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Problem Solving Process of AKM Algebra Content in Junior High School Students Reviewed from Extrovert and Introvert Personality Types

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Abstract

This study aims to describe the problem-solving process of AKM algebra content in junior high school students with extrovert and introvert personality types. This study is a descriptive-qualitative study conducted in class VIII of junior high schools in Sidoarjo Regency. The subjects in this study consisted of 2 students with equal mathematical abilities, namely 1 extrovert student and 1 introvert student. The research instruments were in the form of MBTI personality type questionnaires, TPM AKM questions, and interview guidelines. Data analysis techniques were carried out through the stages of data reduction, data presentation, and drawing conclusions. The results of the study showed that the problem-solving process of AKM extrovert students in understanding problems was to use symbols and not write to state what was asked, while introvert students used symbols and wrote to state what was known and what was asked. In the step of making a plan, extrovert and introvert students can consider the strategies used in solving the problem. In the step of implementing the plan, extrovert and introvert students use the chosen strategy to solve the problem. In implementing the plan, introvert students check all steps repeatedly while extrovert students check only part of the steps. Then, in the review step, extroverted students only rechecked some of their solutions, while introverted students rechecked all of their solutions. Finally, the results of this study can provide information for teachers as consideration and input so that they can develop students' problem-solving processes during learning.

Keywords: problem solving process, AKM, extrovert, introvert

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan proses pemecahan masalah AKM konten aljabar pada siswa SMP dengan tipe kepribadian *ekstrovert* dan *introvert*. Penelitian ini merupakan penelitian deskriptif – kualitatif yang dilaksanakan pada kelas VIII SMP di Kabupaten Sidoarjo. Subjek dalam penelitian ini terdiri dari 2 siswa dengan kemampuan matematika setara yaitu 1 siswa *ekstrovert* dan 1 siswa *introvert*. Instrumen penelitian berupa angket tipe kepribadian MBTI, soal TPM AKM, dan pedoman wawancara. Teknik analisis data dilakukan melalui tahap reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa proses pemecahan masalah AKM siswa *ekstrovert* dalam memahami masalah yaitu menggunakan simbol dan tidak menuliskan untuk menyatakan apa yang ditanyakan sedangkan siswa *introvert* menggunakan simbol dan menuliskan untuk menyatakan apa yang diketahui sekaligus apa yang ditanyakan. Pada langkah membuat rencana, siswa *ekstrovert* dan *introvert* dapat mempertimbangkan strategi yang digunakan dalam menyelesaikan masalah. Pada langkah melaksanakan rencana, siswa *ekstrovert* dan *introvert* menggunakan strategi yang dipilih untuk memecahkan masalah. Dalam melaksanakan rencana, siswa *introvert* melakukan pengecekan semua langkah secara berulang kali sedangkan siswa *ekstrovert* melakukan pengecekan hanya sebagian langkah. Kemudian, pada langkah melihat kembali, siswa *ekstrovert* hanya melakukan pengecekan kembali pada sebagian penyelesaiannya sedangkan siswa *introvert* melakukan pengecekan kembali pada semua penyelesaiannya. Terakhir, hasil penelitian ini dapat memberikan informasi bagi guru sebagai bahan pertimbangan dan masukan sehingga dapat mengembangkan proses pemecahan masalah siswa saat pembelajaran.

Kata kunci: proses pemecahan masalah, AKM, ekstrovert, introvert

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Introduction

Rini et al. (2020) stated that one of the basic skills needed by students in the 21st century is problem-solving skills. In mathematics learning, the problem-solving process is very important and

even the heart of mathematics (Prayoga et al., 2021). This is in line with the opinion of Folger et al. (2022) that problem solving is the main focus of mathematics teaching and learning. In addition, problem-solving skills are also included in the curriculum in most countries. Furthermore, one of the main objectives of the mathematics curriculum in most countries is to teach problem solving (Olivares et al., 2021). This shows that problem solving plays an important role in mathematics education and should have a major role in mathematics education. In solving a problem, a process or problem-solving steps are needed. Polya (1973) suggested that systematically arranged problem-solving steps can make it easier for students to solve mathematical problems. These steps consist of four steps, namely understanding the problem, making a plan, implementing the plan, and looking back.

