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Thinking Trajectory of Students with Thinking and Feeling Personality Types in Solving Algebra Problems

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ABSTRAK

Strategi yang digunakan oleh siswa dalam memecahkan masalah matematika cukup beragam sehingga mempengaruhi tipe kepribadian siswa. Fokus penelitian ini adalah untuk menganalisis lintasan berpikir siswa dalam memecahkan masalah bentuk aljabar ditinjau dari tipe kepribadian thinking dan feeling. Penelitian ini merupakan penelitian kualitatif dengan metode deskriptif. Populasi berjumlah 34 orang siswa, penarikan sampel dilakukan dengan teknik purposive sampling. Teknik pengumpulan data melalui lembar angket kepribadian, soal tes aljabar, dan wawancara. Analisis data kualitatif dilakukan melalui tahap data reduction, data display dan conclution/verifivation. Hasil penelitian didapatkan lintasan berpikir siswa dalam memecahkan masalah bentuk aljabar ditinjau dari tipe kepribadian thinking dan feeling adalah pada siklus analisa soal siswa thinking dapat menunjukkan hal yang diketahui dari soal dengan cara yang tepat dan proses penyelesaian masalah dibuat secara terurut sampai kepada siklus penyederhanaan. Pada siklus penyelesaian siswa thinking sampai memperoleh jawaban akhir dengan melakukan langkah-langkah penyelesaian dengan baik dan benar. berdasarkan hasil tersebut maka dapat disimpulkan bahwa siswa feeling tidak dapat menyelesaikan soal aljabar dengan baik dibandingkan siswa dengan tipe kepribadian thingking. Hal tersebut dikarenakan siswa feeling dalam penyelesaian masalah bentuk aljabar langkah-langkahnya tidak berurutan dan sulit untuk mempertimbangkan dengan dasar benar atau salah (objektif). Oleh karenanya, terkadang ia plin-plan atau bahkan kebingungan dalam mengambil sikap.

ABSTRACT

The strategies students use in solving mathematical problems are quite diverse, so they affect students' personality types. This research focuses on analyzing the trajectory of students' thinking in solving algebraic problems in terms of thinking and feeling personality types. This research is qualitative research with a descriptive method. The population is 34 students; the sampling is done by purposive sampling—data collection techniques through personality questionnaire sheets, algebraic test questions, and interviews. Qualitative data analysis was done through data reduction, display, and conclusion/verification stages. The results showed that the students' thinking path in solving algebraic problems in terms of thinking and feeling personality types is that in the problem analysis cycle, thinking students can correctly show what is known from the problem. The problem-solving process is made sequentially up to the simplification cycle. In the completion cycle, students think until they get the final answer by completing the steps properly and correctly. Based on these results, students need help solving algebra problems properly compared to students with the thinking personality type. It is because students feel that the steps could be more sequential in solving problems with algebraic forms, and it is difficult to consider based on right or wrong (objective). Therefore, sometimes he needs to be more wishy-washy or even needs clarification in taking a stand.

1. INTRODUCTION

Learning is a form of sociocultural activity in which students develop understanding through interacting with their past knowledge and new information (Pane & Dasopang, 2017; Sujana, 2019). In the learning process, there are learning activities that are carried out deliberately by educators to impart knowledge, organize, and construct the environment using various techniques so that students can complete learning activities successfully, quickly, and with the best possible results (Saifulloh & Darwis, 2020; Sasmita, 2020). Learning activities in Indonesia are carried out by instilling various fields of knowledge in students. One of the subjects that must be taught at all levels of education is mathematics. Mathematics is a universal science that supports modern technological advances, thus playing an important role in several disciplines and enhancing human intelligence capacity (Saraswati & Agustika,

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2020; Widayanti & Nur'aini, 2020). The purpose of implementing mathematics learning is to develop students' reasoning abilities based on patterns and characteristics, to manipulate mathematics in making generalizations, collecting evidence, or elaborating mathematical ideas and statements is the goal of learning mathematics (Li & Schoenfeld, 2019; Mutawah et al., 2019). Implementing mathematics learning focuses on developing students' thinking skills, especially problem-solving (Gunawan et al., 2020; Wulandari et al., 2023).

