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Analysis of Students' Mathematical Communication Skills in the Perspective of Gender and Personality Type

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ABSTRACT

This study aims to describe mathematical communication skills in terms of gender and personality type of grade VII students of SMPN 5 Langke Rembong. This research is qualitative research using a descriptive approach. The study subjects consisted of 4 people with details of 2 male subjects and 2 female subjects with introvert-extrovert personality type. The data collection techniques used are tests, questionnaires, and documentation. Data analysis techniques using the Miles & Huberman model data analysis, namely data reduction, data presentation, and conclusions. The validity of the data in this study used triangulation (sources and techniques). The results showed that both male and female students were able to express mathematical ideas in writing correctly and completely, were able to evaluate mathematical ideas in solving the problem correctly, and the solution steps were written sequentially, completely, and correctly, and were also able to write the conclusion of solving the problem given. However, when viewed from the personality type of male subjects with extroverted types, they were less superior in evaluating mathematical ideas, especially in the aspect of writing the formula used to solve the problem.

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INTRODUCTION

Mathematical communication skills are central to mathematics education and an essential process of learning mathematics (Sritresna, 2017; Yuniarti, 2016). Mathematical communicative competence leads to the ability to connect and communicate mathematical thoughts/ideas in writing or orally and understand and accept other people's thoughts/ideas thoroughly, logically, critically, and evaluatively (Lestari & Yudhanegara, 2015; Alamiah & Afriansyah, 2017; Nugraha & Pujiastuti, 2019). Mathematical communication is the ability to communicate mathematics orally, in writing, or visually by mathematical vocabulary, forms of mathematical representation, and mathematical rules Yeager, A. & Yeager, R. (Izzati &

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Suryadi, 2010).

Communication skills are critical in learning mathematics. In this aspect, language is one of the focuses of mathematics learning (Husna & Fatimah, 2013; Luritawaty, 2016; Sritresna, 2017; Alamiah & Afriansyah, 2017). By communicating mathematically, students can organise mathematical thinking orally or in writing. During learning activities, mathematical communication becomes an important aspect; this can be seen during discussion activities between students and teachers, where students can express, explain, visualise, observe, ask, and collaborate so that they can understand more widely about mathematics. If students' mathematical communication can be carried out, a practical situation is also created, thus optimising students' ability to communicate when learning occurs (Yulianto & Suprihatiningsih, 2019; Yonandi, 2011). When mathematics learning activities take place, students are directed to be actively involved so that learning becomes more meaningful and also trains students to be creative and responsible in solving mathematical problems (Hendriana & Kadarisma, 2019). According to Sumarmo mathematical communication skills can also be a means of exchanging opinions and clarifying a concept that is understood (Yonandi, 2011).

Mathematical communication skills, in general, still need to improve. The low level of mathematical communication skills is shown that students' mathematical communication skills are in the minimal category (Naimah et al., 2022). In addition, (PISA) Program for International Student Assessment in 2022, Indonesian students have math skills with a mean value of 366. Of the 80 countries that participated, Indonesia was in the 69th position. With a score of 366, Indonesia is at one level from the bottom, meaning that students can only solve simple problems and must be proficient in communicating, primarily contextual math problems. This condition can be seen from contextual math problems as actual things, causing students to have difficulty working on and communicating them.

Siswono argues that one of the difficulties junior high school students face in mathematics is the low ability of students to solve contextual problems (story problems) (Kristanti & Wijayanti, 2021). The fundamental ability during the learning process and needs development supported by appropriate methods are called problem-solving skills (Hanipah & Sumartini, 2021; Hidayat & Sariningsih, 2018). Thus, the goal of mathematics learning in communicating ideas can be achieved. This situation is further strengthened by research by (Wardhana & Lutfianto, 2018), which shows that the factor for the lack of mathematical communication skills is the need for students to understand basic mathematical concepts.

Ariawan & Nufus research (2017) also shows the same results, showing that students often need help understanding story problems (contextual) from the given issues.

