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STUDENTS' ERRORS IN SOLVING CONGRUENCE AND SIMILARITY QUESTIONS BY FLORENCE LITTAUER MIXED PERSONALITY TYPE

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Abstract

Differences in students' personality types influence the way they solve geometry problems, leading to variations in the errors they make. This research aims to describe errors and determine the factors that cause errors in solving geometry problems in terms of students' mixed Florence Littauer personality types. This research is qualitative descriptive research. The subjects of this research were ninth-grade students at SMPN 13 Malang who had been given material on "similarity and congruence of triangles". Data collection techniques include questionnaires, test questions, interviews. Data analysis techniques in this research include data reduction, data presentation, and drawing conclusions. The results of the research can be concluded that students with mixed natural personality types (SCA) make five errors, namely reading errors, understanding errors, transformation errors, process skills errors, and errors in writing the final answer. Students with mixed-complementary personality types (SCP) have one error, namely an error in writing the final answer. Students with the opposite personality type (SCL) experienced two errors in answering geometry questions, namely transformation errors and process skill errors. The factors that cause errors are (a) not being able to understand the geometry material well, (b) being weak in the prerequisite material, and (c) carelessness made by students when solving geometry problems.

Keywords: Errors, Florence Littauer Personality Type, Geometry.

Abstrak

Perbedaan tipe kepribadian siswa memengaruhi cara untuk menyelesaikan soal geometri, sehingga kesalahan yang dialami pun berbeda. Penelitian ini bertujuan untuk mendeskripsikan kesalahan dan mengetahui faktor penyebab kesalahan dalam menyelesaikan soal kekongruenan dan kesebangunan yang ditinjau dari tipe kepribadian campuran *florence littauer* yang dimiliki siswa. Penelitian ini adalah penelitian deskriptif kualitatif. Subjek pada penelitian ini merupakan siswa kelas IX SMPN 13 Malang yang sudah diberi materi "kesebangunan dan kekongruenan segitiga". Teknik pengumpulan data meliputi angket, soal tes, wawancara. Teknik analisis data pada penelitian ini meliputi reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian dapat disimpulkan bahwa siswa dengan tipe kepribadian campuran alami (SCA) melakukan lima kesalahan yaitu kesalahan membaca, kesalahan pemahaman, kesalahan transformasi, kesalahan keterampilan proses, dan kesalahan penulisan jawaban akhir. Siswa dengan tipe kepribadian campuran pelengkap (SCP) memiliki satu kesalahan yaitu kesalahan penulisan jawaban akhir. Siswa bertipe kepribadian yang berlawanan (SCL) mengalami dua kesalahan dalam menjawab soal geometri, yaitu kesalahan transformasi dan keterampilan proses. Adapun faktor penyebab terjadinya kesalahan, yaitu (a) belum mampu memahami materi geometri dengan baik, (b) lemah dalam materi prasyarat, dan (c) kecerobohan yang dialami oleh siswa dalam penyelesaian soal geometri.

Kata Kunci: Geometri, Kesalahan, Tipe Kepribadian *Florence Littauer*



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INTRODUCTION

Junior high school (SMP) students' ability to solve mathematical problems is influenced by the problem-solving patterns they have applied since they were in elementary school (SD). The results of research conducted by several researchers on students' performance in solving problem-solving tasks are still unsatisfactory. This is evidenced by a study conducted by Mawaddah, et al. (2022) which concluded that there was a 90.38% error rate among students in writing final answers in geometry topics. Students' errors in solving mathematical problems may arise from various factors. Research by Hendrayanto, et al. (2021) revealed that problem solving errors are caused by a lack of understanding of geometric concepts. According to Herdiman, et al (2018) the predominant source of student' errors in addressing geometry questions on congruence and similarity lies in the lack of sufficient mathematical explanation, lack of carefulness in reading the problems, and errors in arithmetic operations, resulting in less accurate outcomes.

Geometry is a topic that students have been learning since elementary school. Students should already be familiar with geometry topics and accustomed to solving problems related to geometry. However, in reality, students often struggle to solve geometry problems correctly. Research by Pebrianti & Suhendra (2023) explained that students' problem-solving approaches in geometry topics are still inadequate due to low understanding of geometry topics. Research by Aziza & Eratika (2022) explains that the most common errors in solving mathematical problems occur in the domains of measurement and geometry. Research

by Ramadhani & Hakim (2021) also concluded that none of the students' answers are correct in solving mathematical problems. This means that students make many errors in the process of solving given mathematical problems. The performance of students in solving mathematical problems, especially in geometry topics, needs to be analyzed so that the errors made by students can be identified.