Algebraic material is one of the mathematical materials that demands the maturity of students' thinking processes. It is because algebraic material is material that combines several symbols, such as addition, subtraction, multiplication, and division, in one arithmetic operation, to solve the problems presented (Hajidin et al., 2020; Maryati et al., 2022; Sakiah & Effendi, 2021). Solving problems in algebraic material requires students to think critically and systematically to solve the problems given. It's just that the reality on the ground shows that the average score for the Mathematics National Examination (UN) for SMP/MTs students in Indonesia in 2019 was only 46.56. This value is in the lowest position compared to other subjects, namely Indonesian (65.69), English (50.23), and Natural Science (48.79) (Tuankotta et al., 2021). It indicates that successful mathematics learning achievement still requires special treatment of students. It aligns with the results of observations on daily test assessments, especially in math material in algebraic forms in class VIIA MTsN 7 Kerinci odd semester. The data shows that only 3 out of 16 students (13.75%) students can fulfill learning mastery based on the school's Minimum Completeness Criteria score limit of 70, and there are 13 out of 16 (81.25%) students do not meet the school's Minimum Completeness Criteria standards. These results indicate that students at MTsn 7 Kerinci have problems with student learning outcomes, and one of the solutions that can determine the success of learning mathematics is to know the student's personality type.

When studying mathematics, students' thought processes are quite diverse. Students have different learning styles and thought processes in understanding mathematics (Legarde, 2022). Some students can learn quickly, while others learn slowly (Delima et al., 2019). It shows that each student has a different path of thinking. To maximize the learning process, the teacher must understand the trajectory of students' thinking well. It is because the trajectory of students' thinking can provide useful information for developing effective learning strategies, developing more effective learning methods, and can provide useful information for developing more effective learning resources (Setyaedhi, 2020; Susilo, 2020; Utami & Bahtiar, 2020). Tracks of thinking can provide guidelines for teachers to formulate learning objectives that must be achieved, allow them to create strategies or actions to be taken to achieve these goals, and teachers/educators are responsible for making lesson plans and presenting teaching materials that should be able to overcome learning barriers (Hidayat & Riyana, 2021; Rangkuti & Siregar, 2020).

There are several paths of student thinking based on personality types in the learning process, including the thinking and feeling personality types. Students with a thinking personality type have better critical thinking skills (Ardiansyah et al., 2022; Sari et al., 2020). In learning activities, students with thinking personalities tend to use logical thinking and objective analysis in making decisions (Afnanda, 2023; Nagahi et al., 2022). Students with the thinking personality type will be smarter at seeing and finding mistakes and often provide solutions based on logical reasons (Filahanasari, 2019; Lazarević et al., 2021). At the same time, students with a feeling personality tend to have a feeling nature. In the learning process or problem-solving, students with a feeling personality will use more of their thoughts than the opinions of others (Jinkerson et al., 2017; Kamal & Radhakrishnan, 2019). It's just that students with this personality type will find it difficult to make decisions objectively based on right or wrong, so they are often confused in making decisions (Murphy et al., 2020). In solving problems, students with this personality tend to be weak in predicting steps in determining a problem's resolution and cannot provide appropriate conclusions (Yielder et al., 2021).

Several previous studies have revealed that each student has characteristics in solving problems, depending on their personality type (Umami et al., 2023). The results of other studies reveal that in the learning process, students have different characteristics with thinking and feeling personalities. At the planning stage, thinking personality students can predict while feeling students cannot solve problems correctly, and at the stage of making conclusions thinking students can fulfill indicators that, while feeling students, cannot show the ability to make conclusions (Fauzi & Abidin, 2019). Based on some of the results of these studies, students with thinking and feeling personalities tend to have different ways of learning. In previous research, no studies specifically discussed the thinking trajectory of thinking and feeling personality-type students in solving algebraic problems. So this research is focused on this study to analyze the trajectory of students' thinking in solving algebraic problems in terms of thinking and feeling personality types.

2. METHOD

This study uses a descriptive qualitative approach. The research data came from class VIIA students at MTsN 7 Kerinci, which consisted of 34 students. Based on the MBTI personality test results, often known as the Myers-Briggs Type Indicator, 16 population subjects were selected. The MBTI is a tool for assessing a person's personality when making decisions. In education, the MBTI is used to study student personality types. Since the MBTI is a self-discovery, professional, and mental health tool, administering the test in counseling provides insight into a person's behavior. Purposive sampling was used to select research participants. Two students with a thinking personality type and two with a feeling personality type were used as research subjects. Selected respondents were studied in two cycles, where each cycle carried out tests to solve algebraic problems, and interviews were carried out afterward to obtain a comprehensive line of thinking. Data collection in this study was carried out using observation, interviews, and tests, with research instruments in the form of algebraic problem test instruments, the Myers-Briggs Type Indicator (MBTI) instrument, and interview guidelines. The instrument has been validated by content and construct validation involving two instrument experts and instrument trials. The validity of the problem-solving test instrument was measured by looking at the validity and reliability values. Valid and reliable results were obtained (0.23 > 0.05). The grid for each instrument can be seen in Table 1.

