



Analysis of Students' Spatial Mathematical Ability viewed From The Florence Littauer Personality Type

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Submitted: 22-06-2025

Revised: 10-11-2025

Accepted: 15-11-2025

Published: 05-12-2025

ABSTRACT

This research aims to analyze the spatial abilities of students in light of Florence Littauer's personality types and understanding of how students personality traits can influence their mathematical spatial abilities. This research is a qualitative research with an exploratory method. Data were collected from eighth-grade students of SMP Negeri 13 Tasikmalaya, . The subjects of the research are eight eighth-grade students from SMP Negeri 13 Tasikmalaya from each representing each of the four personality types. The research instruments included a personality type questionnaire, spatial ability tests, and unstructured interviews. Data were analyzed through data reduction, data presentation, and conclusion drawing. The results indicate variations in spatial ability achievement according to personality type. Students with a melancholic type demonstrated comprehensive mastery of all spatial indicators, while sanguine and phlegmatic students showed strengths in spatial perception as well as some aspects of visualization and rotation, though they still needed reinforcement in using geometric terminology and image representation. Meanwhile, choleric students exhibited strong mental rotation skills but experienced difficulties in visualizing objects from multiple perspectives and assembling shapes after manipulation. These findings contribute to mathematics education theory by highlighting the role of personality types in developing students' spatial thinking skills.

Keywords: analysis; personality type florence littauer; spatial ability

INTRODUCTION

Mathematics is a crucial subject to study at every level of education (Badi'ah et al., 2024). However, the reality is that until now, most students still consider mathematics to be a theoretical science, filled with symbols and complicated formulas, whereas mathematics is a universal science (Chaerunisa, 2019). One of the reasons why mathematics is considered a difficult subject is abstract nature. In line with the opinions of Kurniawan & Marliani (2014) that mathematics is an abstract and hard-to-imagine science. This condition can be seen from the fact that many students still struggle to visualize mathematical concepts, especially those that have no direct connection to real-life situations. Therefore, the ability to imagine is highly required in learning mathematics.

The ability to imagine of the students falls into spatial abilities. Abilities are natural talents possessed by individuals to complete specific tasks (Saputra, 2018). Meanwhile, in the Great Dictionary of the Indonesian Language (KBBI), spatial is defined as something related to space or place. Therefore, spatial ability refers to the ability of students to solve problems related to shapes or space. This aligns with the opinion Lestari and Yudhanegara (dalam Wulansari, 2019), Spatiotemporal mathematical ability is the ability to imagine,

compare, estimate, determine, construct, represent, and understand information from visual stimuli in the context of space. The research findings emphasize that the importance of spatial ability in mathematics learning lies in its contribution to understanding concepts in geometry, algebra, and problem-solving (Rahmi et al., 2023; Uttal et al., 2012). Thus, spatial ability plays a crucial role in helping students convert abstract mathematical concepts into more concrete and meaningful representations (Septian et al., 2023).

The academic ability possessed by students is influenced by many factors. One of them is the character or personality they have. This is in line with the opinion Rahmadhani and Ahmad (Nupus et al., 2024), that the academic ability of students can be influenced by their character or personality. This indicates that each personality type can influence the way students understand and solve mathematical problems, including those related to space and shape.

The characteristics of students commonly found in school learning include some students who are sociable with others, perfectionists in completing tasks, have a strong leadership spirit, and are shy. The personality types that classify these student characteristics are the personality types according to Florence Littauer. The academic ability of students can be influenced by their character or personality. Thus, it can be said that each personality within student has different academic capabilities, especially spatial abilities. The characteristics of students commonly found in school learning include some students who are sociable with others, perfectionists in completing tasks, have a strong leadership spirit, and are shy. The personality types that classify these student characteristics are personality types according to Florence Littauer. that the academic ability of students can be influenced by their character or personality. Thus, it can be said that each personality within student has different academic capabilities, especially spatial abilities. The characteristics of students commonly found in school learning include some students who are sociable with others, perfectionists in completing tasks, have a strong leadership spirit, and are shy. The personality types that classify these student characteristics are personality types according to Florence Littauer. Littauer & Sweet (2016) states that the personality types of students are divided into four types: sanguine, melancholic, choleric, and phlegmatic.