The Indonesian Minister of Education and Culture stated that numeracy is one of the main competencies measured in the National Assessment in the 21st century, called the Minimum Competency Assessment (AKM). AKM is defined as an assessment of the fundamental competencies needed by all students to be able to develop their capacity and participate positively in society, where there are two fundamental competencies measured, namely reading literacy and numeracy (Pusmenjar, 2020). Rivai et al. (2023) explained that mathematical literacy helps someone recognize the role or use of mathematics in everyday life. Furthermore, mathematical problem solving is one of the skills that influence students' literacy and numeracy skills (Salvia et al., 2022). Numeracy skills are very important because they involve students' reasoning power or critical patterns to solve any problems that arise. Students with good numeracy literacy skills can solve problems and think critically about the problems they face (Novitasari, 2022). Based on the results of Indonesia's achievements in the Program for International Student Assessment (PISA) in 2022, it was found that the average score of Indonesian students in mathematics was 366, while the average OECD (Organization for Economic Co-operation and Development) score was 472 (OECD, 2023). These results provide evidence that the numeracy scores of Indonesian students are still below average. So that there needs to be an effort to be able to increase the average score of Indonesian students in the next assessment. In this regard, one of the efforts made by the Indonesian government is through the Minimum Competency Assessment (AKM), which each component refers to the components in PISA and TIMSS (Kemendikbud, 2020).

In solving mathematical problems especially algebra, mastery of algebraic skills is very important (Kusuma et al., 2024). Algebra is one of the AKM numeracy contents that can possibly bring out students' problem solving process. This is because algebra is considered the basis for understanding other mathematical concepts. The algebra material used in this study is the material for linear equations of two variables. Because based on Indonesian education report card data in 2023 shows unsatisfactory results, namely only 40.63% of junior high school / MTs students who have numeracy competencies above the minimum. In addition, based on the results of research conducted by Wulandari et al. (2016) shows that in solving SPLDV problems, students experience difficulties including: (1) students are unable to state what is known and asked from the given problem, (2) students cannot make mathematical models, (3) students are less careful when working so that they incorrectly use algebraic operations such

as addition, (4) students do not know how to look back correctly and what needs to be looked at again. Based on the results of this study, it can be said that students' abilities are still low in solving mathematical problems. This fact can be seen from the many difficulties experienced by students in solving math problems.

Desmita (2014) says that one of the prominent characteristics in junior high school children is the tendency of ambivalence, between the desire to be alone and the desire to hang out. These characteristics in children are closely related to their personality. Therefore, with such characteristics of middle school-age children, teachers are expected to apply learning approaches that pay attention to individual or small group differences (Desmita, 2014). In this case, one of the differences in students can be seen based on differences in personality types. Differences in students' personality types affect their ability to solve math problems (Sari & Kurniasari, 2022). The differences in personality that a person has will affect the way a person solves problems so that it is impossible to solve problems with the same approach and decision making (Okike & Amoo, 2014). So students with different personality types are different in solving problems.

Based on Suryabrata (2016) classifies personality types into two large groups, namely extrovert and introvert personality types. Huitt (1992) noted several relationships between personality types and problem solving, namely (1) individuals who tend to be introverts take longer to think and clarify their ideas before starting to speak, while individuals who tend to be extroverts talk through ideas to clarify them, (2) individuals who tend to be introverts will be more concerned with understanding their concepts and ideas, while individuals who tend to be extroverts will continue to seek feedback from the environment about the continuation of their ideas.

Based on previous research conducted but has not discussed the problem solving of AKM algebra content related to extrovert and introvert personality types. The solution to AKM numeracy problems is not only in the ability to count but also in the ability to think in solving problems. Numeracy in AKM and problem solving show that both have an interrelated relationship. Numeracy in AKM has the intention to train students in reasoning, thinking creatively, and honing the problem solving given, especially in the form of descriptive questions. The purpose of this study is to describe the process of solving AKM algebra content problems in junior high school students with extrovert and introvert personality types.