Table 1. Research Instruments

Instruments	Aspect	Indicator
MBTI Questionnaire	How to Make a Decision	*Thinking* *Feeling*
Algebra Test Questions	Solve problems related to algebraic forms and operations on algebraic forms.	Apply arithmetic operations to algebraic forms to solve problems.
Interview guidelines	Unstructured	Problem-solving skill

Analysis of the results of this study in the form of answers from the question sheet and interview results. The answers to the question sheets noted the stages of students' mistakes in thinking and feeling personality types. The data obtained from the test results are then analyzed. This analysis aims to simplify the data into a form that can be understood, interpreted correctly, and clearly. Data analysis activities include reduction, display, and conclusion/verification.

3. RESULT AND DISCUSSION

Result

The results of the thinking and feeling personality tests in the research population using the MTBI personality instrument can be seen in Table 2.

Table 2. Percentage of students' Thinking and Feeling Personality Type Test Results

Personality type	Frequency	Percentage
Thinking	10	62.5%
Feeling	6	37.5%
Total	16	100%

The researcher evaluated the results by strengthening with the mathematics teacher who taught the class. Ten thinking students will be sampled into two people, and six feeling students will be sampled into two people and identified based on the analysis of the results of the MBTI personality test. Sampling is done by looking at the resulting personality value considerations. The purposive sampling results can be seen in Table 3.

Table 3. Myers-Briggs Type Indicator MBTI Test Results

Respondents	Score	Type
Subject *Thinking* 1 (St_1)	20.00	Thinking personality
Subject *Thinking* 2 (St_2)	19.00	Thinking personality
Subject *Feeling* 1 (Sf_1)	17.00	Feeling personality
Subject *Feeling* 2 (Sf_2)	17.00	Feeling personality

This study focused on four selected research subjects. In the first and second cycles, the subjects were given algebra test sheets, and after the results were obtained, confirmation was confirmed through interviews. Based on the results of algebraic problem-solving tests for thinking (St1, St2) and feeling (Sf1, Sf2), students found several findings in this study, including the first finding shows that the results of written answers from St1 (First Cycle) show that St1 initially made things which are known from the problem. Then he makes an example of the answer from the known thing by explaining k-3 = brother and a-3 = sister. Then he makes the algebraic form with the equation k = a + 7 … (1) and equation (k-3) – 2(a-3) … (2). Next, subject St1 replaces what is known by substituting equation (1) with equation (2). Next, he looks for how old his younger sibling is by replacing k with 7. After that, subject St1 operates like terms. He performs a merger by moving segments by grouping the same variables. Subject St1 did not continue with the problem-solving procedure. Subject St1 answered questions in this section only to determine the result of the algebraic form. It should be completed to the end so that the final answer is obtained, namely in how old the brother and sister are.

The second finding relates to the results of written answers from the second subject in the thinking category (St2) for questions in cycle 1. The results of the analysis show that Subject St2 completes the problem first by making an analogy between the ages of brothers and sisters, which is known from the question, and then directly making the algebraic form by equation k = a + 7 … (1) and equation (k-3) – 2(a-3) … (2). Then subject St2 substitutes equation (1) into equation (2). After obtaining the results of the substitution equation, subject St2 first looks for how old the younger sibling is by replacing k with 7. After that, subject St2 operates like terms. He performs a merger by moving segments by grouping the same variables. It can also be seen in Figure 2 that subject St2 did not continue to finish.

The third finding relates to the results of written answers from the first subject in the thinking category (St1) for cycle two questions. Subject St1, in working on the questions, first makes things known by, e.g., a swimming pool with a width of 7m less than the length and circumference of 86m. Furthermore, subject St1 enters what is known as the formula for finding the circumference to find the length of the swimming pool by carrying out a number combination of the operation's results. He simplifies the operation by grouping the same variables and moving the segments. In cycle 2, subject St1 only solved the problem until he got the result of the pool length and immediately looked for the area of the pool without looking for the width of the pool first.

The fourth finding relates to the results of written answers from the second subject in the second cycle's thinking category (St2). Subject St2, in working on the problem, first made an example of an answer, then looked around the pool to find the length of the pool first by doing a number combination of the operation results. He simplified the operation by grouping the same variables and moving the segments to obtain the final result. The length of the pool is 25m. Subject St2 looked for the width of the swimming pool and obtained 18m results. Then the final step for subject St2, he made an area formula and entered a length value, and then it can be seen in Figure 4 that subject St2 experienced an error in entering a width value. Subject St2 should first find the width of the pool and then proceed to the final solution, finding the area of the pool.