Based on the results of the researcher's interview at SMP Negeri 13 Tasikmalaya conducted with one of the mathematics teachers, it was found that in the class taught by the teacher, some students are already able to solve problems related to visualizing shapes, but most students are still unable to do so. One of the factors influencing this is the different character of the students. Generally, students experience difficulties in viewing objects from certain perspectives, especially in the material of flat-sided spatial shapes, where some students have not been able to solve the given problems. This aligns with the opinion Diantari (Intan et al., 2021), students are still struggling to solve geometry problems, especially on the material of flat-sided three-dimensional shapes.

Based on the problems described, the researcher conducted a study on the material of flat-sided three-dimensional shapes entitled "Analysis of Students' Mathematical Spatial Ability Viewed from Florence Littauer's Personality Type." This research aims to analyze the spatial abilities of students in light of Florence Littauer's personality types and to examine the role of personality types in influencing students mathematical spatial abilities.

RESEARCH METHODS

According to Moleong (2017), Qualitative research is an approach aimed at understanding the phenomena experienced by research subjects, such as behavior, perception, motivation, and actions comprehensively. This approach is carried out through descriptions in the form of words and language, in a characteristic natural context, and using various methods that are natural and exploratory. This opinion is in line with Sugiyono (2019), which states that research methods are a scientific way to obtain data with specific purposes and benefits.

This research uses an exploratory method as its approach. According to Hamdi dan Ismaryanti (dalam Nur et al., 2022), Exploratory research is a type of research aimed at exploring and expanding understanding of a particular condition, or to obtain new ideas that can help formulate problems in more detail. This method is chosen so that researchers can uncover more in-depth regarding the mathematical spatial abilities of learners viewed from personality types according to Florence Littauer's classification.

The data sources in this study focus on eighth-grade H students of SMP Negeri 13 Tasikmalaya. In this research, the selection of participants was based on the researcher's considerations. The criteria included two students from each of Florence Littauer's personality types who were able to complete the test independently without relying on the correctness of their answers. In addition, the selected participants were students capable of expressing their thoughts both in written and verbal forms, enabling them to provide the necessary information and actively participate throughout the research process.

The activities conducted in this research include the students filling out a personality type questionnaire according to Florence Littauer twice at different times to assess the consistency of the students in completing the personality type questionnaire. Then, the students took a test in the form of descriptive questions on geometry material. After that, the students participated in interviews to delve deeper into their abilities. The data collection techniques in this research are (1) the distribution of Florence Littauer's personality type questionnaire, conducted twice at different times to evaluate the consistency of the students, (2) a test in the form of descriptive questions on geometry, and (3) unstructured interviews.

RESULT AND DISCUSSION

This discussion is based on the analysis of the answers to questions related to geometry material, it is adjusted to the spatial ability indicators according to Linn and Petersen (1985), namely spatial perception, spatial visualization, and mental rotation, as well as the results of the personality type questionnaire according to Florence Littauer, which consists of four personality types: sanguine, melancholic, choleric, and phlegmatic, and also the results of interviews conducted by the researcher with the research subjects.

Based on the personality type questionnaire and test results, it was concluded that the S20S students with a sanguine personality type excel in the indicator of Spatial Perception, mastering the ability to differentiate between horizontal and vertical planes both visually and conceptually. They also demonstrate the ability to identify objects horizontally and vertically, even if the object's position is tilted. Furthermore, S20S also possesses good spatial reasoning, although they still require guidance in articulating their reasons using more

precise geometric terms. S20S shows an ability to understand spatial concepts logically and visually, as well as the capability to revise and develop their answers during interviews. In the Visual Spatial indicator, subject S20S has partially met the indicator of "solving problems related to objects that have had their position or shape manipulated." S20S also shows a good initial ability to imagine and describe objects from multiple perspectives. Furthermore, S20S has a preliminary understanding of the ability to visualize objects from various angles, according to the indicator "students can visualize or see the composition of an object after its position and shape have been manipulated." Then, the mental rotation indicator, subject S20S is already able to rotate a flat shape into a three-dimensional shape and imagine the rotation of that flat shape or three-dimensional shape. Moreover, S22P is also capable of depicting three-dimensional shapes after rotation has been performed. However, at the stage of depicting two-dimensional shapes after rotation, S20S has not fully demonstrated achievement of the indicator because they can only accurately represent the result of the rotation in simple situations, such as a rotation of 180°.