Method

This study is a qualitative study that aims to describe the problem-solving process of AKM algebra content in junior high school students with extrovert and introvert personality types. This study was conducted in class VIII at one of the junior high schools in Sidoarjo. The research subjects selected were one student with an extrovert personality and one student with an introvert personality with the criteria of having equivalent mathematical abilities (maximum difference of 5 points between TPM AKM scores), fluency and openness of oral communication. The instruments used were MBTI

personality type questionnaires, TPM AKM questions, and interview guidelines. The personality type questionnaire was used to determine the personality type of students. AKM problem-solving tasks (TPM AKM) were used to determine research subjects with equivalent mathematical abilities and how students solved AKM algebra content problems. Interviews were used to obtain deeper information about students' problem-solving processes that were not obtained during the test. Data collection was obtained using the test method (TPM AKM) and the interview method. The data analysis technique used was based on Miles et al. (2014), namely through the stages of data reduction, data presentation, and drawing conclusions. The data obtained were analyzed based on Polya's (1973) problem-solving process indicators as follows.

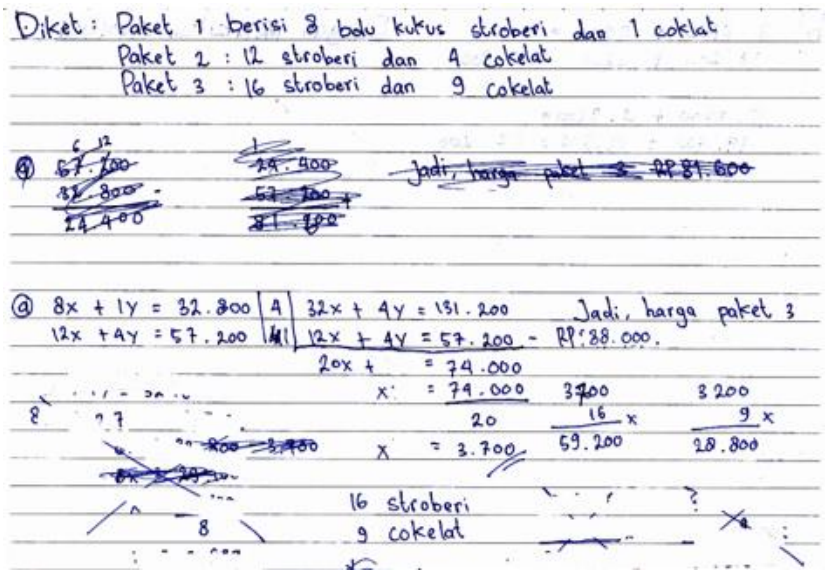
Table 1 Indicators of AKM Problem Solving Process on Algebra Content

Polya's Problem Solving Process	**Problem Solving Indicator**
Understand the problem	a. Identify what information is known, what conditions are needed to solve the algebra problem, and what questions are asked in the algebra problem. b. Using notation appropriate to algebraic problems. c. Create a mathematical model of the problem at hand.
Make a plan	a. Make a problem-solving plan by considering problems that have been solved before or the same problem in a different form. b. Choosing a strategy to solve the problem.
Implementing the plan	a. Using the chosen strategy to solve the problem. b. Check the correctness of each step taken.
Looking back	Rethinking what has been done.

Result and Discussion

After analyzing the problem solving process of each subject, the following results were obtained.