Several factors, including gender differences and personality types, can influence low communication skills. The personality types that are very striking when students learn are introverted and extroverted (Lestari, 2019). Introverts are self-taught, careful when making decisions, calm and hardworking. As an introvert, his interests and attention focus more on his views and experiences (Jaenudin, 2015). On the other hand, extroverts prefer to learn with others, like to be challenged, do not overthink, and need feedback from the teacher during the learning process. Extroverts are social, not just pondering and thinking (Jaenudin, 2015). In addition, extroverted students learn by explaining to others and prefer to work in groups inside and outside the classroom. Therefore, teachers must know students' personality types to foster their mathematical communication skills and help them achieve satisfactory achievements in the learning process.

Gender and personality differences certainly result in physiological and psychological differences in learning. So, genders with different personalities certainly have many differences when learning mathematics. According to Susento (Nugraha & Pujiastuti, 2019: 3), gender differences lie in mathematical ability and how mathematical knowledge is obtained. In the context of social and cultural life, Showalter & Fakih revealed that gender becomes an analytical theory that explicitly distinguishes the theory of gender differences, gender position as a destiny given by God and cannot be changed, and gender role is the concept that creates the most gender injustice (Zulaiha, 2018). The indicators of gender injustice, according to Fakih, are in five ways, namely: 1) marginalisation, which is a form of marginalisation or marginalisation of certain genders (usually women), such as the view that women are not suitable to become leaders. Marginalization also often causes poverty for women because they have no place to get access to work; 2) stereotype, which is terrible labelling of certain genders (usually women) which causes limitations, difficulties, impoverishment, and marginalisation of women; 3) subordination, which is underestimating or underestimating certain genders (usually women) such as beliefs such as women do not have the right to go to high school; 4) double/multi burden, namely tasks that must be carried out by certain genders (usually women) between general and household duties; and 5) violence against certain genders, usually women) often receive sexual harassment and physical, psychological, and economic abuse (Zulaiha, 2018). Meanwhile, there are four indicators of gender equality, namely: 1) access, namely equal opportunities for men and

women to obtain rights, for example in the labour sector, men and women have jobs, professionalism and transparency for equal opportunities in obtaining wages; 2) control, namely gender analysis to achieve gender equality, indicators can benefit women and men with similar basic needs through understanding control or development; 3) participation, namely increasing women and men in relatives and participation in various fields of life in the public sphere to fulfil and direct their aspirations; and 4) women and men who can get uses from development (Zulaiha, 2018).

Candra & Gasa (2020) by nature, men and women are created differently. These differences underlie the different ways of thinking, acting, and the division of roles in social life. In Manggarai culture, men have a special place when compared to women. The superiority of men over women in Manggarai culture is manifested in all dimensions of life. Two expressions show masculine dominance and signalling the exclusion of women in the socio-cultural order of the Manggarai people, namely ata one-ata pe'ang and ema eta-ende wa, Candra and Gasa (2020). The position of women placed below men also impacts how the two communicate with Candra and Gasa (2020). Tunen mentions that women and men differ in genderlect (gender-specific dialect) (Candra & Gasa, 2020). Women tend to use rapport talk (or relationship-oriented talk) communication, which aims to build understanding and empathy in larger groups. On the other hand, men use report talk (or task-oriented talk) communication to seek solutions to specific problems. Furthermore, women tend not to be aggressive when communicating with other parties, either men or fellow women.

In contrast, men are seen as more aggressive and often resort to physical violence. Women are considered helpless creatures, nothing when dealing with men. Thus, differences in characteristics such as personality type and gender need to be studied more deeply, especially those related to students' mathematical communication skills.

RESEARCH METHODS

This qualitative research describes students' mathematical communication skills in terms of gender and personality type. The research subjects consisted of 4 seventh grade students who were determined using purposive sampling technique after being given a personality type questionnaire. The four subjects consisted of one male student with introverted personality type, one male student with extroverted personality type, one female student with introverted personality type, and one female student with extroverted

personality type.

Data were collected using test and non-test instruments. Tests were used to determine students' mathematical communication skills, and non-tests were used to determine students' personality types. The mathematical communication ability test instrument consists of 2 questions in the form of essays with comparison material. The questions were prepared based on indicators of mathematical communication skills that refer to NCTM (Ubaidah, 2016), namely (1) the ability to express mathematical ideas through writing and demonstrate and describe them visually, (2) the ability to understand, explain and evaluate mathematical ideas in writing, and (3) the ability to use mathematical terms, symbols, and structures to express ideas, describe relationships and simulate situations. The personality type instrument consists of 37 questions based on extrovert-introvert personality type indicators referring to Jung (Safitri et al., 2023). The personality type obtained is classified into introverted and extroverted personality types.

