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Analysis of Mathematics Problem Solving Ability in View of Extrovert-Introvert Personality Types

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ABSTRACT

This study was conducted to analyze mathematical problem solving in terms of opportunities in terms of extrovert-introvert personality types in class X of SMKN 1 Patumbak. Researchers took samples, namely class X Rpl students of SMK Negeri 1 Patumbak with a total of 35 students. Sampling is taken by purposive sampling technique, also known as consideration sampling, which is a sampling technique from the population on certain considerations. Instruments and data collection techniques were carried out, namely by distributing questionnaires, conducting interviews, and providing test instruments. From the tests conducted, it is known that students who have extroverted personalities are more enthusiastic in working on questions than students with introverted personalities. From these results it is known that students who have introverted personalities can write down answers, but are less able to explain the answers. Meanwhile, students with extroverted personalities tend to be more confident, both in writing answers and explaining answers.

1. Introduction

Elmarfia & Yohanes, (2020) stated the reasons for the need for students to learn mathematics, namely because: (1) it is always used in other aspects of life, (2) all fields of study require appropriate mathematical skills, (3) it is a strong, short and effective means of communication. clear, (4) can be used to present information in various ways, (5) improves logical thinking skills, accuracy and spatial awareness, and (6) provides satisfaction in solving challenging problems.

Wahyuni et al., (2022) stated that Mathematics is also material taught at the

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educational level, from elementary school to high school and even in tertiary institutions. According to Siregar in (Rita Nauli, Ida Karnasih, Madyunus Salayan 2018) stated 5 reasons for the need to study mathematics because mathematics is; (1) a means of clear and logical thinking, (2) a means of solving daily life problems, (3) a means of relating patterns and generalizing experiences, (4) a means of developing creativity and (5) a means of increasing awareness to cultural development.

This is the teacher's desire to know the students' thinking process in solving a problem in mathematics learning. The importance of solving mathematical problems is reflected in Branca's opinion (Sulastri et al., 2021) , namely that it is one of the important goals in learning mathematics. In fact, the problem-solving process is the heart of mathematics, so to improve problem-solving abilities, skills are needed in compiling problem-solving steps.

Problem solving is a competency that students must have. Zuniana & Rahaju (2019) stated that in SPLDV probem solving, students experienced difficulties including students not being able to state what they knew and asking about the problems given, students not being able to create mathematical models, students not being careful when solving problems. So using algebraic operations incorrectly, students don't know how to look again correctly and what needs to be looked at again.

In the process of mathematics learning activities, a question or problem is a question that must be worked on by students. Therefore, when facing mathematics questions, students must plan in advance the series of commands that will be used. Karimah in (Rozalina & Nurdalilah, 2022) , concluded that problem solving is a reasoning ability that every person must have which will be very useful in solving problems in everyday life. Branca and NCTM Hendriana, Rohaeti, and Sumarno in (Ramadhani, 2020) concluded that problem solving has three meanings, namely: problem solving as a goal, as a process and as an appearance.

In reality, currently there are still many students in Indonesia who have low levels of thinking processes in solving mathematical problems (Habibatul Izzah & Azizah, 2019) . This is proven by the results of PISA (*Program for International Student Assessment*) released in 2019 which prove that the average ability of students in Indonesia in Mathematics and Science subjects is classified as very low (Mustakim, 2020) . Several factors that cause students' low problem solving abilities are also because the learning process is more focused on developing and testing students' memory (Saputri & Febriani, 2017) .

When students solve problems, students not only apply the various knowledge and abilities they already have, but students can find the right combination of rules and regulations so that they control their thinking process. Anwar & Amin (Lia, 2022) state that in solving mathematical problems, students carry out a logical thinking process in order to solve the problem.

One solution that can train students' abilities in solving mathematical problems is in solving according to Polya (Muslim, 2015) . Important steps or stages that students must take in solving problems according to Polya (in Hidayat & Sariningsih, 2018). These include (1) understanding the problem, (2) preparing a plan, (3) implementing the plan, and (4) looking back. One stage to the next in solving the problem supports each other to produce problem solving from related problems. Students play a role in understanding each step of problem solving so that students' thinking processes run well (Sulastri et al.,

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2021) .

