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Analysis of Mathematical Spatial Ability in Terms of Choleric and Melancholic Personality Types in Junior High School Students

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Abstract--Mathematics is one of the subjects that occupies an important role in the world of education. Geometry is a part of mathematics that can hone spatial skills. Variations in spatial abilities differ in students depending on personality type. The purpose of the study was to determine the students' mathematical spatial ability in terms of choleric and melancholic personality types in geometry. This type of research is qualitative research with data obtained through questionnaires, tests, and interviews. Data were analyzed by data triangulation. From this data, it is analyzed and triangulation process is carried out. The results showed: (1) the mathematical spatial abilities of students with choleric personality were categorized as good, which were able to identify, classify, imagine, construct and present geometric shapes and have not been able to state the position of the elements; (2) The mathematical spatial ability of students with melancholic personality types, namely being able to state the position of the elements of a spatial structure, being able to identify, classify, imagine a shape or position, be able to construct and represent a spatial image and be able to investigate a spatial image.

Keywords--geometry, junior high school, mathematical spatial ability, personality type, students.

Introduction

Mathematics is one of the subjects that occupies an important role in education because the implementation of mathematics in everyday life is widely used both for mathematics itself and the application of science, while in the learning process the importance of mathematics is to train the ability to think systematically, logically, critically, creatively and consistent in solving problems (Librianti, 2015; Mursidi & Noviandari, 2020). An example of mathematics in everyday life is when students are asked to measure drums, students can calculate using the formula for the volume of the tube (Kamilia et al., 2018). The example of mathematics in

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the learning process in the classroom is when students are asked to calculate the side length of a cube and only know the volume. So what students do first is to find the formula for the volume of a cube (Mursidi et al., 2021; Najib & Mursidi, 2022). At that time it is expected that students can solve problems logically, creatively and consistently. Given the importance of the role of mathematics in the learning process and in everyday life, everyone must have knowledge in mathematics (Anam et al., 2018).

One of the mathematics subjects taught at school is geometry. According to Stein in (Murdani, 2013), geometry is a mathematical science related to points, lines, planes, spaces, and their relation to one another (Asis & Nurdin Arsyad, 2015). In class VIII junior high school students there is geometry material on the subject of flat-sided shapes which includes competency standards, namely being able to understand the properties of cubes, blocks, and other shapes and determine their size (Gillies, 2004; Garcia et al., 1998). In line with that, it is necessary to have students' mathematical spatial abilities (Farisdianto, 2014; Prawira, 2013). According to Adam & Zulkarnaen (2020), spatial ability is the ability to perceive, store, remember, identify, create, change, and communicate a spatial image. This spatial ability is related to shapes, forms, spaces and their relationships. According to Aini et al. (2019); Putri (2019), people who have spatial abilities will have the capacity to manage images, shapes, colors, and spaces and create images mentally and realistically.

However, the reality shows that there are some students who have difficulty in learning geometry, especially geometric shapes (Gajentaan & Overmars, 1995; Fearn et al., 2009). Meanwhile, the National Council of Teachers of Mathematics (NCTM) in (Siswanto & Kusumah, 2017), states that one of the standards for giving geometry in schools is so that children have spatial and geometric modeling skills and can use visualization in solving problems (Mayasari, 2019; Lestari, 2012). For example, when students encounter a three-dimensional problem where students are asked to find the length of the line connecting the midpoints of two space diagonals of a cube (Fajri et al., 2016; Azustiani, 2017). At that time the students were required to imagine, see, identify a shape in order to solve the problem. Therefore, learning geometry plays an important role in knowing students' spatial abilities.

Research on students' spatial abilities had previously been carried out by Purborini & Hastari (2018), namely about the analysis of spatial abilities in flat-sided shapes in terms of gender differences in class VIII C SMP Negeri 2 Trenggalek, showing: (1) male students are able to solving problems using pictures and drawing solutions, able to connect known data with the concepts they have, able to see problems from different perspectives, able to find patterns in solving problems; (2) female students are able to solve problems using pictures and are able to mention known concepts (Syahputra, 2020; Winarso, 2017).