Students of S21S with a sanguine personality type on the Spatial Perception indicator, which involves distinguishing between horizontal and vertical fields, have not achieved this accurately yet, due to confusion in identifying the direction of the fields. However, when identifying objects both vertically and horizontally, despite the manipulated positions, this has been achieved, particularly in placing objects and recognizing the direction of lines. In terms of the Spatial Visualization indicator, it appears that the S21S subject is still unable to solve problems related to objects that have had their positions and shapes manipulated; furthermore, S21S is also not able to visualize or see the composition of an object after its position and shape have been altered. However, at the stage of viewing an object from multiple perspectives, S21S has provided some correct answers. Then, the Mental Rotation indicator shows that the subject S21S is already able to rotate a flat shape or a spatial shape and imagine the rotation of that flat shape or spatial shape accurately. However, in this case, S21S has not been able to depict a three-dimensional shape after rotation, and also has not been able to depict a two-dimensional shape after rotation..

Both subjects have assessment results indicating that students with a sanguine personality type tend to be less capable of solving the problems given. This is in line with the findings of the research by Mayasari et al. (2019) which shows that students with a sanguine personality tend to be less capable of solving the given problems and easily give up when faced with questions that are perceived as difficult. This statement is also reinforced by Kart's opinion (Agustina et al., 2013), which mentions that individuals with a sanguine personality tend to give up easily and lack resilience. This is evident when the researcher asked the question, 'Earlier you tried to depict the stack of cubes according to the top, front, and side views as shown in the question. Can you tell me how you created this drawing?' but S21S immediately interrupted by answering, 'For this question, I got stuck, ma'am, I'm dizzy trying to imagine it, so I guessed.' This response reflects the characteristics of a sanguine person. Additionally, when the researcher called S20S and S21S for the interview, it was clear that S20S and S21S showed high enthusiasm. Throughout the interview process, S20S and S21S answered every question from the researcher in a loud voice, full of confidence, and with an optimistic attitude. These attitudes illustrate the traits of a sanguine personality. Littauer and Sweet (dalam Rahmaningtyas, Purwati & Nugroho, 2021) explain that

individuals with a sanguine personality are known to be lively, pleasure-loving, optimistic, forgetful, and good at storytelling in an engaging manner.

The S9M student with a melancholic personality type on the Spatial Perception Indicator has almost fulfilled the ability to distinguish between horizontal and vertical planes. Furthermore, in identifying objects horizontally or vertically, although the objects are manipulated, this has not yet been fully achieved, especially in identifying types of lines in slanted positions. Then, on the Spatial Visualization indicator, it can be concluded that the S9M subject is already able to solve problems related to objects that have changed position or shape. Additionally, S9M can also observe an object from various viewpoints. Another ability demonstrated by S9M is the capability to visualize or imagine the arrangement of an object after it has been manipulated in terms of both position and shape. Then, the Mental Rotation indicator shows that subject S9M is already able to rotate a flat shape or a spatial shape and imagine the rotation of that flat shape or spatial shape accurately. Additionally, S9M is also capable of depicting three-dimensional shapes after rotation, and S9M can depict two-dimensional shapes after rotation as well.

S31M with a melancholic personality type has mastered both indicators of spatial abilities tested in the Spatial Perception Indicator. S31M can identify fields and lines based on directional orientation, both in general and in the context of tilted three-dimensional shapes. S31M demonstrates good visual and descriptive reasoning abilities, although in written responses, they still use informal terms (such as 'flat' or 'upright'), they can clarify these meanings during interviews. Thus, S31M shows well-developed spatial abilities and can adjust their perception of direction and position even with geometric shapes in manipulative conditions. In the Spatial Visualization indicators, subject S31M has not yet achieved the indicator "Solving problems related to objects that have had their positions or shapes manipulated. However, S31M shows excellent ability in understanding the shapes of objects from various perspectives. Additionally, S31M has met the indicator of being able to visualize and arrange objects after their shapes and positions have been manipulated, as well as demonstrating a well-developed spatial understanding. And in the mental rotation indicator, S31M has not yet achieved the indicator "Learners can rotate a flat shape or a solid shape and accurately imagine the rotation of that flat or solid shape." However, S31M is already able to depict three-dimensional shapes after rotation has been performed, and S31M has also developed spatial visual skills in depicting the results of rotating two-dimensional shapes, as measured by the indicator, namely that learners can depict two-dimensional shapes after rotation has been performed.

