Research Article

STUDENTS' MATHEMATICAL PROBLEM SOLVING SKILLS BASED ON PERSONALITY TYPE MYERS BRIGGS TYPE INDICATOR (MBTI) AND LEARNING STYLES

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Abstract

Problem-solving skills are an important aspect of mathematics. Problem-solving ability is related to personality type and learning style. This study aims to describe students skills to solve mathematical problems in terms of the personality type Myers Briggs Type Indicator (MBTI) and the learning style. The type of research is qualitative research with subject determination techniques, namely purposive sampling and simple random sampling. The data collection techniques are questionnaires, tests, and interviews. The results showed that subjects with the highest mathematical problem solving ability were rational personalities who had a kinesthetic learning style. While the subjects with the lowest problem-solving ability are guardian personality subjects who have a visual learning style.

Keywords: Artisans, Idealists, Guardians, Personality type, Problem solving, Rationals, Learning style.

INTRODUCTION

Education is one of the means to gain experience and develop the ability to solve a problem in everyday life, ranging from big and small problems (Inastuti *et al.,* 2021). One branch of science that plays an important role in education is mathematics. Problem-solving skills are an important part of the math curriculum. This is emphasized in Permendikbud Number 58 of 2014 where one aspect of ability that needs to be conveyed in mathematical assessment is problem solving. In addition, the National Council of Teachers of Mathematics (2000) also sets five standards of mathematical ability that students need to have and one of them is problem solving skills. Polya (1973) defines problem solving as an effort to find a way out of a problem, and to achieve a goal that cannot be achieved by soon. As for Nasyiwa *et al.* (2022) stated that problem solving is the first step in developing various ideas to find new knowledge, create solving strategies, and organize skills once possessed. Students will be able to solve problems if students are able to understand the problems found, and understand the right procedures to solve these problems, thus students requires appropriate steps (Sari *et al.,* 2021). Polya (1973) stated 4 principles in the process of solving problems, namely: (1) understanding the problem, (2) devising a plan, (3) carrying out the plan, and (4) looking back. Based on observations made at one of the state Islamic schools in the province of West Nusa Tenggara, it was found that students' mathematical problem solving skills were still relatively low. Students do not write answers systematically so they miss several stages of problem solving that should be described. In addition, students also cannot find the correct results from the questions contained in the questions. Based on the results of the initial observation test given to 11 students, only 2 people were able to find the right final result of the questions given. However, these 2 students were also unable to work on the questions using the complete stages of problem solving skills.

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This was confirmed by the results of interviews with several teachers who teach mathematics at the school. The results of the initial test also showed that most students had not been able to solve mathematical problems with systematic and precise procedures. One of the factors in the inability of students to solve problems according to the right steps is the characteristics of students (Sulastri *et al.,* 2021). The characteristics of a person are certainly closely related to the personality of the person. In solving problems, students have different ways (Novitasari, 2017; Novitasari et al., 2015, 2020; Novitasari, Nasrullah, et al., 2021; Novitasari, Risfianty, et al., 2021), so it is necessary for a teacher to know the personality of his students (Ningsih and Awalludin, 2021). One of the most widely used personality test instruments is the MBTI male test. MBTI (Myers Briggs Type Indicator) is formed from 4 main personality dimensions that are dichotomous (opposite), namely: (1) extrovert vs introvert, (2) sensing vs intuition, (3) Thinking vs. Feeling, and (4) Judging vs. Perceiving. From the 4 main personality dimensions, 16 personality dimensions were formed, namely: ISTP, ISFP, ESTP, ESFP, INTP, INTJ, ENTP, ENTJ, ISTJ, ISFJ, ESTJ, ESFJ, INFP, INFJ, ENFP, and ENFJ. Furthermore, by Keirsey (1998) grouped the 16 personalities again into 4 personality types, namely: (1) artisans, (2) idealists, (3) guardians, and (4) rationals. In addition to relating to personality, this problem-solving ability also has a relationship with the learning style of a student. This learning style refers to the way of learning preferred by students, which usually comes from personality, including cognitive abilities and psychological background of life, as well as educational experiences (Umrana *et al.,* 2029). Sundayana (2016) defines learning style as a habit of students to process information obtained, and how the student will use it. If students are able to know their own learning style, it will be easier for a student to adjust the best way of learning for him. DePorter and Hemacki (Sundayana, 2016) suggest the classification of learning styles consisting of 3 types, namely: (1) visual, (2) auditorial and (3) kinesthetic. Every individual has a tendency to one learning style, some even have a tendency to more than one learning style. Knowing that how students problem-solving skill are related to their personality

