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Students' Mathematical Connection Ability in Solving Higher Order Thinking Skills Problems Based on Jambi Culture

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ABSTRAK

Kemampuan koneksi penting sebagai bagian dari keterampilan berpikir tingkat tinggi. Penelitian ini bertujuan mengeksplorasi kemampuan koneksi matematis siswa dalam menyelesaikan soal HOTS berbasis budaya Jambi. Penelitian studi kasus ini melibatkan 32 siswa dengan tipe kepribadian *sensing* dan *intuiting*. Instrumen penelitian mencakup tes kepribadian MBTI *(Myers-Briggs Type Indicator),* lembar tes soal HOTS, dan wawancara. Data dikumpulkan melalui triangulasi sumber dan waktu, dianalisis menggunakan reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan kemampuan koneksi matematis siswa dengan tipe kepribadian *sensing* lebih baik (70%) daripada tipe *intuiting* (56,25%). Temuan ini mengindikasikan siswa dengan tipe *sensing* lebih efektif dalam mengaitkan dan menerapkan konsep matematika pada soal HOTS berbasis budaya Jambi, sementara siswa dengan tipe *intuiting* menghadapi kesulitan dalam membangun koneksi matematis, yang mempengaruhi akurasi jawaban mereka. Dengan demikian, tipe kepribadian memiliki pengaruh signifikan terhadap kemampuan siswa dalam mengintegrasikan dan menerapkan pengetahuan matematika dalam situasi kompleks.

Kata Kunci: Budaya Jambi; Kemampuan Koneksi Matematis; Soal HOTS; Tipe kepribadian *Intuiting;* Tipe Kepribadian *Sensing*;

ABSTRACT

Connection abilities are important as part of higher order thinking skills. This study aims to explore students' mathematical connection skills in solving HOTS problems based on Jambi culture, with a focus on the Kajang leko traditional house and the padamaran cake typical of Jambi. This research used a case study approach involving 32 students with sensing and intuiting personality types. The research instruments included MBTI (Myers-Briggs Type Indicator) personality tests, HOTS question test sheets, and interviews. Data were collected through triangulation of sources and time, then analyzed using data reduction, data presentation, and conclusion drawing. The results showed that students with sensing personality type had better mathematical connection ability (70%) than students with intuiting type (56.25%). This finding indicates that students with the sensing type are more effective in connecting and applying mathematical concepts to Jambi culture-based HOTS questions, while students with the intuiting type face difficulties in building mathematical connections, which affects the accuracy of their answers. Thus, personality type has a significant influence on students' ability to integrate and apply mathematical knowledge in complex situations.

Keywords: Jambi Culture; Mathematical Connection Ability; HOTS Problem; Intuiting Personality; Sensing Personality.

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1. INTRODUCTION

Mathematics is an arithmetic science that has an important role. In addition, mathematics is a basic science that is significant in everyday life (Aspuri, 2019; Gilang et al., 2018; Wulan & Rosidah, 2020). Mathematics also plays an important role in various other scientific fields, such as the development of science and technology (Siagian, 2016).Therefore, through learning mathematics, students can understand and apply mathematical connections both in everyday life and in various other sciences (Siagian, 2016).

According to the National Council of Teachers of Mathematics (NCTM, 2000), skill standards in mathematics learning include problem-solving, reasoning and proof, communication, connection, and representation. Therefore, for the learning process to be effective, students need to develop these skills, including connection ability (rawa et al., 2017). Sumarmo (Siagian, 2016) defines mathematical connection as the ability to connect various mathematical concepts and with other disciplines. Meylinda & Surya (2017) emphasized that connectivity is a key element in understanding mathematical concepts and is important for building a solid foundation for understanding new mathematical concepts.

To determine students' ability to make mathematical connections can be seen by completing HOTS (Higher Order Thinking Skills) question-type exercises. For students to develop HOTS skills well, students need to be familiar with activities related to HOTS, one of which is through students' mathematical connection skills. Based on the results of research (Ali et al., 2018), shows that when solving HOTS-based problems, subjects with poor mathematical connectivity only can understand facts, Average Mathematical Connectivity ability have difficulty in factual and conceptual understanding, and High Mathematical Connectivity have difficulty only with metacognitive knowledge.

