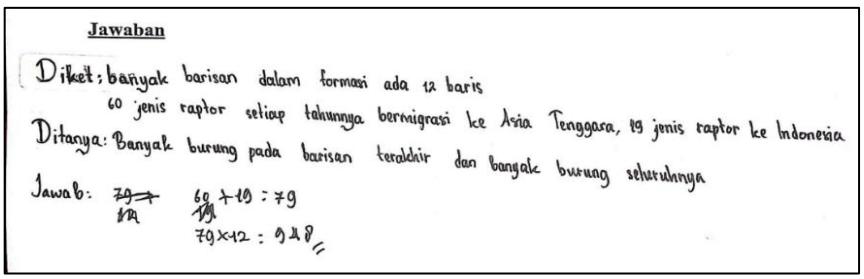
b) Barisan kedua terdiri tiga ekor burung dan seterusnya

(Perhatikan gambar di samping)

Jika banyak barisan dalam formasi tersebut ada 12, berapa banyak burung pada barisan terakhir dan banyak burung seluruhnya yang ada dalam kelompok tersebut? Tentukan rumus umum pada barisan burung tersebut.

Figure 1. Preliminary Study Questions

Researchers conducted a preliminary study involving 18 eighth-grade students to obtain an overview of the problems that students face when solving numeracy problems aligned with one AKM-based numeracy problem. All participating students had received instruction on arithmetic sequences prior to the study. The question contained a narrative context about arithmetic sequences, specifically asking students to determine the number of birds in the last sequence and the total number of birds in the entire sequence. The problem required students to identify the general formula and subsequently calculate the sum of the sequence. The correct solution requires the determination of the general formula is $U_n = 2n - 1$, the number of birds in the last sequence is 23, and the total number of birds is 144, as shown in Figure 1. The purpose of this preliminary study was to identify students' difficulties and variations in their mathematical literacy levels in solving AKM numeracy questions.



Jawaban

Diket: banyak barisan dalam formasi ada 12 baris

60 jenis raptor setiap tahunnya bermigrasi ke Asia Tenggara, 19 jenis raptor ke Indonesia

Ditanya: Banyak burung pada barisan teraldhir dan banyak burung seluruhnya

Jawab: ~~79~~ 60 + 19 : 79

79 × 12 : 948

Figure 2. Preliminary Study Results Student 1

Based on the answers given by Student 1 (S1) in Figure 2, the researcher found that S1 solved the problem using the numbers written in the question, which are the numbers 60 and 19, representing the number of types of migrating raptors. S1 added the two numbers together to get 79, then multiplied it by 12 as the number of rows, and obtained a final answer of 948. In an interview, S1 revealed that S1 did not understand the pattern of the bird rows shown in the question and chose to use the numbers provided in the text because S1 was confused about the pattern given.

Table 1. Confirmation of S1 Answer

P	:	How did you solve this problem?
S1	:	*I saw the numbers 60 and 19, and then there were 12 rows. I thought I just had to multiply them.*
P	:	Why did you add 60 and 19 here, and then multiply by 12?
S1	:	*The problem says there are 60 types, 19 to Indonesia, so the total is 79. Then, because there are 12 rows, I just multiplied it.*
P	:	Did you pay attention to this part of the question, which discusses the number of birds per row? Or did you look at the picture in the question?
S1	:	*Oh yes, there is one bird in the first row and three birds in the second row, but I was confused about how to count them. So, I just looked at the numbers that were already written.*

Table 1 shows that S1 is not yet able to interpret the information in the question into an appropriate mathematical representation. S1 only uses the numerical information written in the question without understanding how that information relates to the question being asked. Based on the OECD's mathematical literacy level, S1's ability can be classified as Level 1, because the student is only able to identify clearly written information and perform simple mathematical operations, but is still unable to solve problems or connect information to the questions asked. These findings show that even though students have learned about numeracy problems in contextual forms, both those related to arithmetic sequences and other material, there are still students who do not understand the meaning of the contextual information provided. This contrasts with the results of interviews with mathematics teachers, who said that in general, students were quite capable of solving AKM numeracy problems and that their mathematical literacy skills were quite good. Unlike S1, the researchers also found significant differences in the way of thinking in the answers of Student 2 (S2), as shown in Figure 3.

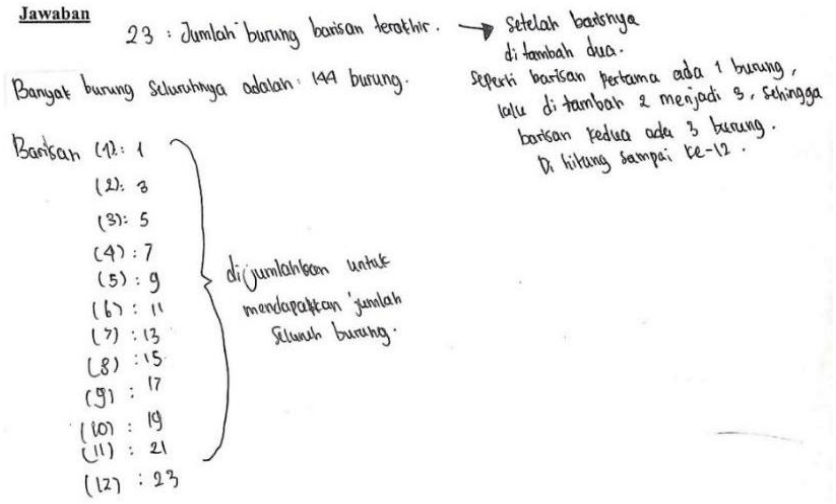


Figure 3. Preliminary Study Results Student 2

The S2 answer shows the ability to understand contextual information and relate it to a more in-depth mathematical representation. S2 mentions that the difference or gap between each row is 2 and explains that students find the difference between each row by looking at the pattern of the first row and the second row, then subtracting the number of birds in the second row from the first row, as shown in Table 2.