Data analysis was carried out on the results of filling out a questionnaire and a test of mathematical description questions the researcher gave. Filling out the questionnaire is aimed at knowing the type of personality of the 30 students. The personality type questionnaire is used to obtain the introvert-extrovert personality type in students. The mathematical description problem test was given to be completed by 30 students of class VII B and then analysed for mathematical communication skills. Based on the results of filling out the questionnaire and solving the questions given to the 30 students, the researcher will select four research subjects who will be the core subjects of the study—selection of 4 subjects by selecting male and female subjects with different personality types. The research subjects are divided into one male with an introverted personality type, one male with an extroverted personality type, one female with an introverted personality type, and one female with an extroverted personality type. Data analysis techniques are data reduction, data presentation, and conclusion drawing Miles & Huberman (Saleh, 2017).

RESULT AND DISCUSSION

Four people were selected based on the personality type criteria: two male subjects and two female subjects. The male research subjects, EO, represent the introverted personality type, and YB represents the extroverted personality type. The female subjects, EJ, represent the introverted personality type, and YN represents the extroverted personality type.

The description of the results of mathematical communication skills in terms of

gender and personality type is as follows.

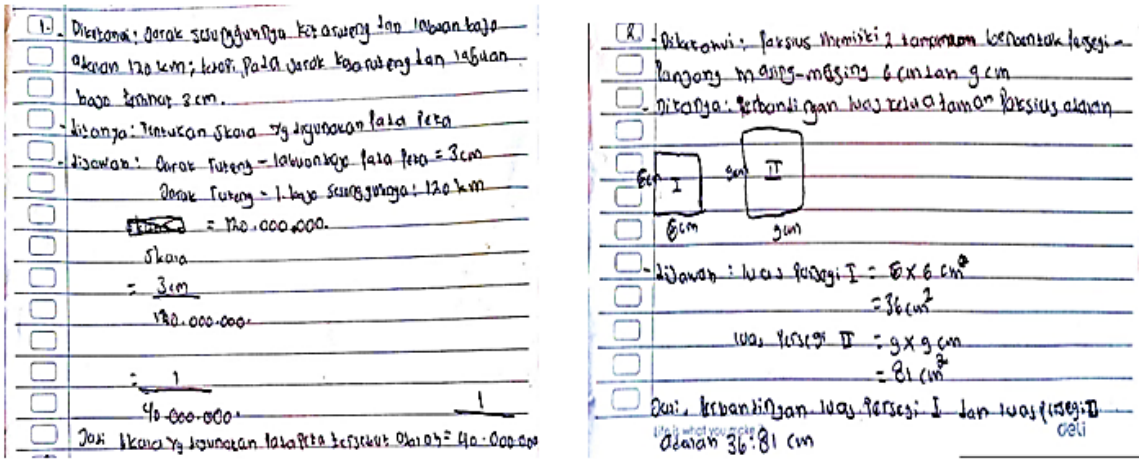

Figure 1. Test Results of Mathematical Communication Ability of Male Subject YB Extroverted Personality Type

Based on Figure 1, it can be seen that the male subject YB with an extroverted personality type can express and evaluate the mathematical ideas in the problem, namely writing down what information is known and questioned wholly and correctly. Subject YB, who has an extroverted personality type, could also describe the relationship or write the conclusion at the end of the solution correctly. However, YB students need help evaluating the problem's mathematical ideas. YB must write the proper concept/formula, solution steps, and the final result.