In the preparation of HOTS questions, stimulus is often used. Stimuli can come from global issues such as information technology, as well as social, economic, health, and educational issues. Stimulation can also come from problems that exist in the environment around the education unit, such as culture, customs, regional characteristics or different advantages that exist in certain regions (Kristanto & Setiawan, 2020). Because education and culture are essential in everyday life. Cultural factors go hand in hand with mathematics; some aspects of these aspects are relevant to math learning. Through culture, especially Jambi culture, which is integrated with math learning, students can easily understand math learning and have fun (Wandari et al., 2018)

Jambi is one of the provinces in Indonesia. Jambi cultural society has many mathematical ideas that can be studied to be used as materials or sources of contextual mathematics learning (Sutrimo et al., 2019). Learning integration includes the utilization of Jambi culture as a medium or object related to flat-sided spaces with kajang leko traditional houses and typical padamaran

cakes from Jambi. This material was chosen. Many students have difficulty in solving problems related to everyday life because students are only accustomed to applying formulas. By including cultural contexts, it can provide meaningful learning in every context of the activities carried out (Kusmaryono, 2012).

Cultural elements are parallel to mathematical aspects. Jambi culture that is incorporated into the question is used as a question stimulus. Stimulus is one of the requirements for making HOTS questions. Integration using Jambi culture as a medium or object associated with mathematical problems, especially in flat-sided space building material. The Jambi culture used is the Kajang Leko Traditional House and the typical Jambi Padamaran Cake which was chosen because it has compatibility with the material, namely flat-sided space building.

The kajang leko traditional house is a traditional house of the Jambi province which has the concept of a stilt house with a triangular prism-shaped roof ridge. The Padamaran cake was chosen because the container of the cake is in the form of a flat-sided space, namely a block, which is the closest thing to the daily life of students. The problem was developed with the aim of activating students' ability to reason and also involving other abilities. This reasoning starts from observing the existing cake container. This observation is expected to reach the conclusion of how students can analyze the intent of the problem and come up with ideas for what they will pour.

To understand students' mathematical connection skills in solving HOTS problems based on Jambi culture, it is important to evaluate students' personality types (Khoiriah, 2018). One way to determine one's personality type is through the MBTI (Myers-Briggs Type Indicator) test (Aprillia, 2021; Fauzi et al., 2019; Putri & Warmi, 2022). This test, which is based on Carl Jung's theory, categorizes personalities into four scales (Ayu, 2020; Fahira et al., 2023; Nainggolan et al., 2022; Putri & Masriyah, 2020; Kamid et al., 2018), including the two main types of Sensing and Intuititing. Sensing is a type of person who tends to process information based on concrete facts and factual data, while individuals with the intuiting type focus more on processing information conceptually, seeing patterns, relationships, and various possibilities. (Ramalisa & Syafmen, 2014) added that personality awareness is related to procedural knowledge, while intuition involves understanding patterns and possibilities. Understanding students' personality types is important to gain insight into how they face and solve mathematical challenges, especially in the context of Jambi culture. This research is relevant because it considers the role of personality in learning strategies that can be tailored to students' individual needs, to support their mathematical connectivity development. Therefore, the researcher focused on students with Sensing and Intuiting personality types.

Several studies on mathematical connections have explored problem-solving skills in solving HOTS problems (Hartati et al., 2017; Yuwono et al., 2020; Septiani & Rubowo, 2021).

Another study shows that the REACT model adapted to the ethnomathematics of Kudus local culture can be an effective alternative to improve junior high school students' mathematical connections, as implied by (A' dadiyyah & Malasari, 2023). In addition, research by Ningsih (2024) produced an ethnomathematics-based Student Worksheet (LKS) designed to support students' mathematical connection skills in triangle material in grade VII SMP. Some studies that use sensing and intuiting personality types include research by Putra (2019).

The relevant research related to this research is research from Kamid et al., (2018) where by using Jambi culture-based educational materials, teachers and students will find math subjects fun, easy to learn and enjoyable. As well as research (Kamid et al., 2020) in which ethnographic elements and flat geometric shapes of Jambi culture such as the structure of the Pondok Tinggi Grand Mosque building, in the city of Sungai Penuh, can be used as a reference to develop local culture-based mathematics learning resources whose application not only introduces and preserves local culture, helps students more easily understand plane geometry but also brings impressions and meanings in mathematics learning.

There are some significant differences between previous studies on students' mathematical connections in solving HOTS problems based on Jambi culture. Some studies focus more on the impact of local culture on students' mathematical understanding, while others examine the role of personality type in the context of mathematical connections.