In the process of learning activities there may be various types of personalities whose learning patterns are not easy to equalize. Because each personality type has its own way of solving the problems it faces, personality types consist of *extroverts and introverts* . Students who have extroverted personalities tend to be active in activities, have high self-confidence, interact well, actively ask and answer questions, think objectively. Meanwhile, students or children who have introverted personalities tend to be more passive. Less active in asking and answering, their self-confidence is slightly lower, they think subjectively (Listia et al., 2022) .

From the results of observations at State Vocational High School 1 Patumbak, the researcher obtained the results of an interview with the Mathematics teacher, Mrs. Dina as a class , then students also do not understand the rules for solving them, and there are still many students who systematically take steps in solving problems. Learning is also still carried out by means of lectures without testing the students' personality abilities. Students also do not have the courage to show themselves to work on mathematics problems, some students have to be appointed by their teacher first to work on mathematics problems, so that students' thinking processes for solving learning mathematics problems are still weak.

According to Ahda (2018), the actual difficulty of students based on understanding in completing mathematics tests is being able to understand the meaning of each word in the test given. In this way, the researchers conducted research on the process of students' mathematical problem solving abilities in opportunity material in terms of *extrovert-introvert personality types* in class X students at State Vocational School 1 Patumbak.

Based on this statement, the problem formulation is "how is the ability to solve mathematical problems in opportunity material in terms of the *extrovert-introvert personality type* in class X State Vocational School 1 Patumbak?"

The aim of this research is "to determine the ability to solve mathematical problems on opportunity material in terms of *extrovert-introvert personality types* in class X State Vocational School 1 Patumbak."

2. Method

This research is included in qualitative research with a descriptive approach. Nirmayani (2021) states that qualitative research is a way of knowing (something) where a researcher collects, organizes and interprets information obtained from humans using the eyes or ears as a filter. The characteristics of qualitative research are 1) It is carried out in natural conditions, directly to the data source and the researcher is the key instrument. 2) Qualitative research is more descriptive. The data collected is in the form of words or images, so there is no emphasis on numbers (Gumilang, 2016) .

In this research, the researcher involved participants, namely students in class X RPL State Vocational School 1 Patumbak with a total of 35 students . To understand students' *problem solving, instruments are used, namely questionnaires, interviews, documentation and tests.*

This instrument was created to estimate the dimensions of Extraversion which has a total of 24 questions, Neuroticism which has a total of 24 questions and lying which has a total of 9 questions. Personality tests are carried out by

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giving respondents a set of questions or written statements to answer.

The formula for finding students' problem solving ability scores is:

$$Nilai = \frac{Skor\ yang\ Diperoleh}{Skor\ Maksimal} \times 100 \quad (1)$$

The following are the descriptive statistical calculations that will be used by researchers in the following Table 1.

Table 1. Descriptive Statistical Calculation

Score	Levels
0 - 39%	Very low
40 - 54%	Low
55 - 64%	Enough
65 - 79%	Tall
80 - 100%	Very Tall

The data analysis carried out was data reduction. This is done to be able to summarize, as well as focus on what is important, discarding what is not needed in the research process. Next, the summarized data is presented. The data presented was obtained from interviews. The final step is drawing conclusions. The activity of drawing conclusions in this research is by describing the results of data presentation with indicators of problem solving steps that have been achieved by students, then analyzing them into problem solving steps according to Polya. So that conclusions will be obtained from the presentation of the data.

3. Results and Discussion

Based on the research that has been carried out, 4 subjects were chosen as follows:

a. The researcher used class X 2 RPL at SMK Negeri 1 Patumbak as a sample consisting of 35 students.
b. The personality results of extroverted and introverted students were obtained from the EPI personality questionnaire, which consisted of 24 questions. The personality questionnaire was given to students in class X 2 RPL SMK Negeri 1 Patumbak, totaling 35 students.

Table 2. Classification of Student Personality Motives

Student Code	Total Value	Personality type
S2	≥ 12	extrovert
S6	≥ 12	extrovert
S3	≥ 12	extrovert
S7	≥ 12	extrovert
S4	≥ 12	extrovert
S11	≥ 13	extrovert
S12	≥ 12	extrovert
S13	≥ 13	extrovert
S14	≥ 14	extrovert
S16	≥ 15	extrovert
S18	≥ 12	extrovert
S19	≥ 12	extrovert
S23	≥ 13	extrovert
S24	≥ 12	extrovert
S29	≥ 12	extrovert