type and learning style, this study aims to describe students mathematics problem solving skill based on MBTI's personality type and learning style.

METHODS

This study is qualitative research where research data is presented descriptively. The research was conducted at one of the state Islamic junior high schools in the province of West Nusa Tenggara. The determination of research subjects used a purposive sampling technique and 9 students were selected as research subjects. Data collection techniques using questionnaires, tests and interviews. The research instruments used were the MBTI personality type questionnaire and learning style questionnaire, tests in the form of math test questions to measure problem-solving abilities, as well as interview guidelines that aimed to ascertain and dig deeper into the results obtained from the questionnaires and tests. The data analysis technique used consists of: data reduction, data presentation and drawing conclusions (Miles and Huberman, 1994).

RESULTS AND DISCUSSION

Research Results

The results of the MBTI personality test questionnaire analysis show that the majority of students are idealistic personality types, namely 16 people or a percentage of 50%. While the dominant learning style is owned by students, namely the kinesthetic learning style, namely as many as 16 students. The grouping of personality types and student learning styles can be seen in table 1 below.

Table 1. Student Personality Types and Learning Styles

Learning Style/Personality Type	Visual	Auditorial	Kinesthetic
Artisan	1	-	2
Idealist	6	4	8
Guardian	2	-	3
Rational	3	-	3

Furthermore, a total of 9 research subjects were selected with each subject representing each learning style of each personality type. The following are the results of the work of each of these research subjects.

Figure 1.

Figure 2. Example of the SaV subject's answers

The work of SaV as a subject with an artisan personality with a visual learning style shows that at the stage of understanding the problem, SaV is able to write down the information in the problem completely and correctly. Next, at the stage of developing a solving strategy, SaV wrote a little example on question number 1, but did not write any plans for the next question. Based on the results of the interview, SaV stated that he did the questions given spontaneously without thinking about planning in advance. As for the stage of implementing the settlement strategy, SaV has been able to solve questions with the correct procedure, and is able to write them systematically. Akan but SaV has not been able to finish until it finds the right final result. Then at the stage of reviewing, SaV does not seem to write conclusions at all from the results of the work he obtained. In his interview, SaV stated that he had tried to double-check the answers he obtained before collecting, but still did not able to find the most appropriate end result.

Figure 3. Example of the SaK subject's answers

Furthermore, the work of S*a*K as an artisan personality subject with a kinesthetic learning style shows that in the stage of understanding problems, S*a*K has been able to write The information in the question is complete and correct. Furthermore, at the stage of developing a settlement strategy, just like S*a*V it turns out that S*a*K also does not write formulas or examples. This is supported by the results of the interview S*a*K which states that he is not accustomed to writing examples or formulas when solving a mathematical problem. As for the stage of implementing the settlement strategy, S*a*K has been able to solve questions with the right procedures and is also able to find the right final result.

Figure 4. Example of the S*i*V subject's answers

Then at the stage of reviewing, S*a*K has also been able to write down the right conclusions from the results of his work, has also been able to carry out re-examination of the result of his work. The work of S*i*V as an idealist personality subject with a visual learning style shows that at the stage of understanding the problem, S*i*V is able to write down the information in the problem completely and correctly. Furthermore, at the stage of developing a settlement strategy, S *i*V apparently did not write formulas or examples. In line with the interview, S*i*V stated that he did not consider it important to write down examples or formulas if he already knew how to solve the question.