Both subjects have assessment results indicating that students with a melancholic personality type still make some errors in solving given problems. This statement does not fully align with the opinion of Littauer & Sweet (2016) which reveals that individuals with a melancholic personality generally have perfectionist traits. However, after analyzing the students with a melancholic personality type, they were found to be superior and more talented than other personality types in solving the given problems. Additionally, the confidence level of students with a melancholic personality in answering questions is considered high. This is in line with their characteristics that tend to be analytical and structured. This aligns with the opinion of Littauer (n.d), which explains that individuals

with a melancholic personality usually have a serious and diligent character, are meticulous, think analytically, and tend to have high intelligence, talent, and creativity.

S08K with a choleric personality type in the Spatial Perception indicator has a basic understanding of the indicator's ability to differentiate lines, horizontal planes, and vertical planes in spatial figures, but still needs reinforcement in terms of naming and mapping planes in spatial figures. Additionally, S08K also excels in the ability to identify objects vertically and horizontally even when the object's position is manipulated well. Furthermore, S08K demonstrates reflective ability, is open to clarification, and can improve understanding when given guided questions. In the Visual Spatial indicator, subject S08K has not been able to solve problems related to objects that have been manipulated in shape because they only rely on visual observation of the front surface. S08K also does not yet have strategies such as counting by layers, estimating depth, or arranging the shadows of shapes. Additionally, S08K is not able to meet the indicator of being able to view an object from many perspectives and has also not been able to visualize or see the composition of an object after its position and shape have been manipulated. Then, in the mental rotation indicator, it is seen that the subject S08K has mastered the indicator "Students can rotate a flat shape or space and imagine the rotation of that flat shape or space accurately." The participant can visualize the direction of rotation, maintain the position of the base side according to the instructions, and accurately determine and describe the result of the rotation in the form of nets of dice. S08K has also achieved the indicator of being able to describe three-dimensional shapes after rotation, both visually and through oral explanation. In addition, S08K is not only able to apply the rotation procedure but also understands the basic principles of two-dimensional rotation, in accordance with the indicator that students are able to describe two-dimensional shapes after rotation.

S27K with a choleric personality type in the Spatial Perception indicator has been able to distinguish between horizontal and vertical planes in three-dimensional shapes, and is also able to identify the orientation of objects even when their positions are manipulated. In the Spatial Visualization indicator, it appears that subject S27K has not yet been able to solve problems related to objects whose position and shape have been manipulated, evidenced by how he counts the number of missing cubes; S27K tends to count less carefully, resulting in less accurate answers. Furthermore, S27K is also not yet capable of visualizing or seeing the composition of an object after its position and shape have been manipulated, however, in the indicator of viewing an object from multiple perspectives, S27K answered very accurately. Then, the Mental Rotation indicator shows that subject S27K is already able to rotate a flat shape or a spatial shape and imagine the rotation of that flat shape or spatial shape accurately. Additionally, S27K is also capable of depicting three-dimensional shapes after rotation, and S27K is able to depict two-dimensional shapes after rotation as well.

From both subjects, the assessment results indicate that students with a choleric personality type have high self-confidence when answering questions. This aligns with the opinion of Littauer (2016), Choleric individual tend to be open in expressing their opinions and show high enthusiasm for the things they learn. In addition, students with a choleric type also have a low error rate, likely due to their persistent and resilient nature. When faced with problems, a choleric person will usually try to find a solution and resolve it immediately.

This is not by the research conducted of Nurhayati & Santoso (2018), choleric types tend not to find new forms but rather existing forms in solving problems.

S04P with a phlegmatic personality type in the Spatial Perception indicator has mastered the indicator of distinguishing horizontal and vertical planes in spatial shapes, and identifying the direction or position of objects both horizontally and vertically even when the position of the objects is tilted. However, the ability to communicate reasoning in writing still needs to be improved, especially in providing explanations and reasons explicitly. In the Visual Spatial indicator, it is seen that subject S04P has met the indicator "Solving problems related to objects that have had their position or shape manipulated." S04P has also met the indicator "Learners can view an object from multiple perspectives." This can be seen from how S04P can observe and transform three-dimensional objects into accurate two-dimensional images from various viewpoints. Additionally, S04P has met the indicator of being able to visualize the composition of objects after their shapes have been manipulated from various perspectives. S04P not only understands position, but also height and the relationships between sides well. In the mental rotation indicator, it appears that S04P has only partially met the indicator "Students can rotate a flat shape or space and accurately imagine the rotation of that flat shape or space." S04P understands the basic shapes of a net for a cube and can follow the initial position and base instructions, but has not yet shown the ability to fully imagine the outcomes of the rotation, meaning the indicator has not been fully achieved. In addition, S04P has not completely met the indicator "Students can depict two-dimensional shapes after rotation," even though they have shown effort and appropriate thinking direction. However, S04P has achieved the indicator of being able to depict three-dimensional shapes after rotation through understanding, visualization strategies, and attention to detail in drawing.

