



## Students' Thinking Processes in Solving Linear Equations and Inequalities One Variable Problems in Terms of Personal Style Using the Assimilation and Accommodation Framework

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<http://dx.doi.org/10.18415/ijmmu.v5i5.301>

### **Abstract**

Personal style can influence the students' thinking process in solving mathematics problems. This study aims to describe the thinking process of students in solving the problem of equations and inequality of linear one variable in terms of student's personal style. This study uses a qualitative method. The research data was obtained by giving personality test sheets, math test sheets, and interviews to five subjects who have different ways of solving problems and personal styles. Based on the results of the study, extroverted and introverted students tend to use the process of assimilation thinking in solving the problem.

**Keywords:** Personal Style; Problem; Assimilation; Accommodation

### **Introduction**

Personality is one of the factors that can influence students in solving problems (Ulya., 2015). Personality or personal style can influence attitudes in the adjustment and socialization of learners to the environment, including in learning (Winarso., 2015). Personal style or personality is the unique nature of the individual and is reflected in every behavior (Rahma & Prasetyaningrum., 2015). According to Kozhevnikov (2007) and Braden & Smith (2006), there are four base types of personal styles, namely extrovert-introvert (EI), sensing-intuition (SI), thinking-feeling (TF), and judging-perceiving (JP). Of the four basic types of personal styles, the extrovert-introvert type is a type of personal style that has traits that are completely different (Braden & Smith., 2006). Students with extroverted personalities tend to like social interactions, enthusiastic, fun, and articulate (Parven & Ramzan., 2013; Braden & Smith., 2006; Chusman & WakeField., 2013). As with extroverted personality, students with introverted personality tend to focus in their own world, quiet, not interested in social interaction and prefer to move alone or with their closest friends (Parven & Ramzan., 2013; Braden & Smith., 2006; Chusman & WakeField., 2013).

Personality is a reflection of things that appear from something thought and felt by students (Yuwono., 2010). This suggests that students have different strategies according to internal interactions within themselves in solving a problem. The ability of students in solving a problem is determined by the

thinking process (Hasanah et al., 2013). Based on that, personality or personal style is an important factor in problem solving because it can be used to know the thinking process of students.

One tool used to identify students' thinking processes is assimilation and accommodation (Nabilah & Mubarakah., 2015). Assimilation is a process whereby a person integrates new information into the schema that is in his mind (Santrock., 2011). Accommodations are a process whereby a person adjusts new information that is incompatible with the schema formed in his mind (Santrock., 2011). The thinking process affects the students' ability to solve problems (Hasanah et al., 2013). This is because in doing problem solving, students do the thinking process so that it can arrive at the answer (Hasanah et al., 2013).

Sukoriyanto, et al. (2016), has conducted research on students' thinking processes in solving permutation and combination problems. The result of the research shows that students still have difficulties in solving permutation and combination problems and suggest to do research on other topic. Based on this and considering that personal style is an important factor in problem solving, it is necessary to conduct research on students' personal style thinking process in solving problems with materials that are difficult enough for students, namely equations and linear inequalities of one variable.

Based on direct observation of the researcher on some students of class VIII SMPN 6 Malang, the researcher sees that the student still difficulties in solving the problem of equation and linear inequality one variable. When given the problem, "What is the value of x that satisfies the inequality  $4x-7 < 9 + 2x$ ?", Student B still can not solve the problem correctly. The problem solving written by student B is shown in Figure 1 below.

$$4x - 7 < 9 + 2x$$

$$2x - 7 < 9$$

$$2x < 2$$

Fig. 1 Results of student B work in solving problems linear inequality one variable

In the case of a linear equation of one variable, student B still finds difficulty in operating one linear inequality of one variable. This is evidenced as the picture above, ie the students write  $2x-7 < 9$ , then the students conclude that the result is  $2x < 2$ .

Based on the results of interviews and preliminary observations described above, students' difficulties are seen from solving problems related to equations and linear inequalities of one variable that is not appropriate. It shows that students have not been able to use the concept they have to solve the problem, so it can be concluded that the student's thinking process is not right yet. Determining the variables used and solving the problem when the variables are in both sides is difficult for students to study the equations and linear inequalities of one variable. Although difficult, the material is important to learn. This is because algebra is the language to generalize a useful process in life (Usiskin., 1995). The importance of mathematics makes mathematics a fundamental lesson in schools taught in the packaging of mathematics learning.