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Student Code	Total Value	Personality type
Number of Students		15 Learners
S1	≤ 10	introvert
S5	≤ 10	introvert
S8	≤ 10	introvert
S9	≤ 07	introvert
S10	≤ 11	introvert
S15	≤ 10	introvert
S17	≤ 09	introvert
S20	≤ 11	introvert
S21	≤ 11	introvert
S22	≤ 10	introvert
S25	≤ 09	introvert
S26	≤ 10	introvert
S27	≤ 07	introvert
S28	≤ 08	introvert
S30	≤ 11	introvert
S31	≤ 08	introvert
S32	≤ 10	introvert
S33	≤ 09	introvert
S34	≤ 10	introvert
S35	≤ 07	introvert
Number of Students		20 Learners

From the table above it can be seen from the total number of students in class X-2 RPL Patumbak 1 State Vocational High School for the academic year 2022-2023 which has a total of 35 students 15 who have extroverted personalities and the remaining 20 students who have introverted personalities.

c. The posttest was carried out by 4 students, 2 as extroverts and 2 as introverts, where 1 student with a high level of thinking had an Extrovert personality type and 1 student with a weak level of thinking had an Extrovert personality type, then 1 student with a very high level of personality had a variety of introverted personalities and 1 student with a medium level of thinking who has a variety of introverted personalities.

Table 3. Problem Solving Ability Based on Variety of Student Personalities

Category	Number of Students	No absence	
		extrovert	introvert
Very high	3		33,09,15
Tall	14	12,02,14,24,16,18	22,35,30,27,25,05,28,20
Currently	9	23,03,04,07	01,08,32,34,10
Low	7	06,19,29,11,13	26,17
Very low	2	29	26

Based on the test results, it was obtained that 3 introvert students were in the very high category, 6 extrovert students and 8 introvert students were in the high category, 4 extrovert students and 5 introvert students were in the medium category, 5 extrovert students and 2 introvert students were in the medium category. low and finally 1 extrovert student and 1 introvert student are in the very low category.

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d. Based on the results of the problem-solving ability test and the results of the interview tests carried out by the students, it can be concluded that students who have a variety of introverted personalities in the first stage are able to write down material and state what is known and asked in questions correctly, then in the second stage the problem-solving ability The problem is to create a well-designed problem solving plan for all questions. Then in the third stage, students with various introverted personalities were not able to re-check the results of the answers they got even though the final results they got were correct. Based on the results of the post-test on problem-solving abilities and interview tests carried out by students, it can be concluded that not all students who have a variety of extroverted personalities can answer all questions correctly and easily.
e. The presentation of the research results was carried out on data on the classification of extrovert and introvert personality types. Next, the data is described according to the stages of mathematical problem solving according to Polya, namely understanding the problem, preparing a solution plan, implementing the solution plan, and re-examining the results of problem solving. The ability to solve problems is seen from each step in solving the problem. The data in this research are the results of written tests and interviews with 2 subjects.

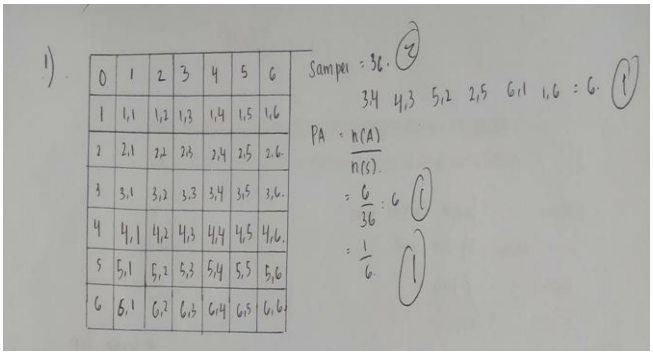

Figure 1. Answer to SH 14 Question Number 1

The extrovert personality type has the characteristics of being happy with people, confident, active, happy working in groups, easy to get along with and speaks after thinking. Based on the results of the SH 14 written test, question number 1 with the extrovert personality type, the subject was able to write what he knew and was correct, but some of the writing requested was not correct. Based on the results of the interview above, information was obtained:

1) Understanding the Problem
   Based on the results of the interview, the subject was able to state what he knew and asked the question correctly as in the answer to question P. Then from the statement the subject was also able to identify several concepts related to solving the question asked even though there were still answers that were not correct.
2) Develop a problem solving plan
   Based on the results of the interview above, the subject can state initial conclusions, and can draw conclusions correctly based on the results of the investigation that has been carried out and is confident in the conclusions he has made.