The Newman Error Analysis procedure is one theory that explains the various errors students make when solving mathematical problems. According to the Newman theory, there are 5 types of errors: (a) reading errors, (b) understanding errors, (c) transformation errors, (d) process skill errors, and (e) conclusion errors (Clements & Ellerton, 1996). Several researchers have conducted studies analyzing errors using the Newman theory, including research by Zulfayanto et al. (2021), which showed that more than 80% of students make encoding errors or errors in writing final answers. Research by Astuti et al. (2024) states that the most common error made by students is errors in writing final answers due to lack of carefulness in solving the given problems. Supported by the findings of Reskina & Kartini, (2022), which stated that the causes of errors are students' inability to use the correct formulas, carelessness in arithmetic operations, and failure to draw conclusions at the end of the answers. Research by Febryana, dkk (2023) explains that the type of error least experienced by students is errors in reading mathematical problems. Supported by the study of Badriani et al. (2022), which explains that only about 10% of students make reading errors when solving problems. The research by Suratih & Pujiastuti (2020) mentions

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that reading errors are caused by carelessness and lack of diligence in interpreting the given problems. The errors committed by students—including reading, comprehension, transformation, process skill, and final answer errors—persist throughout the problem-solving stage. Research conducted by Zulyanty & Mardia (2022) states that errors in the first stage, namely reading errors, will lead to errors in the subsequent stages. Zulyanty & Mardia, (2022) also explain that the most crucial errors in solving mathematical problems are understanding errors. Based on the description of errors explained by several researchers above, there is a need to review other factors that cause errors in solving mathematical problems.

Based on classroom learning experiences, students' errors in solving mathematical questions can be influenced by the personality types they possess. Essentially, the personality of each individual varies. Vazire (2014) explains that an individual's personality can be influenced by genetics and shaped by their life experiences. The Hippocrates-Galen theory is one theory that explains the personality types of individuals. This theory is elaborated in detail in the book "Personality Plus" by Littauer (1996), which contains four personality types: sanguine, choleric, melancholic, and phlegmatic. The sanguine personality type is characterized by optimism, extroversion, and talkativeness (Littauer, 1996). The choleric personality type is characterized by strong leadership qualities, extroversion, and optimism (Littauer, 1996). Individuals with a melancholic personality type are introverted, thinkers, and tend to be pessimistic (Littauer, 1996). The last personality type is phlegmatic, characterized by introversion, observant behavior, and a

tendency to be pessimistic. These four personality types will naturally exhibit differences in solving mathematical problems. For example, the analysis of research by Amalia & Isnani, (2019) states that sanguine types do not solve problems well due to lack of attention to detail and forgetfulness, choleric types solve problems without writing down formulas and lack detail in answering the given problems, melancholic types solve problems with detail and procedural accuracy, and phlegmatic types solve mathematical problems following the steps given during learning.

Based on the descriptions of the four personality types, there are some common characteristics that allow individuals to have mixed personalities. According to Littauer (1996) there are three types of mixed personalities: natural mixed, complementary mixed, and opposite mixed. Natural mixed personality type is a combination of sanguine with choleric and melancholic with phlegmatic. Someone with a complementary mixed personality is a combination of choleric with melancholic and sanguine with phlegmatic. Opposite mixed type is possessed by someone with a combination of sanguine with melancholic and choleric with phlegmatic (Littauer, 1996).

Based on the literature review, researchers have not found any studies connecting students' errors in solving congruence and similarity questions with Florence Littauer's mixed personality types. Therefore, this study aims to describe how students with Florence Littauer's mixed personality types make errors in solving congruence and similarity questions. The researchers hope that with the results of this study, teachers can be assisted in determining appropriate solutions and steps in teaching according to the characteristics

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of students so that errors made in solving congruence and similarity questions will not be repeated. Furthermore, the findings help improve students' geometry understanding and outcomes.