The results of research by Febriana (2015), which is about the profile of spatial ability in terms of mathematical ability conducted at SMPN 1 Gerung West Lombok NTB Province show: (1) students with high and medium abilities are able to change the shape of an object into different forms but have difficulty in representing three-dimensional image into two-dimensional on the plane; (2)

students with low abilities are able to change the shape of an object into a different shape but have difficulty in imagining the shape of an object from a different perspective (Hamidah et al., 2018; Riyani et al., 2017).

From previous research, it was shown that each student's spatial ability must be different, this difference can be influenced by several things, one of which is a person's personality (Fitria, 2014). Related to the personality differences that are owned by each person, the scientist Hippocrates who is known as the father of medical science stated that in humans there are four basic elements of nature including sanguis, chole, melanchole, and phlegma (Chomaria, 2018). Then refined by Galenus and described into personality types with each of its characteristics, namely (1) the choleric type who has strong will, stubbornness, and resourcefulness; (2) the melancholic type who has analytical, thinking, and pessimistic nature; (3) the phlegmatic type who is calm, slow, and less expressive; (4) the type of sanguinis who has agile (very active), confident, and forgetful nature (Anam et al., 2018). The four personality types will affect student behavior both in the surrounding environment and in terms of thinking or in making decisions (Greasley & Bocârnea, 2014; Harrington & Loffredo, 2010).

SMP Muhammadiyah 1 Genteng is a religious-based school whose students have heterogeneous personalities (Krismayani et al., 2020). This was revealed directly by the mathematics teacher through interviews, when the learning process took place the characteristics of each student in listening to various materials, there were students who were actively speaking, actively writing, students who liked to make pictures or charts to write what the teacher said, students who thought slowly in writing (Nyandra et al., 2018). Receive the material, as well as students who have difficulty in understanding the material (Sumandya, 2016). One of the materials that are considered difficult by students is material related to geometry, especially geometric shapes. Students have difficulty in imagining a building if it is exemplified in a classroom or other building, students also have difficulty in constructing a drawing in a flat plane (Beiter et al., 2015; Hunt & Eisenberg, 2010). This shows that students' mathematical spatial abilities are still relatively low and lack of applying mathematical spatial abilities during the learning process. Therefore, in this study, the choleric and melancholic personality types will be used as differentiators for students in the process of identifying students' mathematical spatial abilities (Shomirzayev, 2021).

Method

The Research on Analysis of Students' Mathematical Spatial Ability in terms of Choleric and Melancholic Personality Types in junior high school students is a qualitative study which took place at Junior High School of Muhammadiyah 1 Genteng, Banyuwangi. The respondents of this study were students of Junior High School of Muhammadiyah 1 Genteng with the consideration that these students had obtained the material for building space and then selected students with 3 corelistic personality types and 3 melancholic personality types using the purpose sampling method (Sugiyono, 2010). For data collection is done through the method of questionnaires, tests and interviews. The personality questionnaire was adopted from the book by Florence Littauer which contains 40 statements where each number describes the four personality types, namely sanguine, choleric, melancholic, and phlegmatic. Meanwhile, the test was in the form of 2

essay questions with the subject of flat side space and interviews were conducted on 6 subjects including 3 subjects with choleric personalities and 3 subjects with melancholic personalities. The data obtained were then analyzed using data triangulation techniques, namely reduction, data presentation, conclusion drawing, and triangulation.

Discussion

This research begins with the process of selecting students based on the choleric and melancholic personality types. The personality type questionnaire was given to 30 grade VIII junior high school students. The selection of the class was based on the recommendation of the teaching teacher that the class was more competent in the field of mathematics. The researcher provides a personality type questionnaire online through the google form page which recaps the results of the personality type questionnaire Table 1.

Table 1
Results of the recapitulation of the personality type questionnaire for class VIII Junior High School students

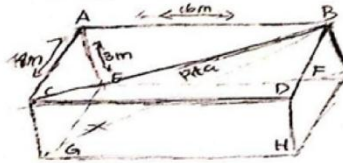
	Type Personality				
	Sanguin	Choleric	Melancholic	Plegmatic	Mix perpersonality
Totally student	10	3	6	7	4

Based on these results obtained 10 respondents who have a sanguine personality, 3 respondents choleric personality, 6 respondents melancholic personality and 7 respondents phlegmatic personality. Meanwhile, the other 4 respondents had mixed personalities, i.e. there were two or more of each dominant personality having the same results. Related to this research, the researcher took 3 respondents from choleric and melancholic personalities, so that the research students amounted to 6 respondents. The consideration of taking these 6 respondents was based on the number of B points representing the choleric personality type and the number of C points representing the melancholic personality type.