Table 2. Confirmation of S2 Answer

P	:	How did you solve this problem?
S2	:	*I read the problem and saw that there was 1 bird in the first row and 3 birds in the second row, so I saw that the difference between each row was 2. Then I continued to the* 12^{th} *row by adding 2.*
P	:	How did you find the difference between each row?
S2	:	*Well, the first row has 1 bird and the third row has 3 birds, so I just subtracted them to get 2. I also saw from the picture that the difference is 2.*
P	:	Then, how did you determine the total number of birds?
S2	:	*I wrote down the number of birds from row 1 to row 12, then I added them up.*

In this case, S2 shows that students are able to identify patterns from the information provided, both in the reading and in the pictures that are given in the questions. From the information that has been obtained, S2 is able to determine the steps to solve the problem, which is by determining the number of birds in each row by adding 2 to the number of birds until it reaches the 12th row. Next, S2 adds up the number of birds from each row to get the total number of birds asked, which is 144 birds. In Table 2, we can see that S2, in solving the problem, first tries to understand the context of the problem, then looks for a way to solve it. Based on mathematical literacy level, S2 can be classified at level 3, because S2 is able to interpret the problem and determine the steps and strategies for solving it correctly according to the real context given.

The analysis shows a contrast between the abilities of S1 and S2 students in solving AKM-type numeracy problems. Based on the results, S1 students are at level 1 of mathematical literacy, where they are only able to recognize basic information and perform simple calculations. Meanwhile, S2 students demonstrate higher abilities, at level 3 of mathematical literacy, where they are able to integrate information in the problem and determine the steps to solve it. The AKM-type numeracy problems used in this preliminary study, as shown in Figure 1, were designed to explore and differentiate students' abilities at each level of mathematical literacy, including both procedural skills and contextual integration, although the students' results were not yet optimal. This difference in literacy levels not only shows the diversity of students' academic achievements, but also has implications for students' readiness to face problems in daily life. Students who only reach level 1, such as S1, are at risk of experiencing difficulties in understanding and solving complex problems. Similarly, students who only reach level 3, such as S2, are at risk of experiencing difficulties in solving complex problems that require mathematical reasoning and logical thinking.

Differences in students' mathematical literacy levels can be affected by various factors, both internal and external. One internal factor that affects students is their personality characteristics. Prasasti et al. (2023) argue that differences in personality characteristics can affect the way students determine the steps to solve problems. This is in line with the opinion of Ningsih and Awalludin (2021), who state that different personality types tend to produce different thinking processes. In the context of mathematical literacy, Nismaya (2018) shows that students' personality characteristics can influence the way students understand and solve mathematical problems.

Pervin (in Wulansari & Walid, 2021) defines personality as individual characteristics that form a consistent pattern of feelings, thoughts, and behaviors that distinguish one person from

another. Keirsey (1998) categorizes a person's personality into four types, which are guardian, artisan, rational, and idealist, based on patterns of behavior and ways of thinking (Agustin, 2018). The guardian type prefers learning with structured and traditional procedures. Students with this type need detailed, concrete, and systematic explanations of the material. This type tends to be inactive in class discussions and is more comfortable when the learning process follows fixed steps. The artisan type has an active, dynamic, and enthusiastic character in learning. Students with this type enjoy being involved in discussions, presentations, and have the drive to show their abilities. This type likes to do everything quickly and tends to be rushed and easily bored with monotonous learning. The rational type likes explanations based on logic. Students with this type are able to accept complex material and enjoy problem solving that requires critical and analytical thinking. This type also likes to ask questions because they are interested in the reasons or basic concepts behind the material being studied. The idealist type is interested in ideas and enjoys reading and writing. Students with this type prefer to complete tasks independently, but also enjoy interacting with other class members to get to know each other better. Students with this type tend to be reflective and humanistic in their learning.

Additionally, after completing the Keirsey personality type questionnaire, it was found that S1 is included in the artisan personality type, which is in line with a tendency to think hurriedly. This can be seen in S1's statement, “I see the numbers 60 and 19, then there are 12 rows, I think it just needs to be multiplied,” which ignores important information in the question and shows a desire to reach a solution quickly through simple calculations. In contrast, S2 was found to have a rational personality type, which indicates a more systematic and analytical thinking style. In S2's answers, it was shown that S2 was able to understand the information in the question and organize the steps to solve it based on the information found. This reinforces the importance of further research on how students' personality types can be related to their mathematical literacy levels in solving AKM numeracy problems.

Furthermore, several studies have examined student thinking based on Keirsey's personality types. The following presents previous studies and their differences from this study.

Table 3. Research Position

Researcher, year	Subject	Research Title	Research Focus
Khamidah & Suherman, 2016	Grade 11 High School Students	*Proses Berpikir Matematis Siswa dalam Menyelesaikan Masalah Matematika Ditinjau dari Tipe Kepribadian Keirsey*	Describe students' mathematical thinking in solving mathematical problems based on Keirsey personality types using Polya's problem-solving steps.
Agustin, 2018	Grade 6 Elementary School Students	*Proses Berfikir Matematis Siswa dalam Memecahkan Masalah Matematika Ditinjau dari Tipe Kepribadian Keirsey*	Describe students' mathematical thinking in solving mathematical problems on fraction content based on Keirsey personality types.
Novitasari et al., 2023	Grade 8 Junior High School Students	Students’ Mathematical Literacy in Solving PISA Problems Based on Keirsey Personality Theory	Describing students' mathematical literacy in solving PISA problems (shape and space content) based on Keirsey personality types.
Saputri & Darmawan, 2025	Grade 8 Junior High School Students	Mathematical Literacy Levels of Students in Solving AKM-Type Numeracy Problems Based on Rational and Artisan Personality Types	Analyzing the achievement level of students' mathematical literacy in solving AKM numeracy problems based on Rational and Artisan personality types and the factors that cause them.

Based on Table 3, Agustin (2018) describes students' mathematical thinking in solving fraction problems based on Keirsey's personality types and shows that all personality types can demonstrate indicators of mathematical thinking, even if not perfectly. Of the four personality types, students with the artisan personality type show the highest mathematical thinking ability in the problem-solving process. Khamidah and Suherman (2016) studied high school students' thinking in solving problem-solving questions and found that the guardian type was able to understand the problem but had difficulty in formulating the steps to solve it, while the artisan and idealist types also showed good understanding but were unable to determine the right solution strategy. Novitasari et al. (2023) studied the mathematical literacy of junior high school students in solving PISA problems with shape and space content based on Keirsey's personality types and found that the guardian and artisan types could identify problems and determine solution strategies but still had difficulty providing logical reasons for their answers. The idealist type was able to solve problems using a "trial and error" strategy and was able to use representations. The rational type demonstrated the highest level of mathematical thinking, showing the ability to use complex representations and more in-depth solution strategies with logical reasoning.