METHOD

This study employs a descriptive design using a qualitative approach. Qualitative research involves exploring a phenomenon and analyzing it using data to explain findings in detail and systematically (Creswell, 2016). In this study, the researcher describes students' errors in solving geometry problems based on Florence Littauer's mixed personality types. The subjects of this study are ninth-grade students from SMP Negeri 13 Malang who have studied the congruence and similarity of triangles.

There are three instruments used in this research, namely the Florence Littauer personality type questionnaire, geometry test questions, and interview guidelines. The Florence Littauer personality type questionnaire consists of 40 characteristic terms, comprising 20 strength characteristics and 20 weakness characteristics for each of the sanguine, melancholic, choleric, and phlegmatic personality types. The Florence Littauer personality type questionnaire is used to classify natural mixed personality types between sanguine and choleric or melancholic and phlegmatic personalities, complementary mixed types between choleric and melancholic or sanguine and phlegmatic personalities, and opposite mixed types between sanguine and melancholic or choleric and phlegmatic personalities.

The geometry test questions are used to describe students' errors in solving geometry problems. The question used in this research relates to

the topics of similarity and congruence. Here is the geometry question used in this research:

Given a right triangle ABC with a right angle at B . Draw a line PQ parallel to line AC , with point P located between A dan B , and point Q located between B dan C . The ratio of the length $BQ : QC$ is $1 : 2$. If the length of $AB = 8 \text{ cm}$ and the length of $AC = 10 \text{ cm}$, determine the length of side PQ !

The interview guidelines in this research utilize a semi-structured interview method, allowing for the emergence of new questions based on the answers provided by the subjects during the interview process. The results of these interviews will complement the data obtained from the subjects' written responses. Triangulation of data is used to ensure the validity of the data obtained. Triangulation of data is carried out through the results of test questions and interviews.

The first step in this research is to administer the Florence Littauer personality type questionnaire to the students, the results of which are analyzed and categorized into three categories: natural mixed, complementary, and opposite personality types, each coded as SCA, SCP, and SCL, respectively. The second step is to select one subject from each category to be given a geometry test question, the results of which can describe the errors made by students with mixed Florence Littauer personality types in solving geometry problems. Error analysis in this research uses the Newman error procedure, which includes reading errors, understanding errors, transformation errors, process skill errors, and conclusion errors. The indicators used in this research can be seen in Table 1.

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Table 1. Error Indicator of Newman Theory

Type of Error	Error Indicator
Reading Errors	The student has not yet been able to understand the terms and symbols in the geometry question correctly
Understanding Errors	The student does not understand the information given in the geometry question correctly and completely
Transformation Errors	The student is unable to determine the correct formula to use in solving the geometry question
Process Skill Errors	The student is unable to correctly write down the procedure used to solve the geometry question
Conclusion Errors	The student is unable to accurately provide the final answer to the given geometry question

The third stage of this research is to interview subjects from each category of Florence Littauer's mixed personality types, with the results supporting the data obtained from the test results. The fourth stage of this research is conducting data triangulation by combining test results and interviews. The test result are used to identify the types and frequencies of students' errors in solving geometry problems, while the interviews are employed to explore the underlying causes of these errors. By comparing both data sources, the researcher obtains findings that are more accurate, valid, and in-depth.

RESULT AND DISCUSSION

The analysis of Florence Littauer's personality type questionnaire from 42 students resulted in 39 students having single personality types, and 3 students having mixed personality types. One subject was selected for each natural, complementary, and opposite mixed personality type to be given a geometry problem. The result shows in Figure 1.

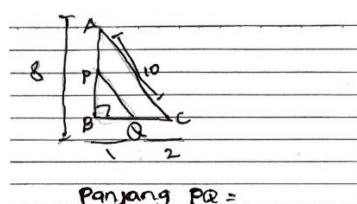


Figure 1. SCA Students' Answer

Subject SCA has a natural mixed personality type. Based on Figure 1 above, it is evident that SCA was unable to solve the geometry question correctly and completely. This is evidenced by SCA's response to the question by merely drawing the requested triangle. Although the diagram drawn by subject SCA is correct, it appears that they were unable to answer the questions asked. Ideally, subject SCA should have responded by clearly stating the information known in the problem, such as the ratio of the lengths BQ to QC being 1:2, to understand the given question better. This indicates a misunderstanding on the part of subject SCA because they did not write down the information from the question completely and clearly. Figure 1 above also shows that SCA did not accurately write down the solution procedure. Subject SCA should have used the Pythagorean theorem and the concept of similarity between two triangles to solve the question correctly. Due to a lack of understanding of the correct solution procedure, subject SCA also did not know which formula to use in solving the given geometry question. Consequently, SCA was unable to solve the given question effectively.