Furthermore, the 6 students were given a written test of the mathematical spatial ability of the cube and block material (Gilligan et al., 2017; Kyttälä & Björn, 2014). After being given the test, interviews were conducted to strengthen the data that had been obtained from the results of the previous written test. The researcher analyzed the test results with the interview results and then triangulated the method and focused on the interview results because it would be used to find out the students' reasons for answering the questions contained in the previous written test. Researchers conducted written tests and door-to-door interviews because it was based on government policy during the COVID-19 pandemic to change the learning process at school to study at home (Najib & Mursidi, 2022).

Student with Korelis personality

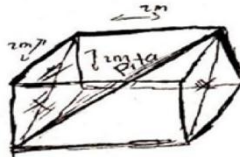
1. a. size : 6 m x 4 m x 3 m



b. Beam

c. Side Diagonal

2. a. Size : 2 m x 2 m x 2 m



b. Cube

c. Space Diagonal

Figure 1. Korelis student test results

To get data, a test is carried out or in the form of a test given to students. The test was given to class VIII Junior High School of Muhammadiyah 1 Genteng with material about geometry. From the test results of students with correlational personalities, it can be seen that students have good abilities in constructing and representing spatial images, this is shown in questions number 1a and 2a, namely students are able to draw the sketch referred to in the question, namely the complete image of the block and cube. Starting from naming and giving sizes, even though there are lines that are not straight. Students who are able to draw the sketch referred to in the problem mean that students are also able to imagine the shape or position of the image, because before drawing, of course, students will imagine it first. This answer will be strengthened in the results of the interview.

Furthermore, students are also able to identify and classify the spatial images shown in questions number 1b and 2b. Students can determine and classify the shapes contained in the problem, in this problem it can be seen that students understand the differences in the shapes of blocks and cubes. In students' answers to numbers 1c and 3c, students are able to state the position of the elements of space, students can describe and show the location of the diagonals and diagonals of space correctly. Of all the questions in the problem, students are able to answer correctly, this means that students are able to investigate a spatial image.

After testing through questions related to geometry, interviews were conducted with students. The results of the interviews showed that students were able to draw a complete sketch of a block and cube. Students also imagine first after reading the problem. Students are able to determine and classify blocks and cubes, students can also explain the reason why they are called blocks in question number 1b and cubes in question number 2b, student's answers show that students understand the difference between geometry of blocks and cubes.

Furthermore, students can show the location of the side diagonals and diagonals of space and can explain the reason even though the words are not quite right. Students are also able to investigate a spatial picture, because all the questions in the interview are questions that test students with the results of their own answers. Students can answer the question correctly.

Students with Melancholic personality

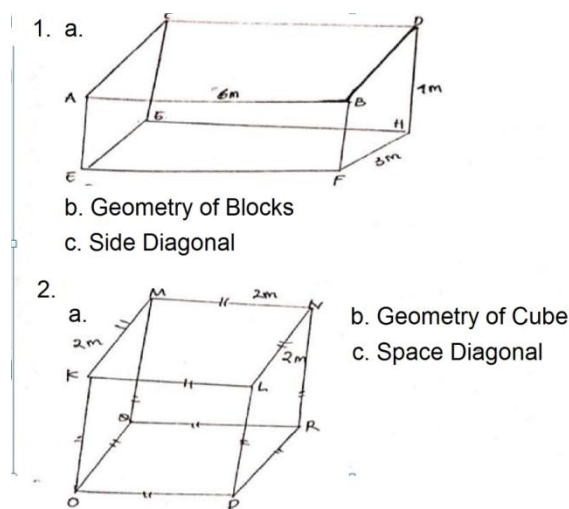


Figure 2. Test results of students with melancholic personality

Referring to the test results, it is known that students are able to construct and represent spatial images, students can draw sketches of spatial shapes according to what is asked in the question. Students draw a complete sketch of the space, starting from naming and giving measurements. Students are also able to identify and classify geometric figures, students can determine the shape of the cuboid at number 1b and the cube at number 2b, from this answer it can be seen that students understand the difference between cuboid and cube shapes. Furthermore, students are also able to determine the line segment referred to in the problem, namely side diagonals and space diagonals, students are able to state the position of the elements of a spatial shape. Of all the questions in the problem, students are able to answer correctly, this means that students are able to investigate a spatial image.