Constructivism theory that enables students in learning can be used to overcome students' difficulties in learning mathematics (Hendrowati., 2015). The formation of knowledge in learning based on constructivism theory occurs because a process that takes place in the process of knowledge formation, namely the process of thinking (Hendrowati., 2015). This is supported by research conducted by Retna (2013), which states the process of thinking is something that is important. This is because teachers can know the weaknesses of students and designing appropriate learning for students by knowing the students' thinking process (Retna., 2013).

Based on this background, in this study the researcher will conduct research related "Student's personal style in solving equation problems and linear inequality one variable in terms of assimilation and accommodation framework". The purpose of this research is to describe the thinking process of assimilation and student accommodation in solving the problem of equations and linear inequality of one variable in terms of student's personal style.

### ***Methodology***

This research applies a qualitative approach where the researcher acts as the main instrument. In this study, researchers used personality test sheets, math test sheets, and interviews to collect data. Instrument personality test sheet and mathematics test sheets were tested to 29 students of SMP Negeri 6 Malang. Furthermore, based on the results of personality tests known the style of each student's problem. After knowing the personal style of students, the authors grouped the answers of introverted and extroverted students. Grouping answers is based on the resemblance of completion steps and answers written by students.

In grouping the answers, the extroverted students are grouped into 3 groups, while the introverted students are grouped into 2 groups. Each group, chosen one person at random to be the subject of research. DP, TA, and AEP are selected as research subjects of the extrovert group, and hereafter referred to as E1, E2, and E3. Meanwhile, MNH and HHA were selected as research subjects of the introvert group, and hereafter will be referred to as I1 and I2. The result of the subject's work in resolving the problem is based on steps of problem solving according to Polya this consists of four steps: 1) Understand the problem; 2) Devise a plan; 3) Carry out the problem, and 4) Look back (Sukoriyanto et al., 2016). The five subjects are then interviewed to know the process of thinking. Research data then analyzed using source triangulation.

### ***Result and Discussion***

The data of mathematics test result from each subject is analyzed so that the result of the thinking process of extrovert and introverted students in solving the problem of linear equation of one variable (Table 1) and the result of extrovert students 'and introverted students' thinking in solving the problem of linear inequality of one variable (Table 2).

Based on the results of research, there are differences in thought processes between research subjects. In solving the problem of linear equations of one variable, there are some differences between extroverted students' thinking processes. At the stage of understanding the problem, extroverted students tend to use the process of assimilation thinking. Extroverted students also tend to use the assimilation thinking process in planning problem-solving strategies and implementing problem-solving plans. This is in contrast to opinion (Condon & Ruth., 2013) which states that extroverted students tend to be weaker to receive and process information (in other words, extroverted students tend to use the accommodation

thinking process). However, this is supported by Dewi (2016) which states that there are extroverted types of students who are engaged in assimilation or accommodation thinking processes.

**Table 1** Student thinking process in solving linear equation problem one variable

Step of Polya	Subjek	
	Ekstrovert	Introvert
1. Understand the problem	E1, E2, and E3 use assimilation thinking process.	I1 and I2 use assimilation thinking process..
2. Devise a plan	E1 and E3 use assimilation thinking process.. E2 use accommodation thinking process..	I1 and I2 use assimilation thinking process..
3. Carry out the problem	E1, E2, and E3 use assimilation thinking process.	I1 and I2 use assimilation thinking process..
4. Look back	E1 use assimilation thinking process. E2 andn E3 use accommodation thinking process..	I1 and I2 use assimilation thinking process..

Unlike the previous stage where E1, E2, and E3 tend to use the assimilation thinking process, in the process of reviewing the problem solving results, E1 uses the assimilation thinking process. Meanwhile, E2 and E3 use the thought process of accommodation. This is supported by Dewi's research (2016), which states that extrovert-type students exist that conduct assimilation or accommodation thinking processes. Based on the discussion it is seen that there are differences in thinking processes between research subjects. This is supported by research conducted by Permatasari et al (2016) which states that subjects who have the same personality exhibit different thought processes, let alone different personalities.

**Table 2** Student thinking process in solving problems linear inequality one variable

Step of Polya	Subjek	
	Ekstrovert	Introvert
1. Understand the problem	E1, E2, and E3 use assimilation thinking process.	I1 and I2 use assimilation thinking process.
2. Devise a plan	E1, E2, and E3 use assimilation thinking process.	I1 and I2 use assimilation thinking process.
3. Carry out the problem	E1, E2, and E3 use assimilation thinking process.	I1 and I2 use assimilation thinking process.
4. Look back	E1 and E3 use accommodation thinking process. E2 use assimilation thinking process.	I1 use assimilation thinking process. I2 use accommodation thinking process.