S22P with a phlegmatic personality type has mastered the Spatial Perception indicators, namely, the ability to distinguish lines, horizontal planes, and vertical planes in three-dimensional shapes, as well as the ability to identify the position of objects both horizontally and vertically, even when the objects are tilted. In the Spatial Visualization indicators, it can be seen that the subject S22P has not been able to solve problems related to objects whose positions and shapes have been manipulated, in addition, S22P has also not been able to visualize or see the composition of an object after its position and shape have been manipulated, however, at the stage of viewing an object from many perspectives, S22P provided several correct answers. Initially, when asked to draw a stack of unit cubes when viewed from the side, S22P gave an incorrect answer, but after being interviewed by the researcher, S22P was able to correct their answer very accurately. Then, in the Mental Rotation indicator, it is observed that subject S22P is already able to rotate a flat shape or a three-dimensional shape and accurately imagine the rotation of that flat or three-dimensional shape. Furthermore, S22P has also been able to illustrate three-dimensional shapes after rotation, and S22P is capable of depicting two-dimensional shapes after rotation. This condition does not fully align with the opinion of Agustina (2015) which states that students with a phlegmatic personality tend to have careless traits, are pessimistic, and dislike challenges.

Based on the two subjects, the assessment results indicate that students with a phlegmatic personality type, namely S04P and S22P, exhibit the typical characteristics of

the phlegmatic personality type as described by Littauer (2016), which are generally calm, stable, and unhurried in facing situations. For example, S04P can understand spatial objects from various perspectives and demonstrates precision and perseverance in the visualization process, although it still needs guidance in articulating reasons in writing. This is consistent with the phlegmatic traits known for being consistent and diligent, although often less expressive in conveying thoughts. Meanwhile, S22P also shows the characteristic of being phlegmatic in the form of cautious responses and requires time to understand visual problems. This aligns with the opinion of Nurhayati & Santoso (2018) who states that learners have a tendency not to rush in solving problems. Although initially answering incorrectly, S22P was able to improve their answers after guidance was provided significantly. This reflects the positive side of the phlegmatic personality, which, according to Littauer is cooperative, open to direction, and able to develop in a supportive environment. Thus, both learners show that although phlegmatic types tend to be passive and lack initiative, they still have strong spatial cognitive potential when given a patient and systematic approach. This is in line with the research conducted by Kamilla et al. (2018) which states that phlegmatic learners tend to avoid difficulties and lack motivation in solving problems. Their character of calmness and emotional stability helps them perform mental rotation and other spatial understanding with considerable accuracy, although at the early stages, success is not always immediate.

The findings of this study reveal variations in student's mathematical spatial abilities across Florence Littauer's personality types. Choleric and melancholic students generally showed higher spatial visualization and mental rotation skills compared to sanguine and phlegmatic students. This suggests that personality traits, such as persistence, organization, and focus, commonly found in melancholic and choleric individuals, may contribute positively to spatial reasoning performance. These findings are research by (Uttal et al., 2012), which that spatial skills can be developed through training that is effective, durable, and transferable.

From a pedagogical perspective, these findings have important implications for the implementation of differentiated instruction. Teachers can design learning activities that align with students' different personality types, thereby increasing student engagement and optimizing spatial learning outcomes. This can also be achieved through STEM-based learning, which emphasizes the importance of spatial thinking as a core component of mathematical competence.

Of course, this study has several limitations. The limited sample size may affect the generalizability of the conclusions. In addition, the use of questionnaires to assess personality types may introduce subjectivity. Therefore, it is recommended to further explore the use of larger and more diverse samples to gain deeper insights into the development of students' spatial abilities.

CONCLUSION

In general, it can be concluded that the achievement of students' mathematical spatial abilities varies according to personality type. Students with a melancholic type tend to demonstrate comprehensive mastery of all spatial indicators. Sanguine and phlegmatic types

show strengths in spatial perception and some visualization and rotation indicators, although they still require reinforcement in the use of geometric terms and image representation. Meanwhile, students with a choleric type have strong abilities in mental rotation, but tend to be weak in visualizing objects from various angles and in arranging shapes after manipulation.

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