1. Extrovert Subject Problem Solving Process



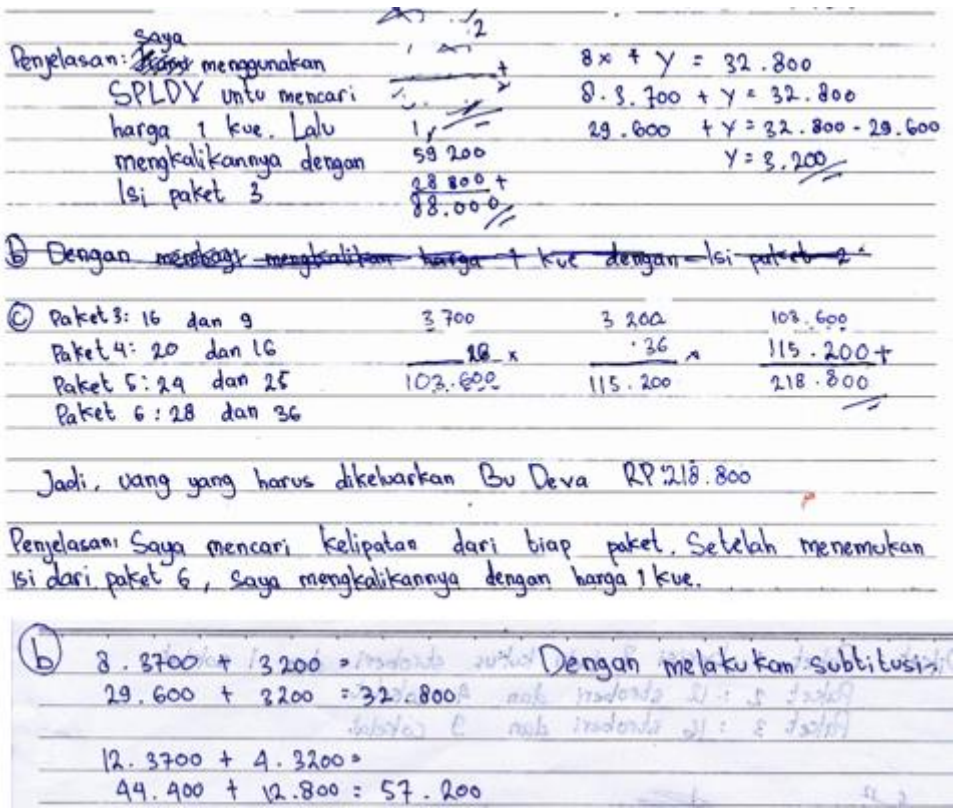


Figure 1 Answers to TPM AKM Extrovert Subject

The initial process of extrovert subjects in understanding the problem is to repeat reading the questions four times. This is because extrovert subjects have difficulty in accessing information from the given problem so they need to reread it until they really understand it. Extrovert subjects are able to recognize known information and questions asked in the problem correctly. Extrovert subjects identify the information available (known) in the given problem, namely package 1 consisting of eight strawberry steamed cakes and one chocolate steamed cake, package 2 consisting of twelve strawberry steamed cakes and four chocolate steamed cakes, and package 3 consisting of sixteen strawberry steamed cakes and nine chocolate steamed cakes. Then, extrovert subjects can identify the information asked in the problem, namely the first question is to find the price of one steamed cake, then calculate the price of package 3, the second question is how to find or ensure the answer to the first question, and the third question is asked to find the price of package 6. Extrovert subjects can express known information and questions asked in the problem correctly and sometimes see questions on the TPM AKM question sheet. But in their answers, extrovert subjects did not note down the questions that had been asked because they forgot and were not careful enough. This is in line with Suryabrata's (2016) that extroverts are fast but less careful, and have low aspiration levels, but tend to overestimate their own achievements.

Furthermore, extrovert subjects were also able to identify the requirements to solve the problem including: knowing the contents of each package and the price of one strawberry steamed cake and the price of one chocolate steamed cake. Extrovert subjects confidently stated that the requirements that had been expressed were sufficient in solving the problem because from the first question it

was clear that they had to find the price of one steamed cake, then they could find the answer. This is in line with Widayanti (2016) that extrovert individuals tend to talk about their ideas to clarify them and always seek feedback from the environment regarding the development of these ideas. In other words, extrovert individuals do not need much time to think and have high confidence in their ideas.

In addition, in solving the problem, extrovert subjects use notation or symbols (x and y) as the price of strawberry steamed cake and the price of chocolate steamed cake, and formulate a mathematical model for the given SPLDV problem, namely 8x + 1y = 57,200 for the equation in package 1 and 12x + 4y = 57,200 for the equation in package 2. This is in line with the results of Susanti's (2018) reserach which states that extrovert students have the characteristics to encode or interpret objects into codes or symbols.

The next process carried out by extrovert subjects is to make a plan based on the problems that have been given. In planning, extrovert subjects always try various solutions to find the most appropriate solution. Even though they felt hopeless at first, extrovert subjects remain determined to try further until they can find the right way or solution to solve the problems encountered. This is in line with Suryabrata (2016) stating that students with extrovert personalities do not give up easily when given math problems and continue to look for solutions.

The next process is the process of implementing the plan based on the planning that has been made previously. The extrovert subject confidently said that the method used to solve the SPLDV problem was substitution and understood the meaning of the method. Based on what was seen on the answer sheet, the extrovert subject also used the elimination method. However, the extrovert subject without much thought revealed that the method was the substitution method and then quickly changed his position and answered that the method in question was the elimination method. This is in accordance with Suryabrata's (2016) which states that one of the characteristics of extroverts is their tendency to be inconsistent in their positions and generally they act quickly but are less careful. This is also in line with Suryabrata (2016) that extroverts tend to behave without thinking first, are always ready to respond, like change, and do not consider much.