Previous research has studied students' mathematical literacy and mathematical thinking based on Keirsey personality types, while in this study, the researchers added a new focus on the context of AKM problems and analyzed mathematical literacy levels according to OECD standards based on Keirsey personality types. This study focused on two personality types, which are rational and artisan. These two types were selected based on previous research showing that both types are equally prominent in mathematical thinking. However, preliminary results in this study show that students with rational and artisan personality types are only able to achieve levels 1 to 3 in mathematical literacy, which is inconsistent with the results found in previous studies. In addition, these two types have different thinking characteristics, where the rational type tends to think systematically, logically, and strategically in solving problems, while the artisan type is more active and quick to develop strategies, but is spontaneous in behavior.

Based on preliminary studies and previous research, it is important to further study the factors that affect students' mathematical literacy levels in solving AKM numeracy problems. The purpose of this study is to analyze individual mathematical literacy levels and identify the factors that affect literacy levels based on rational and artisan personality types. The benefits obtained from this study include theoretical and practical aspects. Theoretically, this study contributes to the development of literature on mathematical literacy by adding the perspective of rational and artisan personality types in the context of AKM numeracy questions. Practically, the results of this study can be used as a reference for teachers in understanding students' ability profiles and thinking processes based on personality types, so that learning can be designed more effectively and in accordance with students' characters to improve learning outcomes.

In addition, this study is expected to provide empirical evidence regarding how different personality types influence students' strategies in interpreting and solving numeracy tasks. Furthermore, the findings may support the development of more adaptive and differentiated instructional approaches that align with students' cognitive characteristics and learning needs.

2. Method

2.1 Research Type

The type of research used in this study is descriptive qualitative, which aims to describe and provide an in-depth picture of a phenomenon or event as it is (Creswell & Creswell, 2018).

This approach was chosen to explore in more detail the level of students' mathematical literacy in solving AKM numeracy problems based on the Keirsey personality types, which are rational and artisan. In addition, this study also seeks to understand how students with different personality types approach and solve AKM numeracy problems, thereby gaining deeper insight into the strategies, thought processes, and the contributing factors behind the observed differences in student approaches.

2.2 Research Subject

The subjects of this research were eighth-grade students. The selection of research subjects was carried out through several stages that considered the students' mathematical literacy abilities and personality types. The researchers discussed with subject teachers about the students' mathematical literacy level and understanding of the tested topics to determine the classes that would be used as research subjects. In addition, the selection process also considered students' activeness and ability to communicate their thinking during problem-solving activities.

In this research, the researcher selected interview subjects using purposive sampling. This technique was used to deliberately select subjects based on certain characteristics that were relevant to the research objectives. The steps taken to determine the research subjects were as follows:

1. Conducting personality tests to students using the Keirsey personality type questionnaire.
2. Grouping the personality test results based on the students' personality categories.
3. Selecting interview subjects from the rational and artisan personality types who had completed the test.
4. Conducting interviews based on the test results until data saturation was reached, when no new information could be obtained from the subjects.
5. Screening the interview data, selecting only subjects with varied answers and different interview results.

Thus, the collected data can provide a more complete picture of students' mathematical literacy levels based on rational and artisan personality types.

2.3 Research Instrument

The main instrument in this research is the researcher, because the researcher plays a role in determining the focus of the research, selecting subjects as data sources, and evaluating the quality of the data obtained. In addition, the researcher also acts as an analyst and problem solver, drawing conclusions based on the research results (Darmawan and Yusuf, 2022). The supporting instruments in this research consisted of the Keirsey personality type questionnaire, a rubric for mathematical literacy level indicators, AKM numeracy test questions, interview guidelines, validation sheets, and recording devices.

1. Keirsey personality type questionnaire sheet
   This questionnaire is used to identify the personality types of the students who are the subjects of the research. The questionnaire contains a number of questions that measure students' personality tendencies into four main categories, which are guardian, artisan, idealist, and rational.
2. Rubric for mathematical literacy level indicators
   This rubric is used as a reference in assessing students' answers on the AKM numeracy test. The rubric is compiled based on mathematical literacy level indicators that refer to the OECD assessment, as shown in Table 4.

Table 4. Student Mathematical Literacy Level Indicators

Literacy Level	Mathematical Literacy Level Indicators
1	Using existing knowledge to solve problems in familiar contexts, where all required information is available and questions are clearly stated.
2	Interpreting problems and solving them using appropriate basic formulas or procedures.
3	Implementing the sequence of problem-solving steps correctly and choosing the appropriate problem-solving strategy.
4	Choosing a solution method and integrating different representations, then connecting them to the real world.
5	Using models to solve complex problems.
6	Using reasoning to solve mathematical problems, generalize, formulate, and communicate findings.

Source: (OECD, 2019)

3. AKM numeracy test sheet
   These test questions are used to measure students' mathematical literacy levels. The questions are compiled based on predetermined mathematical literacy level indicators, as presented in Table 5.

Table 5. AKM Numeracy Test Question Indicators

Question Number	Question Indicator	Literacy Level
1	Presented with a text about the opening of an auditorium. Students are given information about the seating arrangement in the auditorium, including the number of seats per row. Students are asked to calculate the difference between the first and second rows and calculate the number of seats in the last two rows.	4
2	Presented with information about the price of show tickets and the number of tickets sold for each audience category. Students are asked to create a mathematical model and calculate the income from ticket sales.	5
3	Presented with information about the construction of a new auditorium by taking seats from the odd rows of the previous auditorium. Students are asked to compare the n^{th} term formula for each auditorium.	6

4. Interview guidelines
   These interview guidelines contain an outline of questions used to explore further information about students' thinking in solving test questions during interviews. These guidelines are based on the indicators of mathematical literacy levels shown in Table 4.
5. Validation sheet
   Validation sheets are used to evaluate the validity of research instruments before they are applied to research subjects. Validation is carried out by experts to ensure that the instruments are appropriate for the research objectives. The instruments validated in this research were test sheets and interview guidelines.
6. Recording devices
   Recording devices are used to document interviews conducted with research subjects. This documentation aims to ensure that the data obtained can be transcribed and analyzed in depth.