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3) Implement a problem solving plan
   In question P, the subject only understands how to solve it, namely by discussing it with his/her seatmate.
4) Check the solution results again
   In question P, the subject is sure of the answer and checks the answer he wrote again.

The following are the results of interviews that researchers conducted with students for question number 1 with the Extrovert personality type as follows:

Q : What do you know about probability question number 1?
SH 14 : What is known is that there are 36 samples, then 7 dice appear, there are 6 samples, sis.
Q : What are the questions asked about opportunities? Explain?
SH 14 : What is the probability of the event that the number on the dice turns 7?
Q : Do you find difficulty in understanding the elements of opportunity questions? explain?
SH 14 : Yes, I have difficulty understanding the meaning of the first die, which is not a multiple of 5, sis.
Q : What is your strategy for solving this opportunity problem?
SH 14 : My strategy in working on questions is by discussing it with my classmates, Sis.
Q : Do you think the solution steps you took were correct?
SH 14 : Yes, sis.
Q : Did you check your answer again?
SH 14 : Yes sis.
Q : Did you get this solution in another way?
SH 14 : Yes sis, but I'm still confused

The following is a presentation of mathematical problem solving data for the personality type of introverted students.

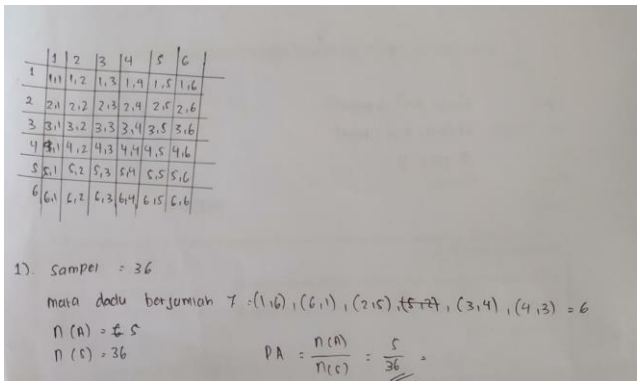

Figure 2. Answer to SH 09 Question Number 1

Based on the results of the interview above, information was obtained:

1) Understanding the Problem
   Based on the results of the interview, the subject was able to state what he knew and asked questions correctly as in the answer to question P. Then

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from the subject's statement he was also able to identify several concepts related to solving the questions asked. Then the subject also checked the answer again whether it was correct or not, from the final result the researcher saw that the subject was able to answer the question with the correct steps and the final result was correct too.

2) Develop a problem solving plan
   Based on the results of the interview above, the subject can state initial conclusions, and can draw conclusions correctly based on the results of the investigation that has been carried out and is confident in the conclusions he has made .
3) Implement a problem solving plan
   In question P, the subject can understand how to solve it, namely by understanding the material that the researcher has previously provided.
4) Check again
   In question P, the subject is sure of the answer and checks again that the answer he wrote is correct.

The following are the results of interviews that researchers conducted with students for question number 1 with the Introvert personality type as follows:

Q	: What do you know about probability question number 1?
SH 09	: What I know from question number 1 is that there are 36 samples, then in the question of how 7 dice appear there are 6 samples, sis.
Q	: What are the questions asked about opportunities? Explain?
SH 09	: What is asked in question number 1 is what is the probability that the number of dice will be 7? Then by showing the first dice that is not a multiple of 5, I can determine n(A), sis.
Q	: Do you find difficulty in understanding the elements of opportunity questions? explain?
SH 09	: Yes, I found a little difficulty in answering question number 1.
Q	: What is your strategy for solving this opportunity problem?
SH 09	: My strategy in working on questions is by understanding the material notes that you have given me, Sis.
Q	: Do you think the solution steps you took were correct?
SH 09	: I think so, sis.
Q	: Did you check your answer again?
SH 09	: Yes sis.
Q	: Did you get this solution in another way?
SH 09	: Yes sis

4. Conclusion

Based on the results that have been obtained, it can be concluded that students with mathematical problem solving in the opportunity material, in terms of extrovert personality types, are more enthusiastic in taking tests than students with introverted personalities. From the research results, it was found that students who have introverted personalities can write answers, but are less able to explain the answers. Meanwhile, students with extroverted personalities tend to be more confident, both in writing answers and explaining their answers.

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Author Contributions
Authors have sufficiently contributed to the study, and agreed with the results and conclusions.

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Declaration of Competing Interest
No conflict of interest is declared by authors.

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