We used VOSviewer to visualize students' mathematical connection skills in solving Higher Order Thinking Skills (HOTS) problems by considering Jambi culture and sensing and intuiting personality types. The data we analyzed included research published in the last five years (2019 to 2024) taken from the Scopus and Google Scholar databases, with the help of the Publish or Perish tool. We used keywords such as "Mathematical connection ability", "HOTS", "Jambi culture-based questions", "Sensing personality type", and "Intuiting personality type" to ensure comprehensive coverage of the literature. Scopus was chosen because of its reputation for providing high-quality and reliable citation data, which is essential for systematic reviews and meta-analyses. In contrast, Google Scholar was chosen for its broad coverage and ease of access, making it useful for exploratory research. The visualization results obtained from VOSviewer can be seen in Figure 1.

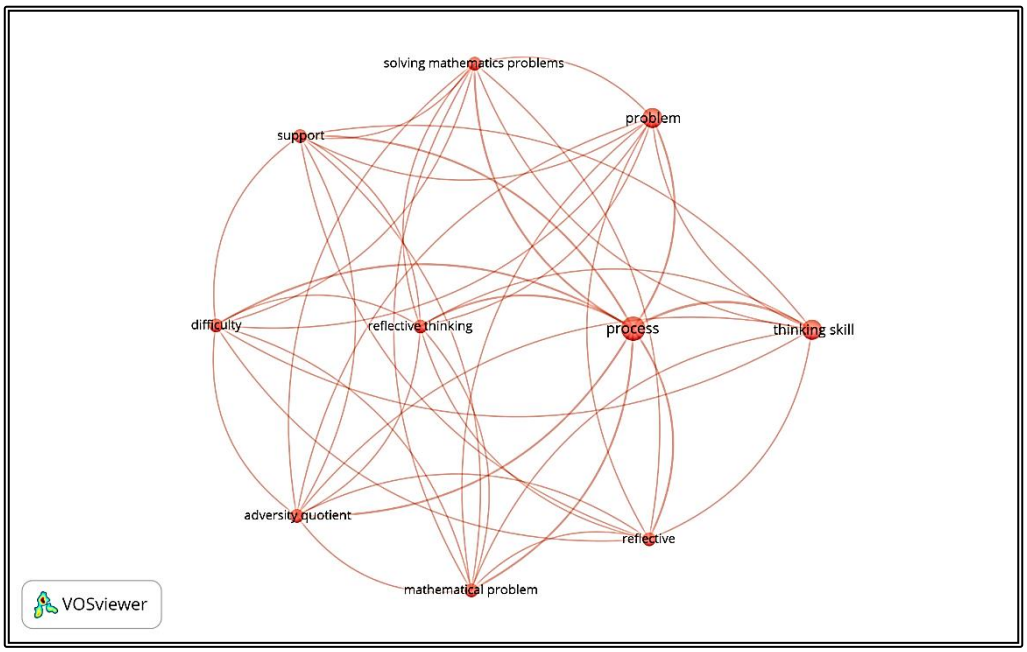

Figure 1. Figure Title

The term "reflective thinking" appears as a central and important node in the visualization, indicating that this term has a strong presence and many connections with other terms. This visualization shows that reflective thinking is a highly connected term, highlighting the importance of solving mathematics problems to help students evaluate and refine their strategies and assess their understanding of the involved concepts. By reflecting on the steps taken and the results obtained, students can identify errors and adjust their approaches. This process enhances metacognitive skills and allows students to connect various mathematical concepts, ultimately deepening their understanding and improving their problem-solving effectiveness.

The specific terms "mathematical connection abilities," "higher order thinking skills," and "MBTI sensing and intuiting personality types" do not appear in the visualization. This indicates that empirical studies examining students' mathematical connection abilities in solving higher order thinking skills problems based on Jambi culture, in relation to sensing and intuiting personality types, are still very limited. This research aims to address this gap by providing data-driven insights on how to enhance students' mathematical connection abilities. The relationship between "Reflective Thinking" and "Solving Mathematics Problems" highlights several significant factors in improving mathematical connection abilities. Reflective thinking, which involves a deep evaluation of the strategies and solutions applied, serves as a foundation for strengthening mathematical understanding. Meanwhile, mathematical problem-solving skills require the careful application of concepts to achieve effective solutions. Overall, the integration of these two elements "Reflective Thinking" and "Solving Mathematics

Problems" can effectively enhance students' abilities to connect and apply mathematical concepts.

This study aims to explore how sensing and intuiting personality types affect students' mathematical connection skills in solving HOTS questions based on Jambi culture. It is hoped that the results of this study can provide new insights to develop more effective and inclusive mathematics learning strategies.