2.4 Data dan Data Analysis Techniques

The data in this research came from various sources that were collected to provide accurate and relevant information. The data collected included the results of student personality tests, written answers from subjects in mathematical literacy tests, and interview recordings conducted to gain a deeper understanding of the students' answers. The data obtained from the research results were analyzed using interactive data analysis techniques by Miles and Huberman. These data analysis techniques consisted of data collection, data reduction, data presentation, analysis of findings, and drawing conclusions (Darmawan and Yusuf, 2022).

The data collection process was conducted through questionnaires, tests, and interviews. The researchers distributed questionnaires containing written questions related to Keirsey's personality types, distributed AKM numeracy test questions designed to measure students' mathematical literacy levels, and conducted interviews to obtain further explanations regarding students' written answers. The collected data was then filtered and selected based on the mathematical literacy level indicators determined by PISA. Data reduction was carried out to filter relevant information and eliminate data that was less significant to the research.

The next stage in the data analysis process is data presentation. This presentation is conducted to convey the results of the analysis systematically, which have been obtained from the data reduction process, so as to provide a clear picture of the patterns found in the research. Data presentation is conducted in the form of a narrative description based on students' written answers to the AKM numeracy test questions and the results of interviews conducted with the research subjects. The students' work results were analyzed based on the OECD's mathematical literacy level indicators and then compared with the interview results to deepen the understanding of the students' thinking processes in solving numeracy problems.

After the data was presented, the final step was to draw conclusions. Conclusions were obtained through analysis of the test and interview results, which were then compared to see the suitability of the data. This process was carried out with the aim of answering the research focus, which is to determine the level of students' mathematical literacy based on Keirsey's personality types, specifically the rational and artisan types. The researcher applied method triangulation to improve the accuracy of the research results. Method triangulation was carried out by comparing the data obtained from the written answers to the mathematical literacy test and the interview results.

3 Result and Discussion

3.1 Keirsey Personality Type Results

Based on the results of the Keirsey personality type questionnaire, it was found that each personality type was present among the 20 students in class VIII A and the 18 students in class VIII B. The distribution of these personalities can be seen in Table 6.

Table 6. Keirsey Personality Types of Eighth Grade Students

Personality Types	Number of Students		Percentage	
	Class A	Class B	Class A	Class B
Artisan	7	4	35,00%	22,22%
Guardian	6	7	30,00%	38,89%
Idealis	2	2	10,00%	11,11%
Rational	5	5	25,00%	27,78%
Amount	20	18	100%	100%

Based on the data presented in Table 6, it can be seen that in class A, the most dominant personality type is artisan, with a percentage of 35.00%. Meanwhile, in class B, the majority of students have a guardian personality type with a percentage of 38.89%, which shows that the guardian type is the most common personality type in that class. In addition, the personality type with the smallest percentage in both classes is idealist. In class A, only 10.00% of students belong to this personality type, while in class B, the percentage is 11.11%.

Students were given three AKM-type numeracy questions as presented in Table 5. The scoring system used followed the AKM assessment format. Each question was designed to measure a specific range of literacy levels. For example, question No. 1 focuses on level 4, thus students who reach that level are considered to have achieved the competencies required for level 1, 2, and 3. The same applies to questions No. 2 and No. 3. Students were categorized into a certain level if they reached all the indicators listed in Table 4 for that level. The final literacy level was determined based on the highest level that shows full competence in all the required indicators.

After the assessment was complete, research subjects were selected again based on the personality types and the diversity of their answers on the AKM test for the purpose of interviews. This selection ensured that the interview results would provide rich insights into various problem-solving strategies across different literacy levels. Students with identical responses were not selected, and the final results are presented in Table 7.

Table 7. Distribution of Mathematical Literacy Levels of Rational and Artisan Personalities

Personality Types	Number of Subjects			
	Level 3	Level 4	Level 5	Level 6
Rational	0	1	1	7
Artisan	2	0	2	4

Based on Table 7, the distribution of mathematical literacy levels of the interviewed subjects with rational and artisan personality types can be seen. The table shows that 7 subjects with the rational personality type were able to achieve level 6 mathematical literacy, 1 subject achieved level 5, and 1 subject achieved level 4. Meanwhile, in the artisan personality type, there were 4 subjects who achieved level 6, 2 subjects who achieved level 5, and 2 subjects who achieved level 3.

3.1.1 Mathematical Literacy Level of Students with Rational Personalities

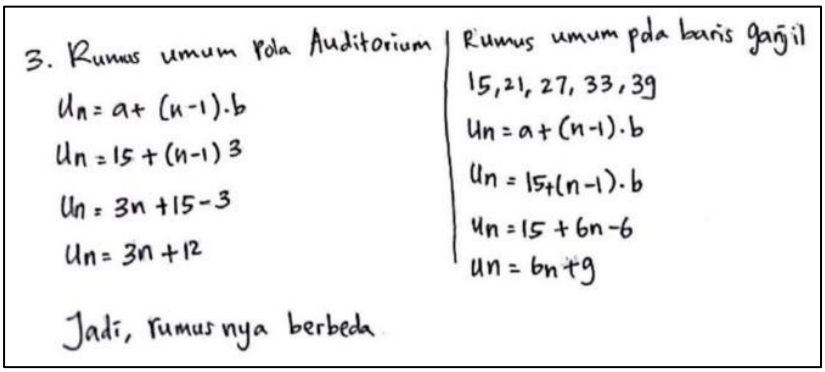


Figure 4. Answer to Question Number 3 Subject R1

At level 6 of mathematical literacy, students are supposed to be able to use reasoning to solve math problems, generalize, formulate models or formulas, and clearly communicate their

findings. This level is the highest level of mathematical literacy according to the OECD, so only a small number of subjects are able to achieve it optimally. Based on the analysis of question number 3, subject rational 1 (R1) was able to generalize, formulate, and conclude the answer correctly. Question number 3 required the subject to compare two sequence patterns, which are the pattern of many seats in the Main Auditorium and the new pattern formed from the odd rows of the Main Auditorium as the Private Auditorium. R1 was able to find a new pattern from the odd rows of the seating pattern in the Main Auditorium. As shown in Figure 4, R1 was able to correctly formulate two general formulas, which are for the seating patterns in the Main Auditorium and the Private Auditorium. This ability shows that the subject is not only able to determine patterns in numerical form, but can also generalize these patterns into algebraic form. In the interview, R1 explained that subject found a new pattern taken from the odd rows in the seating pattern of the Main Auditorium, as shown in the following interview.