Figure 5. Example of the S*i*A subject's answers

As for the stage of implementing the settlement strategy, S*i*V has been able to solve questions with the correct procedure, but has not been able to solve until finding the right final result. Then at the stage of reviewing, S*i*V apparently did not write any conclusions at all from the results of the work he obtained. In his interview, S*i*V also stated that he did not write the conclusion because he considered it not really necessary. In addition, S*i*V also did not check back in advance on the results of his work. Furthermore, the work of S*i*A as an idealist personality subject with an auditorial learning style shows that S*i*A in understanding problems has been able to write down information that obtained from the questions correctly but incompletely.

Figure 6. Example of the S*i*K subject's answers

Furthermore, at the stage of developing a settlement strategy, just like S*i*A, it turns out that S*i*A also does not write formulas or examples at all, namely for reasons not accustomed to writing planning. At the stage of implementing the settlement strategy, S*i*A has indeed been able to solve questions with the right procedures, but has not been able to find the right final result. In addition, the way S*i*A is written has not been seen systematically because it is not well directed. Then at the stage of reviewing, S*i*A was also unable to write down the right conclusions from the results of his work, nor did he re-examine

before collecting. Then it is the result of the work of S*i*K as an idealist personality subject with a kinesthetic learning style that shows that S*i*K in understanding problems has been able to write down information obtained from the questions correctly and completely.

Figure 7. Example of the S*g*V subject's answers

Furthermore, at the stage of developing a settlement strategy, just like S*i*A and S*i*V it turns out that S*i*K also states that he does not write formulas or examples for reasons Something similar, that is, it is not accustomed to writing plans. However, in the results of work number 1, S*i*K wrote a few examples, but not with work in number 2. As for the stage of implementing the settlement strategy, S*i*K has been able to solve the question with the right procedure but has not been able to find the right final result for the problem number 1. As for question number 2, S*i*K has been able to find the right final result. Then at the stage of reviewing, S*i*K has also been able to write the final conclusion of the results of his work, although the conclusion on question number 1 is still There is a mistake because the final results obtained are not the most accurate. In addition, S*i*K has also carried out a re-examination of the results of his work before it was collected. The work of S*g*V as a guardian personality subject with a visual learning style shows that at the stage of understanding the problem, S*g*V has been able to write down information in the problem will but not yet appropriate because S*g*V did not write down what was asked completely. Furthermore, at the stage of developing a settlement strategy, S*g*V seems to write a little example on question number 1, but not with number 2. Based on the results

of his interview, S*g*V stated that he did not understand what is called developing a solution strategy and only wrote down what was in the in his mind. As for the stage of implementing the settlement strategy, S*g*V was able to solve the question with the correct procedure r for question number 1, but has not been able to find the final result that exactly.

Figure 8. Example of the S*g*K subject's answers

Then for question number 2, it appears that S*g*V has not been able to do the right procedure, so it has not been able to find the right final result . Then proceed with the review stage where S*g*V apparently did not write conclusions at all from the results of the work he obtained and also did not do re-examination of the results of his work. Furthermore, the work of S*g*K as a guardian personality subject with a kinesthetic learning style that shows that S*g*K has been able to write down the information in the problem completely and true.
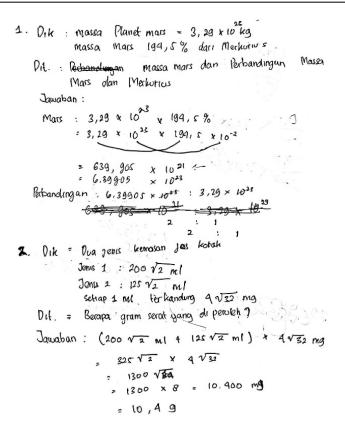
Figure 9. Example of the S*r*V subject's answers