Meanwhile, introverted students, I1 and I2, did not show any difference in thinking processes in solving linear equation problems. At the stage of understanding problems, planning problem-solving strategies, and implementing problem-solving plans, E1, E2, and E3 tended to use the process of assimilation thinking. This is in contrast to opinion (Condon & Ruth., 2013) which states that extroverted students tend to use the process of accommodation thinking. However, this is supported by research results Dewi (2016) which states that there are extroverted types of students who perform the process of assimilation or accommodation thinking.

In contrast to the stage of understanding the problem, planning a problem-solving strategy, and implementing a problem-solving plan where E1, E2, and E3 tend to use the assimilation thinking process, in the process of reviewing the problem-solving results, E1 uses the assimilation thinking process. Meanwhile, E2 and E3 use the thought process of accommodation. This is supported by Dewi's research (2016), which states that extrovert-type students exist that conduct assimilation or accommodation thinking processes. Based on the discussion it is seen that there are differences in thinking processes between research subjects. This is supported by research conducted by Permatasari et al (2016) which states that subjects who have the same personality exhibit different thought processes, let alone different personalities.

Meanwhile, introverted students, I1 and I2, did not show any difference in thinking process in solving the problem of equality of line variables. In understanding problem, planning problem solving strategy, implementing problem solving plan, and looking back at problem solving result, I1 and I2 using assimilation thinking process. This is supported by the opinion of Condon & Ruth (2013) that states introverted students tend to receive and process information thoroughly (using assimilation thinking processes) and research results Dewi (2016) which states introverted students using the process of assimilation thinking.

In solving the problem of linear inequality of one variable, there are some differences between extroverted students thinking process that is E1, E2, and E3. In understanding the problem, planning a problem-solving strategy, and implementing a problem-solving plan, E1, E2, and E3 using the assimilation thinking process. This is supported by the opinion of Hasanah (2013) which states that extroverted students tend to engage in assimilation thinking processes. However, this is in contrast to Condon & Ruth (2013) opinion that extrovert students tend to use the accommodation thinking process.

Meanwhile, in reviewing the problem solving results, E1 and E3 use the accommodation thinking process, while E2 uses the assimilation thinking process. This is supported by the results of research Permatasari et al (2016) which states that subjects who have the same personality shows different thinking processes.

In solving the problem of linear inequality of one variable, there are some differences between the introverted student thinking process that is I1 and I2 In understanding the problem, planning the problem solving strategy, and implementing the problem solving plan, I1 and I2 both use the process of assimilation thinking. This is supported by the opinion of Condon & Ruth (2013) that states introverted students tend to use the process of assimilation thinking and research results Dewi (2016) which states introverted students using the process of assimilation thinking.

In looking back at the problem solving results, I1 uses the assimilation thinking process, whereas I2 uses the accommodation thinking process. The difference in thinking processes I1 and I2 in reviewing the outcome of this problem is supported by the results of Permatasari et al (2016) study which states that subjects with similar personalities exhibit different thought processes.

## **Conclusion**

Based on the result of the research and discussion above, it can be concluded that the extrovert thinking process in solving the problem of linear equations is (1) the students tend to understand the problem, plan the problem solving strategy and implement the problem solving plan with assimilation, and (2) again the results of problem solving with accommodation. As for the introverted student's thinking process in solving the problem of linear equations of one variable is the students tend to understand the problem, plan the problem solving strategy, implement the problem solving plan and re-examine the results of problem solving with assimilation.

In solving the problem of linear inequality of one variable, the extroverted student's thinking process is (1) the student understands the problem, plots the problem solving strategy, and implements the problem solving plan with assimilation, and (2) the student tends to re-examine the results of the problem solving with the accommodation. Meanwhile, the introverted student's thinking process in solving the linear inequality problem of one variable is (1) the students understand the problem, plan the problem solving strategy, and implement the problem solving plan with assimilation, and (2) the students re-examine the results of problem solving by assimilation or accommodation.

## **Recommendation**

Based on the above conclusions, the following suggestions are proposed: 1) Based on this research, students' weaknesses and learning designs have not been presented in accordance with the students' thinking process. For the next researcher, it is suggested to express the weakness of the students based on the thinking process and to design the learning according to the thinking process of the students; 2) This research only describes the students' thinking process in solving the problem without continuing with scaffolding. For further research it is suggested to research by providing scaffolding assistance; 3) Based on this study, subjects were selected from extroverted and introvert groups at random. For the next researcher, it is advisable to take the subject with the mathematical capabilities of the two groups in order to obtain more accurate results; 4) Based on the results of this study, there are differences in thinking processes between subjects in one category. For the next researcher, it is advisable to examine the factors that cause the difference.

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