Table 8. Interview 1

P	:	Here you write down the formula for the odd row pattern. What does the pattern look like?
R1	:	The pattern is 15, 21, 27, 33, and 39.
P	:	How did you determine the odd row pattern?
R1	:	It was taken from the initial pattern, the Main Auditorium, selecting only the odd rows.

After determining the pattern, R1 formed a general formula from the two patterns obtained using the nth term formula in arithmetic sequences, which is $Un = a + (n-1)b$. This formula was correctly applied based on the information that subject R1 had identified from the previous patterns. After forming the general formula from the two patterns, R1 connected the information that had been obtained to compare whether the two formulas were the same or not. In the answer, R1 concluded that the two formulas were different because the structure of each formula was different. This shows that the subject was able to apply the knowledge that subject knew to draw logical conclusions.

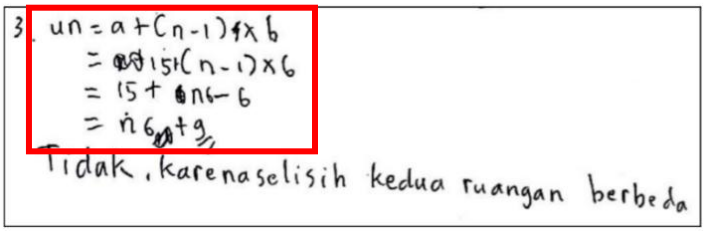


Figure 5. Answer to Question Number 3 Subject R2

Besides subject R1, subject rational 2 (R2) also showed the ability to generalize patterns into algebraic forms, specifically for the Private Auditorium seating pattern, as shown in Figure 5. R2 found the pattern in the same way as R1, which was to take the odd rows from the Main Auditorium pattern to form a new pattern. After determining the new pattern, R2 formulated a general formula using the nth term formula, which is $U_n = a + (n-1)b$, with a value of $a = 15$ and a difference of $b = 6$, so that R2 found the general formula for the new seating pattern, which is $6n + 9$, as shown in Figure 5 marked with a red box. However, unlike R1, who compiled and compared two general formulas from the two patterns found, R2 only compiled a general formula for one pattern, which is Auditorium Private. However, R2 was still able to draw conclusions about the general formula for both patterns, even though the reasoning used was not the same as that stated by R1. R2 concluded that the general formulas for the two

auditoriums were different because the difference in seats between rows in the Main Auditorium and the Private Auditorium was not the same. The subject argues that in formulating the formula, the information used is the initial value and the difference between rows, so if the difference is different, the formula results cannot be the same. This shows that even though the reasoning strategies differed, with R1 comparing the structure of the formula formed and R2 based their conclusions on observations of the sequence pattern, both subjects were still able to draw logical conclusions that were appropriate to the context of the problem.

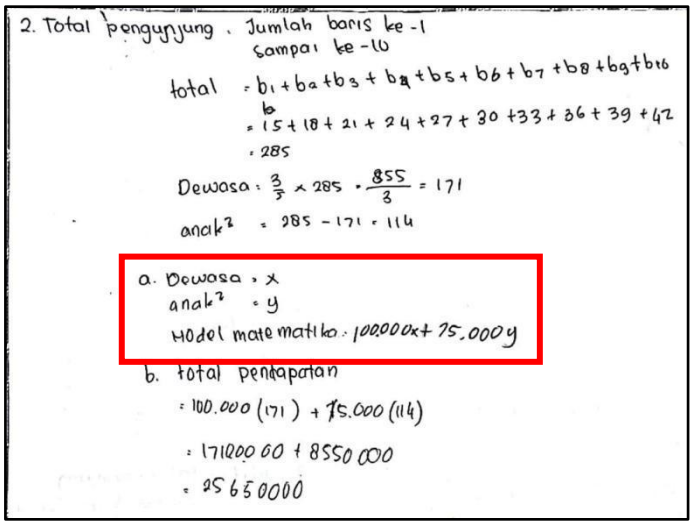


Figure 6. Answer to Question Number 2 Subject R3

At level 5 of mathematical literacy, students are supposed to be able to use models to solve complex problems. In this context, all subjects with a rational personality showed the ability to create mathematical models in question number 2. The only rational subject who was able to reach level 5 was rational 3 (R3), as shown in Figure 6. The figure shows that R3 formed a mathematical model using variables that the subject determined themselves. R3 chose to use the variable x to represent the number of adult visitors and y to represent the number of child visitors. R3 used these variables in a mathematical equation to calculate the income from ticket sales, which was the purpose of the question. In an interview, R3 explained that creating mathematical models helped subjects simplify information and make it easier to find solutions. The following is an excerpt from an interview with subject R3.

Table 9. Interview 2

P	:	What was your reason for creating this mathematical model?
R3	:	Because this mathematical model makes it easier to understand the problem and the time required to solve it.

Based on interview 2, R3 was able to clearly explain the reason for creating a mathematical model, which is to make it easier to understand the problem and to make it easier to solve the problem. This shows that R3 understands the function of mathematical models as a tool to help in the problem-solving process. By representing the information from the problem in the form of a mathematical model, the subjects can simplify the information and plan the steps for solving the problem systematically.

Meanwhile, the other rational subjects did not write down the mathematical model explicitly in the form of equations using variables. However, from their solution patterns, it can be seen that the subjects still modeled the situation in a similar form. The subjects directly calculated the total ticket income based on the number of seats and the ticket price for each

category. The answers used by the subjects still reflected an understanding of the problem structure, even without the use of mathematical equations. The calculations performed by the subjects can be considered equivalent to the mathematical model formed by R3. The difference is in the form of presentation, not in the understanding of the concept.