Furthermore, at the stage of developing a solving strategy, just like the previous subjects, it turns out that SgK also states that he is not accustomed to writing formulas or examples in doing problem. As for the stage of implementing the settlement strategy, SgK was able to solve the question with the correct procedure for question number 1, but was not able to find the right final result. Then for question number 2, it appears that SgK has not been able to do the right procedure, so it has not been able to find the right final result. Finally, at the stage of review, SgK was also unable to write down the conclusions of his work, nor did he re-examine before collect. The work of S*r*V as a rational personality subject with a visual learning style shows that at the stage of understanding the problem, S*r*V has been able to write down the information in the problem completely and correctly.
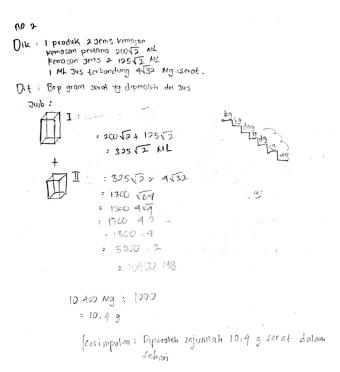

Figure 10. Example of the S*r*K subject's answers

Furthermore, at the stage of developing a settlement strategy, S*r*V does not seem to write down any formulas or examples and only directly works on solving problems with procedures that he knows. Then at the stage of implementing the settlement strategy, S*r*V has been able to solve the question with the correct procedure, also the final result found to be correct. However, at the stage of reviewing, S*r*V apparently did not write any conclusions at all from the results of his work but had time to re-examine. From the interview, S*r*V stated that he considered that writing conclusions was not so important. Furthermore, the work of S*r*K as a rational personality subject with a kinesthetic learning style shows that S*r*K has been able to write down the information in the problem completely and true. Furthermore, at the stage of developing a settlement strategy, it appears that S*r*K has tried to make plans by making examples and also illustrations in the form of pictures. Then at the stage of implementing the settlement strategy, S*r*K has also been able to complete his work with the right procedures and is also able to find the right final result. Then at the stage of reviewing, S*r*K has also been able to write conclusions based on the results he obtained, has also carried out re-examination before collecting.

DISCUSSION

Based on the presentation of research results from S*a*V as a subject with an artisan personality with a visual learning style shows that SaV has been able to pass the stages of understanding problems and Execute the settlement strategy well. This is in line with the results of research by (Aryanto *et al.*, 2018) which said that artisan subjects have been able to mention what is known and asked, have also been able to analyze the information found. In addition, artisan subjects have also been able to carry out the plans made. In line with the results of research by Imamuddin *et al.* (2019) which states that visual subjects have been able to pass indicators of understanding problems and also implementing solving strategies. However, the results of research from Imamuddin *et al.* (2019) are not in line for the stages of developing a

settlement strategy because visual subjects have been able also to pass through indicators of the stages of planning a settlement strategy. While in this study shows that SaV has not been able to pass through. This also turned out to be not in line with research by Aryanto *et al.* (2018) where artisan subjects have been able to strategize . As for the stage of reviewing again, SaV has not been able to pass it optimally. SaV did re-examine, but did not conclude the results of his work. Furthermore, SaK as a subject with an artisan personality with a kinesthetic learning style whose work shows that SaK has been able to pass the stages of understanding problems and execute the settlement strategy well. So this is in line with the results of research by Aryanto *et al.* (2018); Anggraini and Hendroanto (2021) which shows that artisan subjects have been able to pass the stages of understanding problems and implementing solving strategies as well. Kinesthetic subjects have not been able to write telerbih work plans first before working on it. Furthermore, at the stage of reviewing it turned out that SaK had been able to pass it. The third subject is SiV as an idealist personality subject with a visual learning style, where the results of SiV's work show that he has been able to pass the stage of understanding the problem and execute the settlement strategy well. This is in line with research by Imamuddin *et al.* (2019) which shows that visual subjects have been able to pass the indicators of both stages. Furthermore, the work of SiV also shows that SiV is not able to pass the stages of developing a settlement strategy and reviewing it. Somewhat out of line, the results of research from Khamidah and Suherman (2016) show that idealist subjects have been able to create mathematical models as forms planning, however, idealist subjects do not re-examine but can draw conclusions. In addition, the results of research fromm Imamuddin *et al.* (2019) also show that visual subjects have also been able to pass the indicators of the stages of planning a settlement strategy, However, it has not been able to pass the re-checking stage indicator.