The fifth finding relates to the results of the written answers from the first subject with the feeling category (Sf1) for the first cycle. The results of working on the questions showed that the subject first analyzed the questions by making known things from the questions, namely k as the age of the older sibling and an as the age of the younger sibling. Then he makes an example of an answer from what is known by making the statement brother = k-3 and sister = a-3, then he makes the algebraic form. After that, subject Sf1 operates like terms. He does a combination by moving segments by grouping the same variables. After all the results were obtained, the Sf1 subject immediately added the results.

The sixth finding relates to the results of written answers from the first subject with the feeling category (Sf2) for the first cycle. The results of working on the questions showed that the subject first analyzed the questions by making an example of the questions, namely x as the age of the older sibling and y as the age of the younger sibling. Then he exemplifies the answer from what is known by making the statement x=y+7. Furthermore, the Sf2 subject replaces what is known by substituting it. Then, he obtained the age of his younger sibling, with the final result being y=7. In the second cycle, Sf1 left the answer empty because it did not know how to answer the question.

The seventh finding relates to the results of written answers from the second subject with the feeling category (Sf2) for the second cycle. Subject Sf2 in working on the problem first, for example, L=P-7m. After that, subject Sf2 immediately entered the perimeter formula to find the length of the swimming pool by combining the numbers from the results of the operation, and he simplified the operation by grouping the same variables and moving the segments, so subject Sf2 obtained the final result of the pool

length, which was 79m. and the Sf2 subject looked for the width of the swimming pool and obtained 72m results. As shown in Figure 4. Nine subject Sf2 solves the problem of finding the width of the pool.

After obtaining the results of the work on the questions, the research was then continued in the interview process. The interviews were conducted right after the research subjects completed the task sheet for solving algebraic questions in each first and second cycle. The results of the interviews were used to see the thinking path of students with thinking and feeling personalities who were selected to be research subjects in solving algebraic problems. The results of the first and second cycle interviews showed that St1 could state in his own words the information used as what was known and the information used as what was asked from the questions given, both question number 1 and question number 2. During the interview, it appeared that St1 could read the questions correctly and precisely. Then, it also appears that St1 understands the information contained in the problem. Because St1 can sort information well and can relate the information, in solving question 1, St1 can also decide on the right steps to get an answer.

Furthermore, the results of the first cycle and second cycle interviews on the St2 subject showed that the St2 subject could state in his sentence regarding the information used as what was known and the information used as what was asked from the questions that had been given, both the first cycle questions and the cycle questions. Second. During the interview, it appeared that St2 understood that the information from each question could help him complete the questions as ordered. Because St2 can sort information about questions well and relate information in deciding the right steps. Sf1's answer at the time of the interview stated that he could state the information used as what was known and the information used as what was asked from the questions given in question number 1 and question number 2. However, Sf1 experienced errors and errors in calculations which led to obtaining answers which needed to be corrected. The results of the Sf2 interview also experienced mistakes and errors in the steps for solving the questions, resulting in obtaining answers that needed to be more right and appropriate. The results of inferring student learning trajectories can be seen in Figure 1.