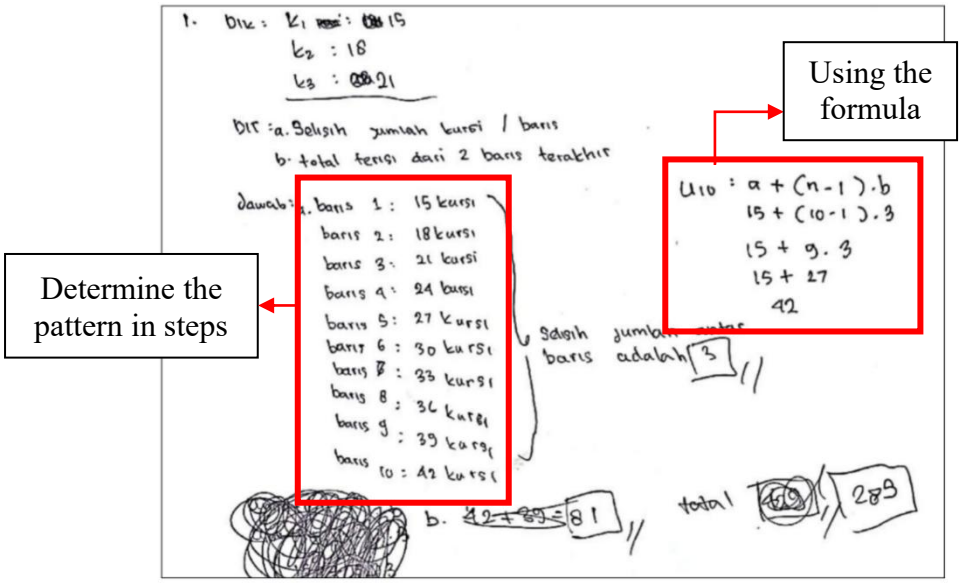


Figure 7. Answer to Question Number 1 Subject Rational 4 (R4)

At level 4 of mathematical literacy, subjects are supposed to be able to choose a solution method, integrate different representations, and connect them to the real world. After reaching level 3 by determining a strategy for solving problems, subjects then choose the solution method used to apply that strategy. Based on the analysis of question number 1, the rational subject who was only able to reach level 4 was rational 4 (R4), as shown in Figure 7, marked with a red box. The solution method chosen by R4 is to use a combination of two methods, using a formula and determining the pattern in steps by adding the differences between rows until reaching row 10.

3.1.2 Discussion of the Subject of Rational Personality

The results of the research show that the majority of subjects with a rational personality type showed a very good level of mathematical literacy in solving AKM numeracy problems. Of the subjects under research, R4 subjects were only able to reach Level 4, R3 subjects reached Level 5, while most other rational subjects successfully reached Level 6, which is the highest level. This achievement was supported by several factors. Internally, the innate characteristics of rational individuals have a big role. The subjects tend to have logical, systematic, and analytical thinking patterns, which enable them to develop efficient and appropriate problem-solving strategies. This is consistent with the findings of Jumrah (2023), that students with rational personality are capable of generating solutions grounded in logical reasoning, not just based on intuitions. In addition, rational subjects often demonstrate a high degree of independence in making decisions related to solution strategies, as well as the courage to try various solution methods as long as they are appropriate to the context of the problem. In line with the analytical and systematic nature of rational subjects, most rational subjects also have a habit of reading the questions repeatedly to ensure a thorough understanding of all the information provided in the questions. This is supported by the results of research by

Fitriyaningsih and Ni'mah (2023), which states that students with the rational type read questions repeatedly to ensure proper understanding and are able to draw conclusions from the problems in the questions.

From external factors, the achievement of this high level of mathematical literacy can also be affected by previous learning experiences. Most likely, rational subjects are accustomed to solving complex and contextual problems, so their skills in handling AKM numeracy tasks are well developed. In other words, the success of rational subjects in achieving the highest level in solving AKM numeracy problems is not only influenced by their personality traits, but also supported by prior learning experiences that align with their analytical and systematic thinking style. This is further supported by an interview with the mathematics teacher in the students' class, who stated that students with certain personality tendencies are generally more active and enthusiastic when dealing with challenging, context-based problems compared to their peers. Such engagement is often linked to their preference for logical reasoning and structured problem solving. This finding is consistent with Rahmah et al. (2024), who argue that the greater the variety and intensity of students' learning experiences, the higher the level of knowledge and competence they achieve. Therefore, the alignment between personality characteristics and the nature of the tasks given becomes an important factor in fostering optimal mathematical literacy development. Although this study did not explicitly measure the types or frequency of prior learning experiences, the observed performance patterns suggest that such experiences play a meaningful supporting role, and this aspect can be explored more deeply in future research.

However, researchers also identified several additional findings that provide a more nuanced understanding of rational students' performance. Some rational subjects still demonstrated a tendency to be less thorough when completing problems, particularly in the final stages of calculation. Such patterns indicate that errors did not stem from a lack of understanding, but rather from lapses in carefulness and verification during the final steps. This observation aligns with the findings of Nada et al. (2024), which highlight that students with a rational personality type may prioritize efficiency and logical structure over meticulous checking, leading to minor but impactful computational mistakes. Consequently, this suggests that fostering mathematical literacy should not only emphasize conceptual mastery and reasoning skills but also the development of accuracy and attention to detail. Integrating reflective practices, such as rechecking answers and validating results, may help rational students achieve more consistent and precise outcomes in solving AKM numeracy problems.

On the other hand, rational subjects also always tried to take the time to double-check their answers. This explains why most rational subjects tended to submit their answers close to the end of the time limit, or even when the time limit had ended. In addition, a high level of curiosity was also apparent in some rational subjects, who actively asked questions and sought answers about things they did not understand or mistakes they had made. These findings are in line with Agustin (2018) research, which shows that the rational type is able to recognize the importance of the learning process and does not hesitate to ask questions and seek explanations from others to improve their understanding. This trait also serves as an additional driver for the learning process and understanding of rational subjects.

3.1.3 Mathematical Literacy Level of Students with Artisan Personalities

Based on the analysis of question number 3, the artisan subject capable of generalizing, formulating, and correctly concluding the answer is artisan subject 1 (A1). A1 was able to find a new pattern from the odd rows of seats in the Main Auditorium, as shown in Figure 8.