Based on the interview results, it is known that subject SCA forgot about the symbols used in the question and

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expressed confusion in answering the question. Subject SCA also explained that they did not know the formula to use in solving the problem. This indicates that subject SCA experienced errors in transformation, as evidenced by the answer sheet shown in Figure 1, where they only responded with a diagram of right triangle ABC and could not provide the final answer. From the description of the answer sheet results and the interview above, it can be concluded that subject SCA made errors in reading, understanding, transformation, process skills, and writing the final answer in solving the given geometry question.

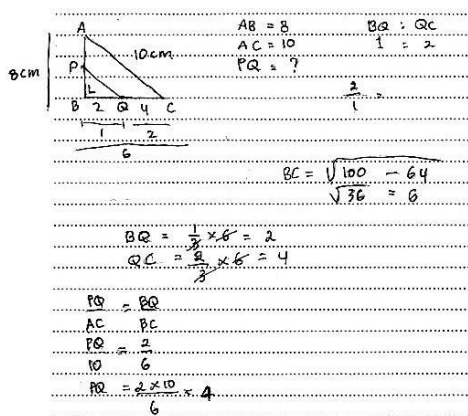


Figure 2. SCP Student's Answer

Subject SCP is a student with a complementary mixed personality type. In Figure 2, it can be seen that subject SCP successfully solved the geometry question well and systematically until obtaining the final result. However, the final result written on their answer sheet is still slightly inaccurate. This occurred because subject SCP made an error in arithmetic operations. It is apparent that in the calculation " $\frac{2 \times 10}{6}$ ", subject SCP obtained a length of $PQ = 4$, whereas the correct length should be $PQ = 3.33$. Although subject SCP intended to round it, rounding down should have occurred because the digits after the decimal

point have a value below 5. This error happened because subject SCP drew line PQ parallel to line AC , whereas it should have been parallel to line AB . Due to this error, subject SCP made the comparison $\frac{PQ}{AC} = \frac{BQ}{BC}$, resulting in an inaccurate outcome. Ideally, subject SCP should have compared the corresponding sides, namely $\frac{AB}{BC} = \frac{PQ}{QC}$. The errors made by subject SCP led to inaccuracies in writing the final answer in solving the geometry questions.

Based on the excerpt from the interview, it appears that SCP understood the geometry question. Although the answer shown in Figure 2 indicates that SCP obtained the wrong final result, in the excerpt, SCP seems confident in their answer. Lack of precision is the cause of the errors made by subject SCP in solving the geometry question. Thus, it can be concluded that subject SCP made errors in writing the final answer when solving the geometry question.

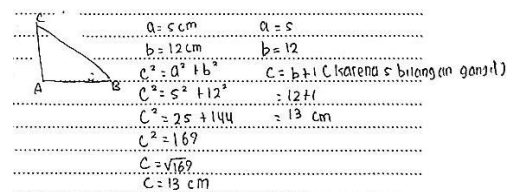


Figure 3. SCL Student's Answer

Subject SCL is a student with a mixed opposite personality type. Based on Figure 3 above, it is evident that SCL was unable to draw a right triangle correctly. This is evidenced by SCL drawing a triangle but not indicating the right angle symbol at the point requested by the problem, namely point B. Thus, the triangle drawn does not accurately represent a right triangle. In Figure 3, SCL appears to solve the geometry problem using the Pythagorean theorem, resulting in an

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incorrect final answer of 13 *cm*. This is because subject SCL did not write down the information given in the problem correctly. SCL wrote down the values of $a = 5 \text{ cm}$ dan $b = 12 \text{ cm}$. The information provided by SCL is unclear and incorrect. Ideally, SCL should have written down information such as the length of $AB = 8 \text{ cm}$ dan $AC = 10 \text{ cm}$, so that the solution steps used by subject SCL would lead to the correct final result. This indicates that subject SCL made an error in process skills.