Interviews were conducted with students. Based on the results of the interviews, it can be seen that the students are able to draw a sketch of the rectangular block in number 1a and the cube in number 2a with a complete picture. After reading the problem, students also imagine first. Furthermore, students are also able to identify the image of the spatial structure referred to in the question, in question number 1b students answer geometry of blocks with the right reasons, and in question number 2b students answer cube space with the right reasons as well. It can be seen from the students' answers that they really understand the difference between cubes and blocks.

In students' answers to numbers 1c and 2c, students also answered correctly, students were able to draw and indicate where the tape and wire were stretched, and could determine what was drawn, namely side diagonals and space diagonals. Students are able to state the position of the elements of a geometric shape. Of all the questions in the questions and interviews, students can answer correctly, students explain correctly, students are able to investigate a spatial image.

Students with personality are able to state the position of the elements of a shape, students can show the location of the diagonals and diagonals of space and can explain the reasons correctly. Another thing is that students with correlie personality are able to identify and classify images of blocks at number one and cubes at number two. The ability to imagine the shape or position of a geometric figure, but not all of the students' answers are correct. Indirectly, students before working on interpreting in the mind which then constructs and represents a geometric figure, students can draw a complete and correct sketch of the shape, starting from naming the shape and giving the size. The ability of students with korelis personality in investigating geometric figures is in good category and when interviewed students are able to answer all questions on the questions that have been done.

The findings in this study are related to the working process, students with personality correlations are very fluent. During the interview, students with korelis personality did not experience difficulties in doing the mathematical spatial ability test, cubic students answered every question given in the interview correctly, quickly and firmly. Judging from the results of working on with korelis personality it is neater in writing answers. This is in accordance with the nature of the choleric, which is discipline and neat in doing things. The results of the analysis on students are in accordance with the Hippocrates-Galenus theory (in [Littauer, 2005](#)), which states that the choleric personality type is target-oriented, sees the whole picture, is well organized, looks for practical solutions, moves quickly to act, delegates work, emphasizes results, and make targets.

Students with melancholic personality are able to state the position of the elements of spatial structure. Students can show the location of the diagonals and the diagonals of space. Students are well able to identify and classify spatial images and are able to determine spatial images in questions. Students with melancholic personalities are able to imagine the shape or position of the image from a certain point of view. This is proven by, students are able to construct and represent spatial images, students can draw blocks and cubes correctly, students seem to understand the shape of cubes and blocks. In addition, students' ability to invest in pictures is also in good category.

The findings in this study are related to the working process, in solving problems, students have analytical characteristics, emphasize results, are well organized, and get creative solutions according to the melancholic personality type. The results of the analysis on students with melancholic personality type are in accordance with the theory of Hippocrates-Galenus in [Littauer, 2005](#) which states that the melancholic personality type is perfectionist, high standards, aware of details, persistent and careful, gets creative solutions, likes diagrams,

graphs, charts and lists. Students with melancholic personality have understood the shape of cubes and blocks. At the time of the interview, students with melancholic personalities lacked confidence and were still hesitant in placing the ribbon and wire positions. This is in accordance with what was stated by Hamidah et al. (2018), that melancholic students tend to be less confident in solving problems.

Conclusion

The mathematical spatial ability of students with a choleric personality type is able to identify and classify a spatial image, be able to imagine the shape or position of a spatial image, be able to construct and represent a spatial image, but has not been able to state the position of the elements of a spatial structure and has not been able to investigate a spatial image. Mathematical spatial abilities of students with melancholic personality type are able to state the position of the elements of a spatial structure, able to identify and classify a spatial image, able to imagine the shape or position of a spatial image, able to construct and represent a spatial image and be able to investigate a spatial image

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