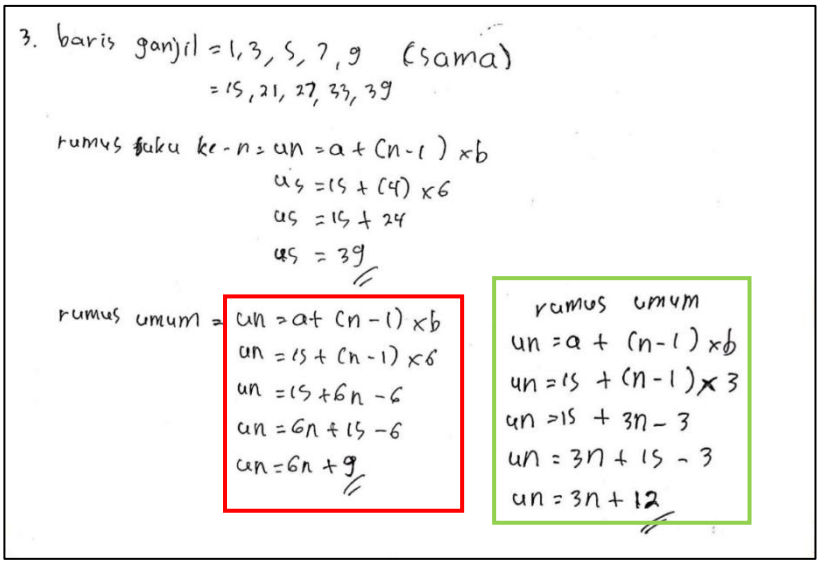


Figure 8. Answer to Question Number 3 Subject A1

Based on the analysis of question number 3 in Figure 8, the artisan subject capable of generalizing, formulating, and correctly concluding the answer is artisan subject 1 (A1). A1 was able to find a new pattern from the odd rows of seats in the Main Auditorium, as shown in Figure 8. A1 used the formula for finding the n^{th} term to generalize the pattern into an algebraic form and obtained the result $U_n = 6n + 9$, as marked in red. A1 also found the general formula for the rows in the Main Auditorium in the same way, obtaining the result $U_n = 3n + 12$, as marked in green. This was reinforced by A1's statement in Interview 3.

Table 10. Interview 3

P	:	From question number 3, did you find a new pattern?
A1	:	The odd-numbered rows are taken from rows 1, 3, 5, 7, and 9. So we get the pattern 15, 21, 27, 33, and 39.
P	:	How do you determine the general formula for the n^{th} term?
A1	:	Using the Un formula. For a, since it's the beginning, a is 15. For b, it's 6, because I took it from the 1st and 3rd rows, which have a difference of 6, so b is 6.

Based on the interview results, it can be understood that A1 is able to explain the pattern determination process coherently and consistently, and can relate the patterns found to the concept of the general formula for arithmetic sequences. This further strengthens A1's achievement at level 6 of mathematical literacy, which is being able to generalize, formulate, and communicate the conclusion reached.

Several other artisan subjects have not been able to reach this level because they still do not understand how to generalize patterns and are unable to understand what is meant in the questions. Although there are subjects who try to use the n^{th} term formula to help with generalization, the formulation process is not correct, so the results obtained are not in line with the expected solution.

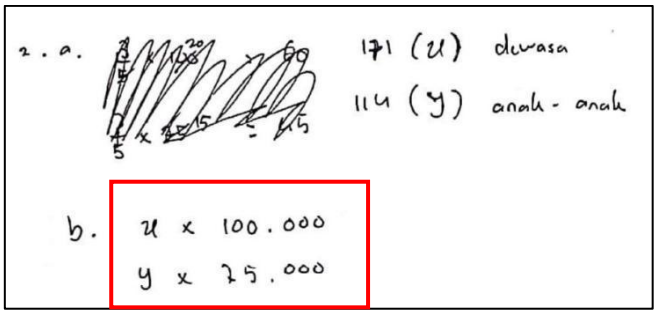


Figure 9. Answer to Question Number 2 Subject A2

Meanwhile, there were two artisan subjects who were only able to reach level 5 by showing their ability to use mathematical models to solve complex problems. This achievement can be seen in the solution to question number 2 by artisan subject 2 (A2), as shown in Figure 9. Subject A2 was able to show the ability to form mathematical models based on the information available in the question in the form of algebraic equations. However, the equation was not complete until the second category was added, because A2 only modeled how to calculate ticket income per category without adding them up and then adding them directly in the calculation process.

Besides that, at level 4, there are artisan subjects who use a circle diagram to help solve the problem, as shown in the answer of artisan subject 3 (A3) in Figure 10 below.

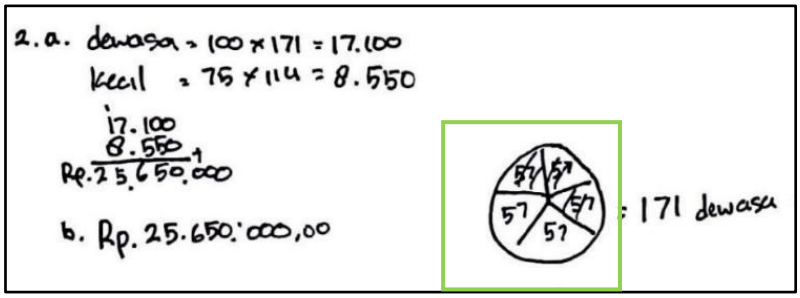


Figure 10. Answer to Question Number 2 Subject A3

In Figure 10, subject A3 uses visual representation in the form of a pie chart to help determine the number of adult visitors, which in the question is known to be $\frac{3}{5}$ of the total number of visitors. The subject divided the circle into five equal parts by dividing the total number of visitors by 5 and obtaining a result of 57 people for each part. The subject then shaded 3 parts as a representation of adult visitors, as shown by the green marks.