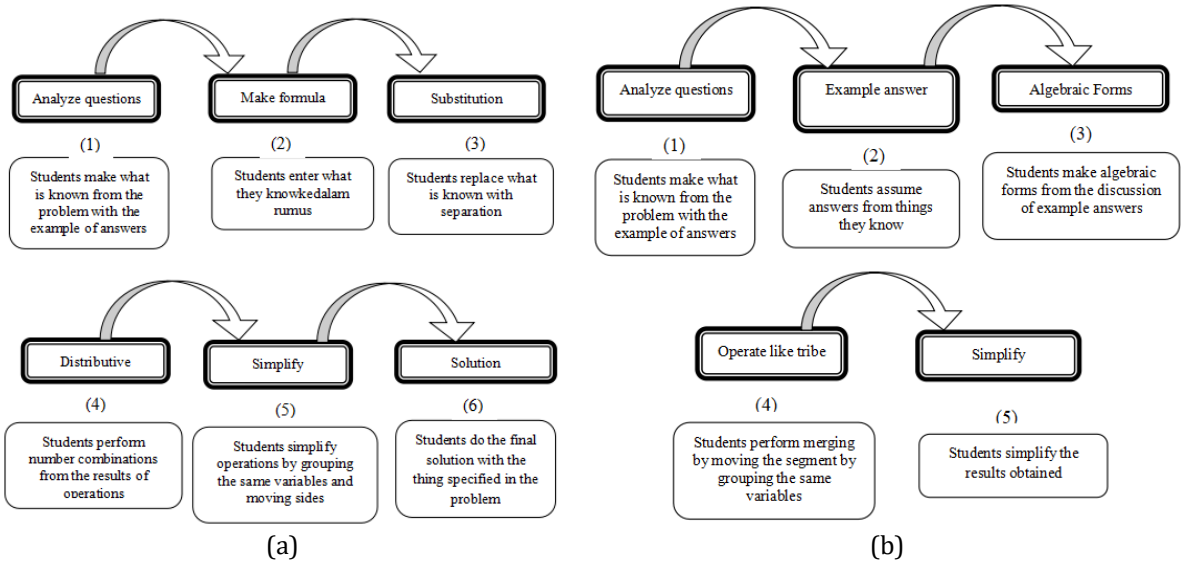

Figure 1. The Thinking Trajectory of Personality Students *Thinking (a)* dan *Feeling (b)*

Discussion

Based on the results of the research analysis that has been carried out, several main findings were obtained in this study, including first, the trajectory of thinking of students with thinking and feeling personalities in solving algebraic problems shows that in the process of solving problems of algebraic forms thinking students start by analyzing the problem then the subject enters things that are known into the formula, and then substitute by replacing things that are known with examples and then the subject performs number combinations from the results of operations and finally completes by simplifying the final result of solving the problem. These results show that thinking students always use logic and analytical power to make decisions so that they can solve problems quite well (Delima et al., 2019; Legarde, 2022). Students with the thinking personality type tend to have the ability to think creatively, so they can carry out the process of assimilation and abstraction well and can reconfirm answers but are

unable to determine other ways of solving problems (Juniar et al., 2021; Rini et al., 2020; Widodo et al., 2020). To minimize mistakes, students with thinking personalities need more training to solve questions so that students will be skilled in solving them (Legarde, 2022).

The second finding shows that students with a feeling personality tend to be subjective, sometimes wishy-washy, and even confused in making decisions. It is indicated by the finding that feeling students start answering questions with the ability to analyze questions and devise plans, mathematical operations, and simplifications without conclusions. Mistakes made by students with a feeling personality type are more numerous when compared to students with a thinking personality type (Felder et al., 2002; Setyaedhi, 2020). Students with a feeling personality need to be completed in identifying known and asked information, improperly manipulating the algebra of the problem, making mistakes in performing algebraic operations, and not making conclusions. And these students do not intentionally make mistakes, but these students can correct their mistakes (Homa, 2020). Besides that, the feeling personality type cannot critically analyze a problem, which is characterized by incompleteness in solving the problem (Hidayat & Riyana, 2021; Rangkuti & Siregar, 2020).

Based on these two findings, it can be said that the thinking trajectory of students with thinking personality types has advantages compared to the learning trajectories of students with feeling personalities in solving algebraic problems (Setyaedhi, 2020; Susilo, 2020; Utami & Bahtiar, 2020). This difference depends on the talent possessed by each student. Students follow different paths and think differently when trying to understand ideas or solve problems. The results obtained in this study align with previous research results, which revealed that each student has characteristics in solving problems, depending on their personality type (Umami et al., 2023). The results of other studies reveal that in the learning process, students have different characteristics with thinking and feeling personalities. At the planning stage, thinking personality students can predict while feeling students cannot solve problems correctly, and at the stage of making conclusions thinking students can fulfill indicators that, while feeling students, cannot show the ability to make conclusions (Fauzi & Abidin, 2019). Based on the results of this study, students with thinking and feeling personalities tend to have different ways of learning.

4. CONCLUSION

Based on the results of the research analysis and discussion, it can be concluded that the trajectory of students' thinking in solving algebraic problems in terms of thinking and feeling personality types has differences. Thinking students can show what is known from the problem correctly to the problem-solving process and make it sequentially to the simplification cycle. However, thinking students only get to the final answer after taking the correct steps. Meanwhile, Feeling students needed help to solve the problem. Students Feeling in solving problems with algebraic forms, the steps are not sequential, and it is difficult to consider based on right or wrong (objective). Therefore, sometimes he needs to be more wishy-washy or even needs clarification in taking a stand. Students only rely on intuition to answer questions without paying attention to critical abilities and the ability to conclude answers due to a lack of rationality towards questions from questions. So that in the process of solving algebraic problems, students with the thinking personality type are better than students with the feeling personality type. However, it should be noted that each individual has different abilities and potential, and success in solving problems depends on many factors, including motivation, interest, and educational background, which were not the focus of this study.

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