2. METHOD

This research uses a qualitative method with a case study approach. The focus of this research is to describe students' ability to make mathematical connections when solving HOTS problems, seen from sensing and intuiting personality types. This description was done through direct observation, diagnostic test results, and structured interviews with the research subjects. The source of data came from 26 students of class XII D SMA Negeri 3 Sungai Penuh. The selection of subjects was based on the MBTI personality test, which showed that some students had sensing and intuiting personalities. The research subjects were selected using purposive sampling method, and 2 students with sensing personality type and 2 students with intuiting personality type were selected.

The main instrument in this research is the researcher himself, who is responsible for designing, implementing, and analyzing research data. As supporting instruments, this study used questionnaires, tests, and interviews. The questionnaires used have been referred from sources that have proven to be valid and reliable and suitable for use in the context of this study. The interview guidelines were developed based on the ability indicators that had been tested for validity, ensuring that the questions were relevant and accurate. The Jambi culture-based HOTS (Higher Order Thinking Skills) questions used were designed through a systematic evaluation process. This evaluation process included four stages of testing: Expert Review, One-to-One, Small Group, and Field Test. The Prototype 1 design that has been developed will be submitted simultaneously to Expert Review and One-to-One to get input and initial improvements. In the Expert Review, the experts will provide an assessment of the quality and relevance of the questions, while in the One-to-One, the questions will be tested individually to assess the clarity and understanding of the participants. After that, Prototype 1 will be tested in a Small Group setting to evaluate group interaction and the suitability of the questions in the group context. The final stage is the Field Test, where the Jambi culture-based HOTS questions will be applied in a wider and real condition to collect data on the effectiveness and acceptance of the questions. This evaluation process aims to ensure that the designed questions are valid, reliable, and effective before being used in research.

Figure 2. Hots of Kajang Leko Traditional House

Figure 3. Hots Problem of Typical Jambi Padamaran Cake

The research procedures carried out in this study refer to the research procedures according to (Moleong, 2014), namely the pre-field stage, the field research stage, and the data analysis stage. Instrument or research tool and is the main key to the qualitative research process carried out. Other instruments that support this research are MBTI subject selection questionnaires, connection ability tests in the form of task sheets that solve HOTS questions based on Jambi culture, and interview guidelines used to determine students' connection abilities.

Data analysis techniques in research are carried out interactively and continuously at each stage of research until they reach saturation. Activities in data analysis include data reduction,

data presentation, data analysis, and conclusion drawing. Data reduction involves selecting and identifying data relevant to the research questions, as well as coding each unit of data to determine its source. Data presentation includes data classification and identification, where organized and categorized data is presented to facilitate conclusion drawing. The categories in this stage are related to the components of mathematical connection ability. Data analysis includes systematically searching and compiling data obtained from students' written work, interviews, field notes, and documentation. Data are organized into categories, translated into units, synthesized, arranged in patterns, selected which are important, and made conclusions to facilitate understanding by researchers or other parties. Conclusions were drawn based on the results of analyzing the data that had been collected, both from written work and interviews, as well as indicators of students' mathematical connection abilities in solving HOTS questions based on Jambi culture.

Table 1. Categories of Mathematical Connection Ability

Connection Capability Percentage	Category
$0 < x < 50\%$	Low
$50\% < x \leq 70\%$	Medium
$70\% < x \leq 90\%$	High
$70\% < x \leq 90\%$	Very High

The scoring guidelines for the mathematical connection ability test used according to Rawa & Sutawidjaja (2016) are:

Table 2. Scoring Rubric for Mathematical Connection Ability

Score	Frequency	Percentage
1.	Students do not answer questions	Low
2.	Students can answer some questions about mathematical connection skills and make many errors in calculations	Medium
3.	Students can answer mathematical connection ability questions, identify important parts correctly, but there are still errors.	High
4	Students are able to answer questions, the ability to re-explain mathematical ideas completely and correctly..	Very High

3. RESULT AND DISCUSSION

a. Research Results

1) MBTI Personality Test Results

The first data collection was done by giving the MBTI personality test to 26 students, which aims to get research subjects with sensing and intuiting personality types. This test consists of 20 objective questions, each with two answer choices, namely a and b, which are adjusted to the characteristics of students with sensing and intuiting personality types.

Based on the results of the personality test conducted on 32 students, the data are shown in Table 3.