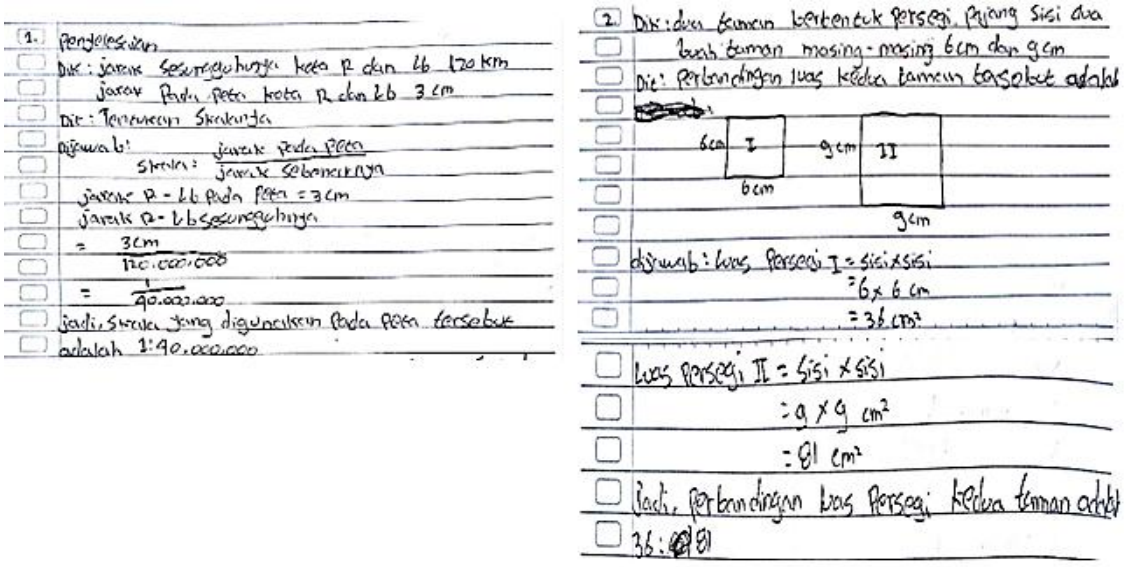

Figure 2. Test Results of Mathematical Communication Ability of Male Subject EO Introverted Personality Type

Based on Figure 2, it can be seen that the male subject EO with an introverted personality type can express, evaluate, and connect mathematical ideas wholly and accurately.

In addition, the EO male subject with introverted personality types can express, assess, and connect mathematical ideas wholly and appropriately, which is in the problem, namely students, by writing known and questioned information wholly and accurately. The male subject, EO, could write down the known and questioned information, write and apply formulas, and conclude wholly and correctly.

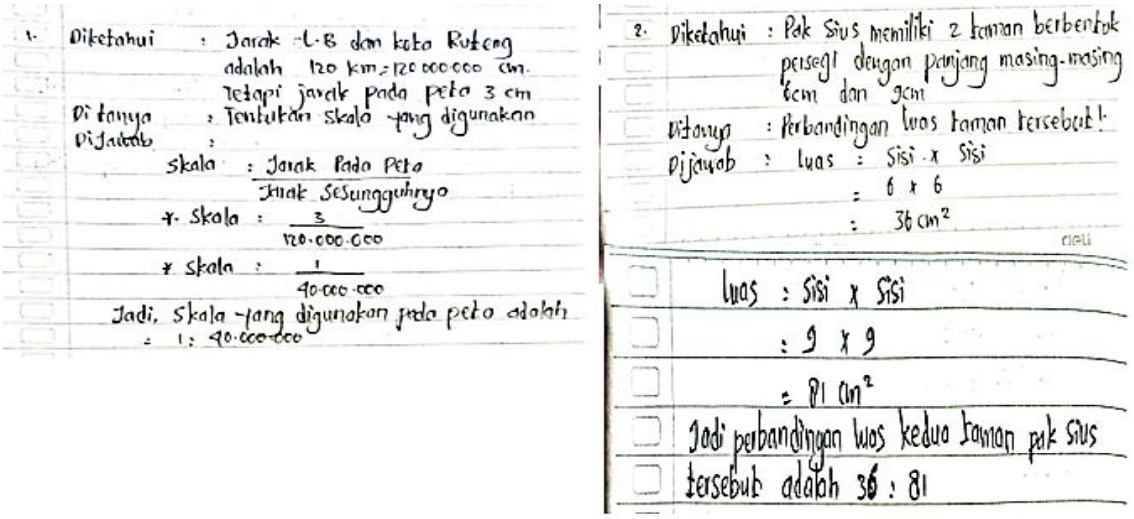

Figure 3. Test Results of Mathematical Communication Ability of Female Subject EJ *Introverted* Personality Type

Figure 3 shows that the female subject EJ with an introverted personality type can express the mathematical ideas in the problem. Namely, students can write the known and questioned information wholly and correctly. In addition, EJ students are also able to evaluate mathematical ideas by writing the formula, solution steps, and the correct final result. EJ students can also describe the relationship by writing the conclusion at the end of the solution correctly.