The interview excerpt indicates that subject SCL used the ABC formula to solve the given geometry question. However, in Figure 3, SCL answered using the Pythagorean theorem. This occurred because subject SCL was still confused and did not know which formula to use in solving the problem. From the description of the work in Figure 3 and the interview excerpt above, it can be concluded that subject SCL made errors in transformation and process skills in solving the given geometry question.

Based on the description above, the student with a natural mixed personality (SCA) made five errors: reading, understanding, transformation, process skills, and writing the final answer. The causes of these five errors include the fact that subject SCA forgot about the symbols, did not know the information in the question, could not determine the formula and procedure to use, and could not provide the final answer to the geometry question. This is consistent with the findings of the study by Hariyani & Aldita (2020), which identified the causes of five Newman's procedure errors, including students' inability to interpret symbols, failure to understand the problem, inability to determine the required formulas, failure to perform calculations, and inability to

write the final answer correctly. Supported by the research findings of Hidayanto & Lisrahmat, (2023), which concluded that factors contributing to students' errors include lack of precision, being rushed and unfocused, and fear of running out of time when solving the given questions. The problem-solving process carried out by subject SCA is also influenced by their personality type. Littauer (1996) explains that individuals with a natural mixed personality have difficulty making decisions and tend to procrastinate. With these two negative traits, it can be said that SCA's answer, which only consists of a right triangle diagram, is in line with their personality, as it does not demonstrate the correct solution.

Students with a complementary mixed personality type (SCP) made only one error, which was the error in writing the final answer. The cause of this error is that subject SCP was not careful in arithmetic operations, resulting in the wrong final answer being written. This is consistent with the findings of the study by Vionita & Hartono, (2021) which explain that students do not review their written solutions, so the lack of precision in answering questions can lead to errors in determining the final answer. Finally, students with an opposite mixed personality type (SCL) made two errors: transformation and process skills errors. The cause of these errors is not knowing which formula to use and not being able to write down the procedure used to solve the geometry question correctly and completely. Consistent with the research by C. Chusnul dkk, (2017) which concluded that transformation errors occur because students are not yet able and are confused in choosing the formulas, theorems, or definitions to use

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in solving geometric question. Littauer (1996) also explains in his book that people with opposite mixed personalities tend to be doubtful and confusing. This is evident in subject SCL, who stated that in solving the geometry question, they used the ABC formula. However, on their answer sheet, subject SCL used the Pythagorean theorem. Therefore, the solution provided by subject SCL did not yield a good result.

This study found that students with a natural mixed personality type (SCA) experienced all types of errors described in Newman's theory, namely reading, comprehension, transformation, process skills, and final answer errors, most of which were caused by limitations in understanding symbols, determining formulas, and a tendency to delay completion due to their personality traits. Students with a complementary mixed personality type (SCP) made only one error in writing the final answer due to a lack of accuracy, while students with an opposite mixed personality type (SCL) committed two errors, namely transformation and process skills errors, caused by uncertainty in selecting the appropriate formula. These findings indicate that differences in personality types contribute to students' error patterns in solving geometry problems. The strength of this study lies in the use of data triangulation techniques that enhance the validity of the findings, while its weakness lies in the limited number of subjects and the relatively simple instrument used to determine personality types. According to these findings, it is expected that teachers pay closer attention to students' personality differences so that geometry learning strategies can be more adaptive and students' errors can be minimized.

CONCLUSION AND SUGGESTION

According to the results and discussions, students with a natural mixed personality type (SCA) made the most errors, namely five errors including reading, understanding, transformation, process skills, and writing the final answer. Students with a complementary mixed personality type (SCP) made one error, which was the error in writing the final answer. Students with an opposite mixed personality type (SCL) experienced two errors in solving the geometry questions, namely transformation and process skills errors. Therefore, it can be concluded that there are differences in the errors made by students with a natural mixed personality (SCA), students with a complementary mixed personality (SCP), and students with an opposite mixed personality (SCL) in solving the given geometry questions. The factors causing these errors include a lack of understanding of the geometry material provided as test questions, low understanding of prerequisite material by students, and carelessness when solving the given geometry questions.

The results of this study can be used as a comparison and reference for further research related to errors in solving geometry questions based on the personality types of students at the junior high school level. It is hoped that future research can expand more widely to provide the best solutions in minimizing errors made by students in solving geometry questions.

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