In the process of re-checking, extrovert subjects confidently state that the answers obtained and the completion process carried out are correct. Extrovert subjects re-check each process or steps of the solution and the answers obtained by checking their calculations. This is in line with Widayanti (2016) that extrovert individuals tend to continuously seek feedback from the environment regarding the development of their ideas and have high self-confidence.

The extrovert subject stated that at first he made a mistake but after reviewing it again the extrovert subject realized that after entering the values of x and y in the equations of packages 1 and 2 the price was not the same as the price of packages 1 and 2 in the question so the extrovert subject rechecked his work and worked on it again. This is in line with research of Suryabrata (2016), when associated with the activities of extrovert students in learning mathematics, then the

students show an active attitude in learning both individually and in groups, think logically and mathematically, and do not give up easily in finding solutions when faced with mathematical problems, but tend to be less critical and careless in solving problems.

However, the extroverted subject did not check question c because of the multiples so that the extroverted subject felt that the part did not need to be checked. Based on this description, it can be concluded that the extroverted subject is impatient when encountering problems. This is in accordance with what Djaali (2023) stated that individuals with extroverted personalities tend to be impatient when encountering problems. In addition, from the minutes in the field it appears that extrovert subjects are among the earliest to submit the results of their work. This is in line with Suryabrata's statement (2016) that people with extrovert personalities usually work quickly.