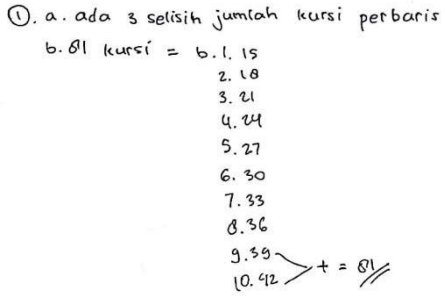


Figure 11. Answer to Question Number 1 Subject A4

There are two artisan subjects who were only able to reach level 3. This achievement can be seen in the answer to question 1, which was completed by artisan subject 4 (A4) in Figure 11. In Figure 11, it can be seen that A4 correctly carried out the sequence of steps to solve the

problem to determine the number of seats in the last two rows. A4 solved the problem by finding the number of seats in each row using the method of adding the differences sequentially to obtain the number of seats in rows 9 and 10, then adding the two to obtain a result of 81 seats. This is also shown in A4's statement in Interview 4.

Table 11. Interview 4

P	:	How did you solve this problem?	
A4	:	I used my own method. So, I multiplied by 3 first, to get 15, 18, 21, 24, and so on up to the 10th row. But actually, I added 3. Now, in the last two rows, there are 39 and 42, which add up to 81.	(1)
P	:	Is there another way you can solve this?	
A4	:	Actually, there is another way, using the n^{th} term formula. I didn't use that formula because I tried to use another formula, but the result is still the same.	(2)

Based on the interview results, in statement (1), subject A4 was able to explain that A4 found the sequence pattern by adding the differences sequentially until reaching the 10th row. This shows that the subject understands the addition pattern even though he still uses simple arithmetic strategies. Furthermore, in statement (2), when asked about alternative methods of solution, A4 was able to identify another, more formal method, by using the n^{th} term formula. However, the subject preferred to use a strategy that the subject considered easier, even though it was less efficient. This shows that A4's main focus was on obtaining the correct final answer, rather than on using a more common or formal mathematical method.

3.1.4 Discussion of Artisan Personality Subjects

The research results show that the majority of subjects with artisan personality types achieved a fairly good level of mathematical literacy in solving AKM numeracy problems. Of the subjects under research, subject A4 was only able to reach level 3, subjects A3 and A2 were able to reach level 5, while subject A1 was able to reach level 6, which is the highest level of mathematical literacy according to the OECD. This achievement was affected by several factors. Internally, artisan subjects had a flexible, intuitive thinking style and preferred practical problem-solving approaches. In solving context-based numeracy questions, such as AKM problems, artisan subjects were able to quickly find important information, even though in the process they often ignored other information or the content of the story in the question. This quick processing is explained by the research of Sunarto et al. (2017), that when trying to understand a problem, the artisan type prioritizes the question first, before considering other information. This means that artisan type focus only on the key details needed to answer the question, causing them to quickly filter out information that is not essential.

The ability of some artisan subjects to reach levels 5 to 6 is also demonstrated by the way they intuitively develop strategies and use visual or numerical representations, even though they are not yet able to write mathematical models in the form of equations or in a more systematic manner. According to Keirsey (1998), the artisan types tend to articulate their thought process and understanding by using drawings. Relawati and Lukito (2020) found that the student with artisan type expresses their thought process in the form of pictures and written notes. Although artisan subjects are not yet able to show other representations or mathematical models, they are still able to process information and apply it to the context of the question. In addition, the artisan subject's tendency to get bored easily and lack of interest in long thinking processes can

also be a hindrance in solving problems, especially those that require reading, understanding the context, and constructing mathematical models before reaching a final conclusion.

Researchers also found several additional findings, in which most artisan subjects submitted their answers earlier than other subjects, because they felt enough with their answers and were reluctant to work on the questions again, which shows a tendency to immediately complete the questions when they feel bored or lose interest. This finding is consistent with the research by Nurfajriah and Sugiman (2024), which states that subjects are always in a hurry to complete tasks and draw incorrect conclusions. In addition, some subjects were seen daydreaming or even drawing things outside the context of the questions during the test to avoid boredom when faced with questions that were too long. This condition shows that artisan subjects need interesting stimulation to stay focused on completing the questions.

3.2 Differences in Mathematical Literacy Levels Between Rational and Artisan Personality Subjects

Based on the results of the research, differences were found between the mathematical literacy levels of students with rational personalities and those with artisan personalities in solving AKM numeracy problems. Students with rational personalities showed higher mathematical literacy levels than students with artisan personalities. Most subjects with rational personalities were able to achieve a high level of mathematical literacy, which is level 6. Of the nine rational subjects, seven were able to reach level 6, one subject reached level 5, and one other reached level 4. This shows that the majority of rational subjects were able to understand contextual problems and determine strategies for solving complex problems. On the other hand, out of the eight artisan subjects, four subjects were able to reach level 6, two subjects reached level 5, and the other two subjects were only able to reach level 3.

These differences in achievement are affected by the thinking characteristics of each personality. Rational subjects are able to think logically and analytically, which makes it easier for them to understand information, determine strategies for solving problems, and draw conclusions. The habit of reading questions repeatedly and more learning experience are also supporting factors in achieving mathematical literacy. Meanwhile, artisan subjects have an intuitive and flexible thinking style and prefer practical solutions. This allows them to quickly obtain important information, but they may overlook other information that may be necessary for problem solving. Some artisan subjects also tend to solve problems immediately, which affects their in-depth analysis of numeracy questions.

4 Conclusion

Based on the results of the research, it can be concluded that the level of mathematical literacy of students in solving AKM numeracy problems shows a diversity of achievement levels. Subjects with a rational personality type were able to achieve a level of mathematical literacy of one subject at level 4, one subject at level 5, and seven subjects at level 6. Meanwhile, students with artisan personality types achieved mathematical literacy levels of two subjects at level 3, two subjects at level 5, and four subjects at level 6. These levels of achievement were affected by the thinking characteristics of each personality type, whereby rational students were able to think logically and analytically. In contrast, artisan students demonstrated practical and intuitive thinking, but disliked lengthy thinking processes. In addition, learning experiences also affect the achievement of mathematical literacy levels, especially in accustoming students to dealing with contextual problems. The learning strategies designed should be able to be adapted to the thinking characteristics of each personality.

Based on this research, it is recommended that further research be expanded to review other aspects, such as affective aspects, which include students' interest and motivation in solving AKM numeracy problems. In addition, further research can be conducted with a subject scope that involves different levels of education so that the research results can be more general and are also expected to contribute to the development of mathematics learning to improve students' mathematical literacy levels.

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