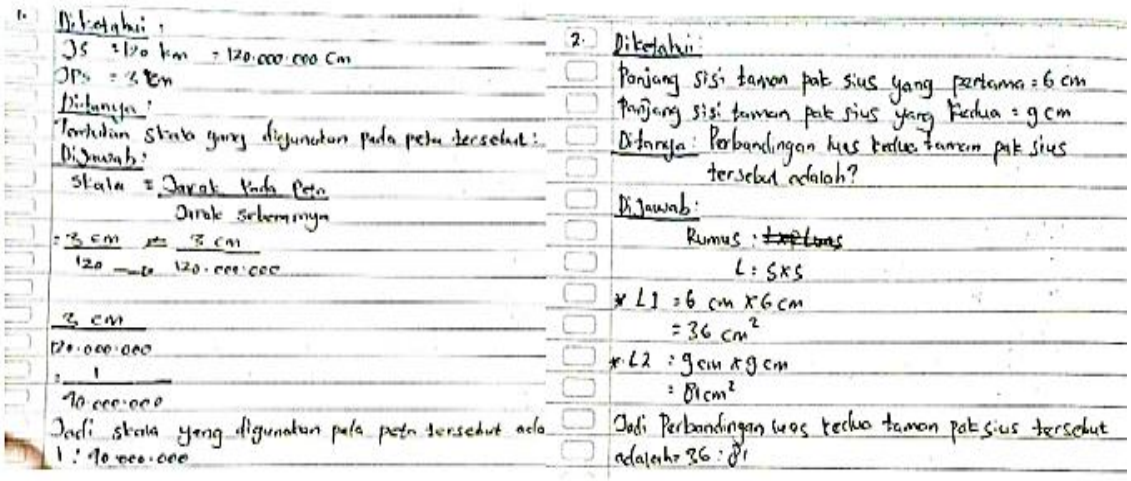

Figure 4. Test Results of Mathematical Communication Ability of Female Subject YN Extroverted Personality Type

In Figure 4, it can be seen that subject YN with extroverted personality type has similar abilities to students with female subject EJ with introverted personality type who can express mathematical ideas in the problem. Namely, students can write known and questioned information wholly and correctly. In addition, YN students are also able to evaluate mathematical ideas by writing the formula, solution steps, and the correct final result. YN students can also describe the relationship by writing the conclusion at the end of the solution correctly.

Mathematical communication skills are essential skills for students to have. According to NCTM (Ubaidah, 2016), mathematical communication skills are the ability to express mathematical ideas in writing, demonstrate and describe them visually, the skills to interpret, explain, and assess written mathematical concepts, and the skills to use terminology, symbols and mathematical forms to express ideas, describe relationships and simulate conditions. Meanwhile, in this study, the mathematical communication skills referred to are written mathematical communication skills with the following indicators; students can express mathematical ideas in the given problem. They can write about known and questionable information wholly and accurately; students can evaluate mathematical ideas in the problem. They can write formulas, complete steps, and achieve the correct final results; and students can describe the relationship by writing the conclusion at the end of the solution correctly.

The skill to express all mathematical ideas through writing and visual delivery shows that the subject can communicate his mathematical ideas through various means. According to (Prayitno, 2018), his condition aligns with one aspect of mathematical communication: writing. Writing is an activity that is done consciously to describe ideas expressed by media, be it paper, computer, or other forms. Through writing, students can connect the concepts being learned with the concepts that have been learned. The skill of communicating what is in the mind well can influence others to understand the ideas that the subject has.

Students' Mathematical Communication Ability in terms of Gender

Based on the research data, there is no significant difference between males and females. Where in writing, the solution to the problem given by male and female students can fulfil the existing indicators of mathematical communication skills. Both can also express mathematical ideas, evaluate these ideas, and describe relationships. This finding aligns with the research results by (Mulyastuti et al., 2021) which show that the mathematical communication skills of female students are almost the same as those of male students.

Lestari et al., (2019) found no significant differences in students' mathematical communication skills in accuracy and fluency at the stages of understanding the problem, preparing a solution plan, and assessing it. Regarding solving numerical problems, (Pambudi et al., 2021) showed that male students' mathematical communication skills were almost as good as female students.