Table 3. Student Personality Test Results

Personality	Total	Percentage
Sensing	23	71,88%
Intuting	9	28,12%
Total	32	100%

The selection of research subjects was carried out by referring to the MBTI personality test results with the highest scores and using purposive sampling techniques. The details of this process can be seen more clearly based on the highest questionnaire score listed in Table 4 below:

Table 4. Student Personality Categorization

No	Student Name	Score	Personality
1	Subject *Sensing* 1 (S1)	17	*Sensing*
2	Subject *Sensing* 2 (S2)	16	*Sensing*
3	Subject *Intuiting* 1 (I1)	15	*Intuiting*
4	Subject *Intuiting* 2 (I2)	14	*Intuiting*

2) Test Results of Jambi Culture-Based Higher Order Thinking Skills Problem Solving Task Sheet

Next, the subjects received a test sheet containing HOTS questions focusing on Jambi culture. The results of solving the two culture-based HOTS questions showed variations among the research subjects. The details of the results are presented as follows:

a) Problem One

The first question discusses the traditional house of Jambi Kajang Leko, which is a flat-sided space. The following are the results obtained from students' answers:

Table 5. Scoring Results of Students' Mathematical Connection Ability on Problem 1

No	MBTI TYPE	Score	Category Score
1	Subject Sensing 1 (S1)	4	ST
2	Subject Sensing 2 (S2)	4	ST
3	Subject Intuiting 1 (I1)	2	ST
4	Subject Intuiting 2 (I2)	2	R
5	Total	12	
6	Percentage	75%	High

In Table 5, it can be seen that in question number 1, two students obtained the ST (Very High) category with a score of 4. This happened because they successfully applied mathematical concepts to solve HOTS questions related to Jambi culture, especially in

analyzing the Kajang Leko traditional house in the form of a triangular prism. In contrast, the other two students fell into the R (Very Low) category. The percentage result for question number 1 was 75%.

b) Problem Two

The topic of the second question focuses on padamaran cake, a typical Jambi food that has a flat shape. The following are the results obtained from students' answers:

Table 6. Scoring Results of Students' Mathematical Connection Ability on Problem 2

No	MBTI TYPE	Score	Category Score
1	Subject Sensing 1 (S1)	4	ST
2	Subject Sensing 2 (S2)	3	y
3	Subject Intuiting 1 (I1)	1	SR
4	Subject Intuiting 2 (I2)	1	SR
5	Total	9	
6	Percentage	56,25%	Medium

Based on Table 6, question number 2 which assesses the application of mathematical concepts in Jambi padamaran cakes shows results with a percentage of 56.25%. In this question, a student was in the ST (Very High) category because he was able to apply the concept of flat buildings correctly and provide a detailed explanation. On the other hand, one student was in the T (High) category because he was able to answer the question well and recognize important elements, although there were some mistakes. The other two students were in the SR (Very Low) category.

b. Discussion

In the first mathematical connection indicator, which involves identifying relationships between different representations of concepts and procedures, some students were able to organize their understanding and procedures well and provide correct answers. However, some students still had difficulties. S1 and S2's test sheets showed that they managed to connect mathematical concepts and mathematical ideas well. I3 and I4 showed inappropriate understanding of concepts and often made mistakes in procedures, so their answers were not entirely accurate.

Widiyawati et al., (2020) observed that students often provide answers without really understanding the concepts or following systematic steps. Instead, students should be able to connect concepts and procedures that have been learned to solve the problem (Garc í a & Flores, 2018). The assessment on the first indicator shows that students with sensing personality have better concept understanding compared to intuiting type. This finding is consistent with previous studies, which show that intuiting type students tend to process information conceptually, although the methods they apply may not always be accurate (Maharani, 2019).

In the second mathematical connection indicator, which assesses understanding of the relationship between topics in mathematics, it appears that S1 and S2 were able to make connections between topics quite well, although their calculations were still not precise. In contrast, I3 and I4 faced challenges in connecting various topics. They often just copied the problem into a mathematical modeling format without successfully applying other concepts correctly. Many students still have difficulty in understanding the relationship between topics, with an average achievement of only 41% (Indriani & Noordyana, 2021). This is due to students' habit of forgetting previous material, even though they should be able to connect various topics in solving problems (Hana & Sumartini, 2021). In addition, the habit of students who only memorize formulas without understanding the concepts deeply makes it difficult for them to answer problems different from the examples given (Arwadi et al., 2021). Therefore, it is important to continue to train students' mathematical connection skills through student-focused learning, applicative problem exercises, and the development of problem-solving skills.