2. Introvert Subject Problem Solving Process

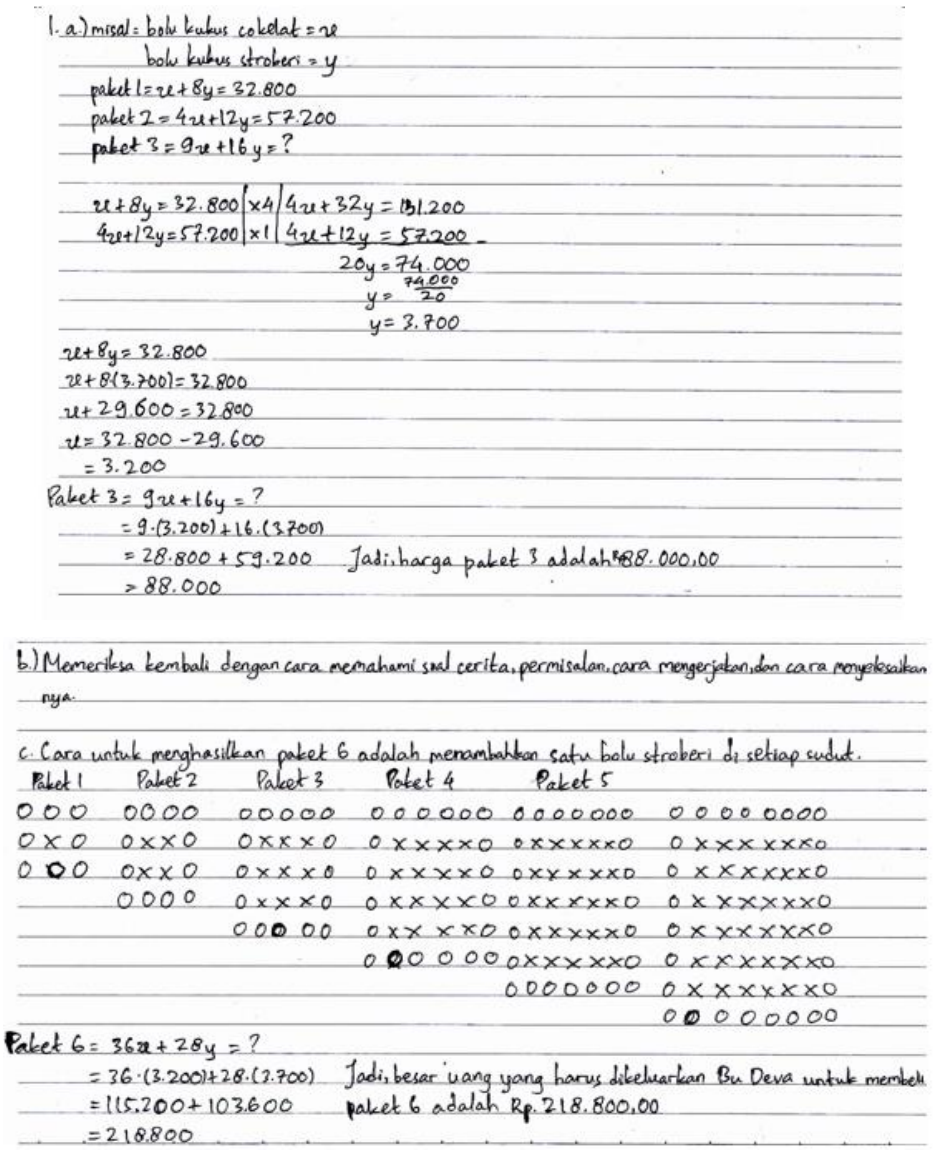


Figure 2 Answers to TPM AKM Introvert Subject

The initial process of introvert subjects in understanding the problem is to repeat reading the questions twice. This is because introvert subjects first ensure the problem and questions and to find all the information. From reading the questions, introvert subjects can recognize the information available, the questions asked, and the requirements needed to solve the problem. Introvert subjects verbally state what is known, namely package 1 consists of eight strawberry steamed cakes and one chocolate steamed cake, package 2 consists of twelve strawberry steamed cakes and four chocolate steamed cakes, and package 3 consists of sixteen strawberry steamed cakes and nine chocolate steamed cakes and the information asked regarding the price of package 3, checking the results of the work on the questions for point a, and the amount of money that Mrs. Deva needs to pay to buy steamed cakes for package 6 by reading the question sheet. Introvert subjects express it carefully. This is in line with Burtăverde & Mihăilă (2011) who state that introvert individuals tend to have high concentration and are afraid of failure, making them more careful.

In addition, introvert subjects can state the requirements needed to solve the problem correctly, namely using the method of example, substitution, and elimination from the known price of steamed cake and the contents of the packages. However, introvert subjects expressed doubts in stating that the requirements mentioned were sufficient to solve the problem. This is in line with Widayanti (2016) research that people who have an introvert personality tend to pay more attention and worry about their understanding of the concepts and ideas they have or in other words have low self-confidence. Introverted subjects express known and asked information by writing it through symbols. The symbols written by introverted subjects are used to compare the price of chocolate steamed cake with "x" and the price of strawberry steamed cake with "y". Then formulate a mathematical model for the given SPLDV problem, namely $x + 8y = 32$ for equation package 1, $4x + 12y = 57,200$ for equation package 2, and $9x + 16y$ for mathematical model package 3.

The next process carried out by introvert subjects is to make a plan based on the problems that have been given. In their planning, introvert subjects consider problems that have been solved previously and are similar (relevant) to the problems encountered. Introvert subjects also stated that they had encountered problems like the questions given but there was something different about the questions. The difference is that introvert subjects have never encountered questions like those in package 6. This is in line with Huitt's statement (in Widayanti, 2016) that individuals with introverted personalities need time to think about and explain their ideas before starting to speak.

The concept used by introvert subjects in solving problems is the SPLDV concept using the substitution and elimination methods and the concept of number patterns. The reason for choosing this method is because according to introvert subjects, it is clear when looking at the problem and only adding every three corners from the previous package. The next process is the process of implementing the plan based on the planning that has been made previously. Introverted subjects stated that each process taken was in accordance with the previously prepared completion plan. Introverted subjects applied the determined strategy, namely the strategy of working and drawing

to solve the AKM algebra content problems and ensuring accuracy in each process carried out by rechecking. This is in accordance with the statement of Burtăverde & Mihăilă (2011) which states that introverted individuals tend to have high concentration and are afraid of failure, making them more careful.