Fourth, namely SiA as an idealist personality subject with an auditorial learning style where the results of his work show that SiA has been able to pass the stages of understanding problems and Execute the settlement strategy well. This is in line with the results of research by Umrana *et al.* (2019) which shows that auditorial subjects have been able to understand problems well, as well as being able to carry out all steps to resolve the issue.

Next is at the stage of preparing a completion plan and reviewing where the results of SiK's work show that he is unable to pass it. Somewhat out of line, the results of research from Hamidah and Suherman (2016) show that idealist subjects have been able to create mathematical models as forms planning, however, idealist subjects do not re-examine but can draw conclusions.

The next subject is SiK as an idealist personality subject with a kinesthetic learning style. The results of the work of SiK show that SiK has been able to go through three stages, namely understanding the problem, implementing the resolution strategy, and reviewing it.

The sixth subject is SgV as a guardian personality subject with a visual learning style. The results of the work of SgV show that it is not optimally able to pass any stage. This is not in line with research by Sari *et al.* (2021) which shows that guardian subjects can meet and work on all problem-solving indicators.

Next is SgK as a guardian personality subject with a kinesthetic learning style where the results of SgK's work also show results that are not much different from SgV where SgK is also only able to carry out the stages of understanding the problem optimally. However, for other stages, SgK has not been able to carry it out. The stages of understanding the problem, developing a resolution strategy, and executing it.

Then the next subject is SrV as a rational personality subject with a visual learning style. Based on the results of the work of SrV, it can be seen that SrV has been able to carry out the stages of understanding problems and implementing optimal resolution strategies . This is in line with research from (Awi *et al.,* 2021; Imamuddin *et al.,* 2019) which also shows that rational subjects have been able to pass both stages, namely by determining what is known and asked, and has also been able to carry out problem-solving steps. As for the stages of developing a settlement strategy, SrV has not been able to carry it out. As for the stage of reviewing, SrV has been able to carry it out even though it is not yet optimal.

Last is SrK as a rational personality subject with a kinesthetic learning style. The results of the work of SrK show that SrK has been able to perform three stages optimally, namely understanding the problem, implementing the resolution strategy, and reviewing it. However, at the stage of developing a settlement strategy, SrK is indeed able to do it but is not yet optimal. This is somewhat in line with research from Awi *et al.* (2021) where the results of the study show that rational subjects tend to be able to carry out each stage of problem-solving indicators. As for the review of learning styles, this is in line with research by Anggraini and Hendroanto (2021) which shows that kinesthetic subjects have been able to pass the stages of understanding problems, devise solving strategies, and execute them. which shows that the kinesthetic subject has been able to go through the stages of understanding the problem, implementing the resolution strategy, and reviewing it.

Conclusion

Based on the results of research and discussion described above, subjects with the highest mathematical problem solving ability are subjects with rational personality types and have a kinesthetic learning style, where this subject has been able to pass all stages of problem-solving ability. While the subjects with the lowest problem-solving ability are subjects with guardian personality types and have a visual learning style, where these subjects are only able to pass two the stage of problem-solving ability, which even for both stages has not been able to be passed optimally.

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