Based on the personality types of the students studied, students with sensing personalities successfully connected the topics when solving the given problem. The processes and procedures they used were evident in their test sheets. Students with sensing type manage information based on facts that have been learned and follow systematic steps. This finding supports the results of previous studies which show that students with sensing type have a good ability in connecting various topics (Putra & Syarifuddin, 2019).

In the third indicator, which evaluates students' ability to apply mathematical concepts to other fields, the results from Table 5 show satisfactory achievement. All students successfully connected the given problem with other disciplines and were able to transform the problem into a mathematical model. The research indicated that students who could transform the problem into a mathematical model could also structure the next steps effectively. They do not face difficulties in understanding problems related to everyday situations (Radite et al., 2022).

In terms of personality type, both sensing and intuiting students showed similar abilities in connecting mathematics with other disciplines. This finding is consistent with the results of research (Putra & Syarifuddin, 2019) which states that students' ability to systematically link topics is highly dependent on their understanding of the integration of mathematics with other fields. The following is an example of answers from students with sensing personality types.

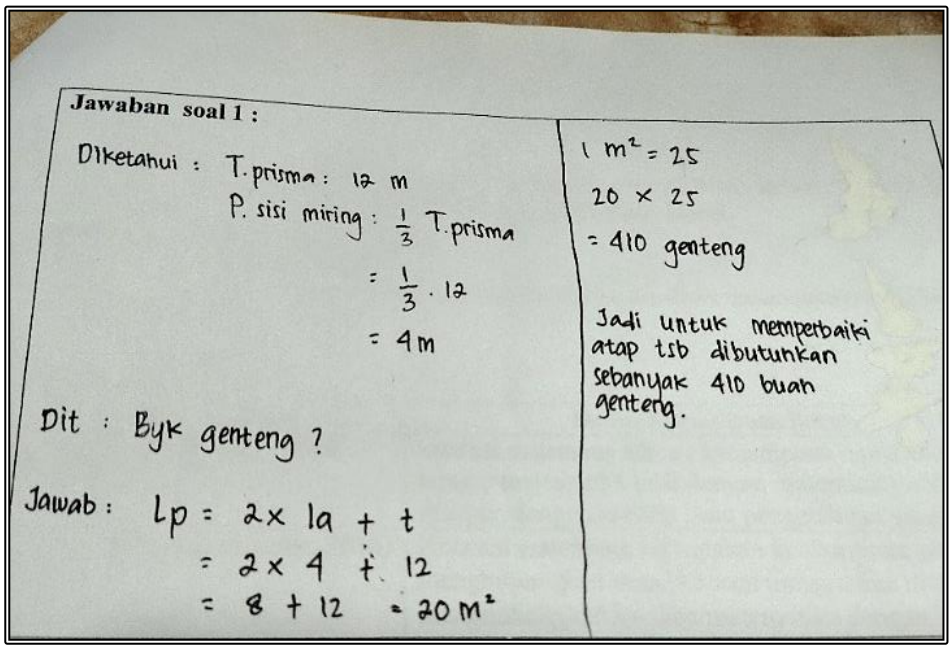

Figure 4. Student Answers on Sensing Personality

Here is an example of a student's answer with an intuitive personality type.