In the process of re-checking, the introvert subject stated that he had checked and checked by recalculating the answers to questions a, b and c and looking at all the problems or information found. The introvert subject expressed the existence of other alternatives with hesitation but the introvert subject did not use them. It can be concluded that the introvert subject was pessimistic before trying by stating that he did not use them. This is in line with Suryabrata (2016) that introvert individuals have pessimistic characteristics towards several problems. In addition, introvert subjects also carry out repeated alternative checks (solutions) because they want to find very certain results. This is in line with Widayanti (2016) who argues that people who have an introvert personality tend to be more concerned and worried about their understanding of the concepts and ideas they have or in other words have low self-confidence. This is also in line with Suryabrata's statement (2016) that introverted individuals tend to have relatively high intelligence, are meticulous but slow, and have high ambitions but often underestimate their achievements. Furthermore, according to Zuniana & Rahaju (2019) individuals with an introvert personality tend to be prone to worry, which results in them needing to do repeated checks to ensure the correctness of their answers.

Sari & Kurniasari (2022) stated that students who have different personality types are also different in solving problems. The following table shows the similarities and differences between extroverted and introverted personality subjects in solving problems.

Table 2 Similarities and Differences in Problem Solving of Extroverted and Introverted Personality Subjects

Extrovert Subject	**Introvert Subject**
a. Read the questions more than twice.	a. Read the questions twice.
b. Note down the available (known) information, but do not note down what is asked.	b. Record what is available (known) using direct mathematical models and record what is asked.
c. Write using symbols to show what is being asked.	c. Write using symbols to show what is known and what is being asked.
d. Symbolizing “x” for the price of strawberry steamed cake and symbolizing “y” for the price of chocolate steamed cake.	d. Symbolize by for example the price of chocolate steamed cake with “x” and the price of strawberry steamed cake with “y”.
e. Considering previously resolved problems that are relevant to the	e. Considering the problems that have been encountered

	Extrovert Subject		Introvert Subject
	problems encountered, namely problems related to motorbike and car parking.		previously regarding ordinary SPLDV but not related to other concepts, namely number patterns as in question c.
f.	Implementing a predetermined strategy, namely a strategy of doing and trying.	f.	Implementing working and drawing strategies.
g.	Applying substitution and elimination methods as well as multiples of number patterns in solving problems.	g.	Applying elimination and substitution methods and the concept of number patterns in solving problems.
h.	Expressing ignorance that there are different alternatives.	h.	Suggesting that there are different alternatives but not using them.
i.	The processes carried out in solving problems include: understanding the problem-making a plan-implementing the plan-looking back-implementing the plan-looking back.	i.	The processes carried out on problems include: understanding the problem-making a plan-implementing the plan-looking back.

Based on Table 2 above, it appears that the problem solving process between extrovert and introvert subjects is different. However, there are also similarities, including: in the process of implementing the plan, both subjects apply the substitution and elimination methods and the concept of number patterns in solving the given problems, in the process of understanding the problem, both subjects symbolize it with the notation "x" and "y" based on the given problem.

Conclusion

Based on the analysis, it is concluded that the problem-solving process of AKM algebra content in junior high school students differs based on personality type. Students with an extrovert personality type begin the process of understanding the problem by reading the problem repeatedly to understand the information given. In this process, extrovert students recognize the known information, the questions asked, and the conditions for solving the problem, then formulate a mathematical model based on the problem. At the planning stage, extrovert students choose a trial and error strategy and work on it. The implementation of the plan is carried out by implementing the strategy that has been prepared, but tends to be rushed so that it is at risk of making mistakes. When checking back, extrovert students evaluate the process that has been carried out, correct mistakes, but do not consider other alternative solutions. The problem-solving process that is gone through includes understanding the problem-making a plan-implementing the plan-looking back-implementing the plan-looking back.

Students with an introvert personality type begin the process of understanding the problem by reading the problem carefully to ensure the information and questions. In this process, introvert students recognize the available information, questions, and problem-solving requirements, then formulate a

mathematical model based on the problem. In the planning stage, introvert students develop strategies that are relevant to similar problems that have been solved, namely by choosing a strategy for working and drawing. The implementation of the plan is carried out carefully and accompanied by checks at each step to ensure accuracy. When rechecking, introvert students evaluate repeatedly to get accurate results, even though there are doubts about other alternative solutions. The problem-solving process that is gone through includes understanding the problem-making a plan-implementing the plan-looking back.

The results of the study showed that introvert students were more careful because they were afraid of making mistakes but tended to be less confident with their understanding, while extrovert students had high self-confidence, but tended to be careless and hasty in solving problems. So it is hoped that teachers can provide motivation to students to be more careful, confident and more focused in solving problems.

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