Students' Mathematical Communication Skills Viewed from *Introvert-Extrovert* Personality Type

From the acquisition of research data, it is evident that students with introverted personality types can fulfil all indicators of mathematical communication skills. This is evidenced by the student's answer, where he can describe mathematical ideas by writing known and questionable information from the problem properly and correctly, evaluate mathematical ideas by writing formulas and systematic solution steps, and write the conclusion properly and correctly. This finding aligns with the research results by Rumita et al., (2021), which state that students with introverted traits tend to be proficient in using mathematical language and mathematical representations, providing brief, clear, and detailed lines of thought. In addition, these students can apply various forms of representation effectively. This means that students with introverted traits can perform calculations correctly and draw the correct conclusions. This aligns with Sobur's view (Rumita et al., 2021), which says that students with introverted traits are more fluent in writing. Introverted personality types, in terms of learning, prefer individual tasks. Students with this personality type are known to be quiet, do not like crowds, and bring ideas alone. They must think carefully before answering something, be thorough, earnest, and consistent, and have a calm and more patient attitude when facing a problem (Ghufron, M. N., & Risnawita, 2010; Rosida & Astuti, 2015; Jaenudin, 2015).

On the other hand, students with extroverted personality types can also fulfil all indicators of mathematical communication skills. However, in writing the formula used in solving problems, students with extroverted personality types still need to be superior. This is in line with the research of Rumita et al. (2021), which states that students with extroverted personality types can only fulfil two indicators of mathematical communication ability out of five existing indicators. Extroverted personality types in terms of learning, need feedback from teachers and friends, cannot move individually in groups, act first rather than think, are

easily distracted by distractions from others, and do not have enough patience to complete detailed tasks (Ghufron, M. N., & Risnawita, 2010; & Jaenudin, 2015).

Students' Mathematical Communication Skills in terms of Gender and Personality Type

From the acquisition of research data, it is evident that the communication skills of male and female students with each *introvert-extrovert* personality type do not have significant differences. Male and female students with *introverted* personality types could fulfil all indicators of communication skills. Both could describe mathematical ideas by writing down the known and questionable information from the problem, evaluate mathematical ideas by writing down the formulas used in solving the problem, write the solution steps systematically, and describe the relationship by writing the conclusion. Meanwhile, male and female students with *extroverted* personality types can also achieve all indicators of mathematical communication skills. However, male students with *extroverted* personality types are slightly less superior in writing the concepts used in solving the problems given. However, in writing, known and questionable information can be written wholly and precisely; also, in writing, the steps of solution and calculations can be done properly and correctly, and the relationship by writing the conclusion; male students with *extroverted* personality types can write well and correctly as well as female students with *extroverted* personality types. This finding aligns with Ningsih & Awalludin, (2021) research, which shows that the mathematical communication skills of students with *extroverted* and *introverted* personality types are generally able to solve problems and have similarities.

CONCLUSION AND RECOMMENDATION

The results of this study can conclude that students' mathematical communication skills in terms of gender and personality type are almost the same. In contrast, the mathematical communication skills of male subjects with extroverted and introverted personality types are similar. However, male subjects with extroverted personality types were slightly less superior in writing the formula used in solving the given problem. Meanwhile, the mathematical communication skills of female subjects with introverted and extroverted personality types do not have significant differences, which can be said to be the same.

The mathematical communication abilities of male and female subjects with extroverted personality types do not differ prominently. However, female subjects were

superior in writing the formulas used to solve the given problem than male subjects. Likewise, the mathematical communication skills of male and female subjects with introverted personality types do not differ significantly and can be said to be the same.

Male subjects with extroverted personality types could express mathematical ideas in writing wholly and correctly, evaluate mathematical ideas in solving problems correctly, and write the conclusion of solving the problem. However, the male subject with an extroverted personality type still needed to improve in writing down the formula used to solve the problem. The male subject with an introverted personality type was able to express mathematical ideas in writing wholly and correctly, was able to evaluate mathematical ideas in solving the problem correctly, and the steps of the solution were written sequentially, entirely, and correctly, and was able to write the conclusion of the solution of the given problem.

Female subjects with introverted personality types and female subjects with extroverted personality types can express mathematical ideas in writing correctly and completely, evaluate mathematical ideas in solving problems correctly, and write the solution steps sequentially, completely, and correctly. They are also able to write the final conclusion of solving the problem given.

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