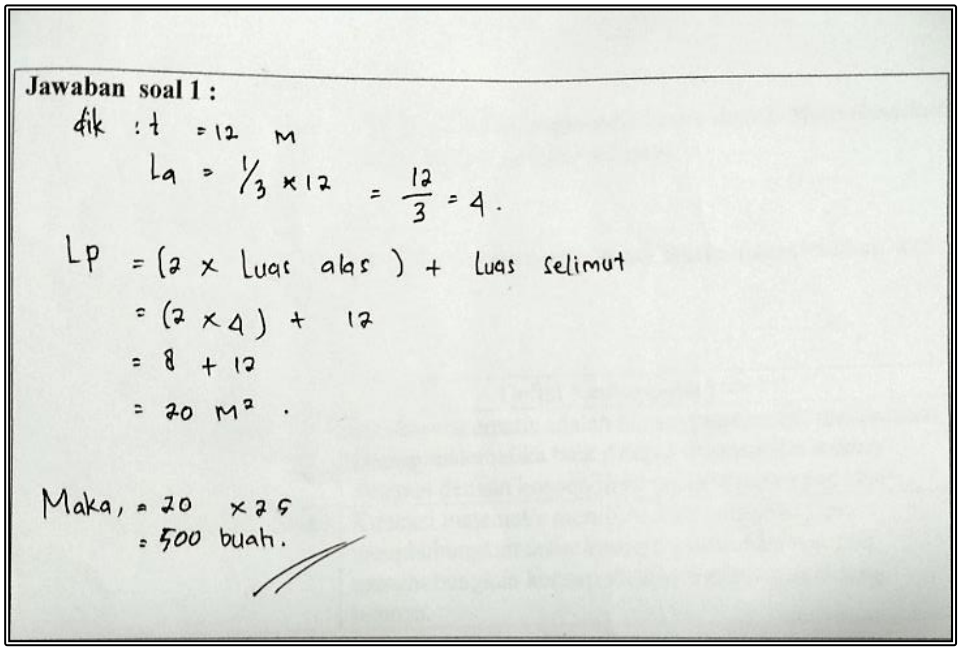

Figure 5. Answers of Students with Intuitive Personality

In Figure, it can be seen that students with sensing personalities showed better results in solving problems that connect Jambi typical padamaran cakes with mathematical concepts, as reflected in their total scores. In the first indicator, students with intuiting personality types faced difficulties in linking the concept of padamaran cakes with flat shapes. This can be seen from the answer sheets of I3 and I4, where they only recorded and calculated the data without providing an explanation of the relationship between flat shapes and the required dough calculation

method. Although I3 and I4 tried to find the relationship, their answers were not correct. On the other hand, students with a sensing personality type, such as SI and S2, managed to link the concept of flat shapes with the procedure for calculating the dough correctly, as seen from their well-structured answers.

In the second indicator, students with intuitive personalities faced challenges in understanding the mathematical relationship between the concepts of flat buildings and padamaran cakes typical of Jambi. This difficulty was caused by the inability of I3 and I4 in the initial stage to identify the relationship between concepts, which resulted in the inaccuracy of their answers when trying to explain the relationship between topics mathematically. On the other hand, students with sensing personalities, such as S1 and S2, were more effective in finding relationships between concepts, so they showed better understanding on this second indicator.

As was the case in the first and second indicators, the results in the third indicator showed a similar pattern, where students with sensing personalities gave more correct answers compared to intuiting types. The connection between the three indicators means that if the achievement in the first and second indicators is inadequate, the achievement in the third indicator will also be affected. Analysis of the answer sheets revealed that I3 and I4 faced difficulties in connecting various concepts, which hindered their understanding of the relationship between concepts. This difficulty impacts on the application of these concepts in everyday contexts. Examples of answers from intuiting personality student type can be seen below.

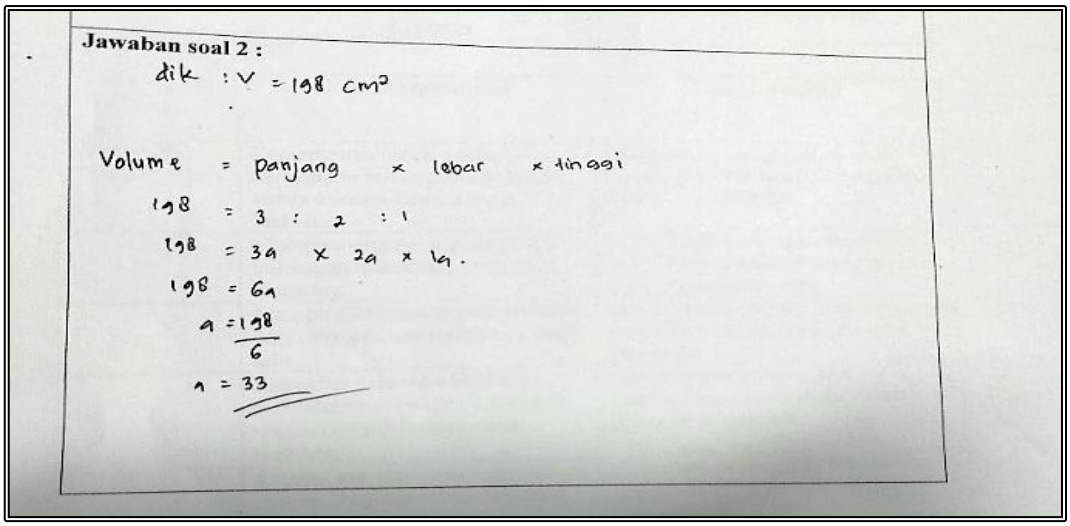

Figure 6. Answers of Students with Intuitive Personality

Examples of answers from a sensing personality type can be seen below.

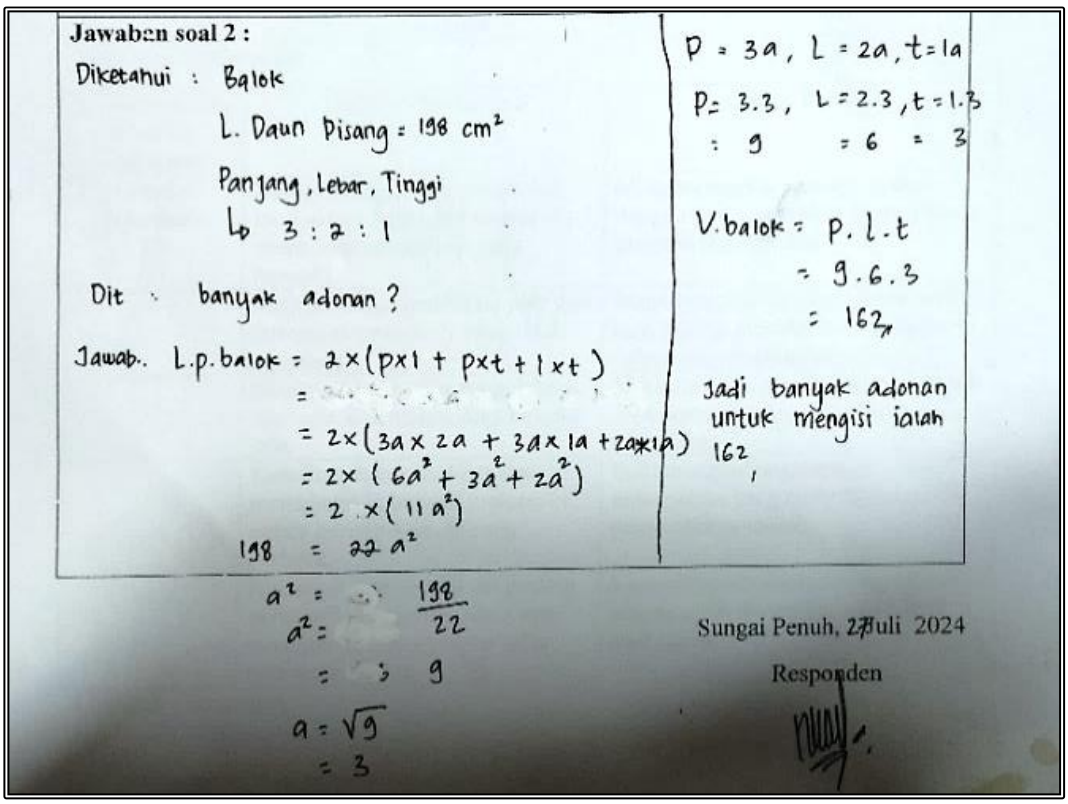

Figure 7. Answers

Analysis of the answer sheets revealed that students with intuitive personalities often treated the data directly without in-depth evaluation, causing difficulties in connecting the concept of flat buildings with the procedure for calculating the amount of dough in a typical Jambi padamaran cake. As a result, the resulting conclusion is less accurate. Research Nainggolan et al., (2022) shows that students with a sensing personality type tend to see data as it is and have not made maximum connections in mathematics, so the results are less precise. In contrast, students with intuiting personality type process information to find relationships between concept representations and procedures, resulting in better understanding. This finding supports the theory that sensing students process data based on concrete and realistic facts, while intuiting students are better able to understand the relationship of concepts and procedures holistically. Meanwhile, research (Wandari et al., 2018) found that the mathematical connection ability of sensing type students was at a moderate level, while intuiting type students had higher abilities. This is different from the results of our study, where sensing students showed better mathematical connection skills than intuiting students. This may indicate differences in context or approach in assessing mathematical connection skills between studies.

Overall, these differences in results can be attributed to differences in methodology, item type, or characteristics of the respective research samples. This research shows that personality type influences the way students process information and make inferences, but the different

results in each study emphasize the importance of considering context and specific approaches in the evaluation of mathematical ability.

4. CONCLUSION

The conclusion of this study revealed that students with sensing personality type showed better mathematical connection ability compared to intuiting personality type. Sensing personality type students obtained a percentage of mathematical connection ability of 70%, while intuiting personality type students only reached 56.25%. This finding shows that students with the sensing type are more effective in linking various mathematical concepts and applying them to hots problems based on Jambi culture. In contrast, intuiting type had difficulty in building the necessary mathematical connections, thus affecting the accuracy of their answers. Therefore, personality type has a significant impact on students' ability to integrate and apply mathematical knowledge in complex situations.

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