
Analysis of Students Mathematical Argumentation Abilities in Solving System of Linear Equation in Two Variables Problems Based on The Level of Creative Thinking

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Abstract

The research is important to conduct because students' mathematical argumentation skills are still often underdeveloped, especially when they are required to justify solutions and connect them with their level of creative thinking. Strengthening these skills is essential not only for obtaining correct answers but also for fostering logical reasoning, critical thinking, and deeper conceptual understanding in mathematics learning. The mathematical argumentation ability of junior high school students in solving SPLDV problems based on the level of creative thinking is defined as the ability of students to convey reasons (data, claims, warrants, backing, and qualifiers) to support or refute a claim derived from a solution to an SPLDV problem. The purpose of this study was to describe students' mathematical argumentation abilities across four categories of creative thinking: very creative, creative, quite creative, and less creative in solving SPLDV problems. This study employed a qualitative descriptive approach. The subjects consisted of four students of Petra Jombang Junior High School, each representing one level of creative thinking: very creative, creative, quite creative, and less creative. The main instrument was the researcher, supported by mathematical argumentation test sheets and interview guidelines. Data validity was ensured through time triangulation. Data analysis was conducted through data reduction, data presentation, and drawing conclusions. The results showed that students with quite creative and less creative levels were able to write data and claims and also convey them verbally, while students with very creative and creative levels tended to convey data and claims verbally. Students with very creative thinking generated warrants based on ticket prices, whereas those with creative, quite creative, and less creative thinking generated warrants based on the grouping of travel participants. All students were able to convey backing, conclusions, and qualifiers verbally.

Keywords: Mathematical, Argumentation, Solving Problems, Creative Thinking

1. Introduction

In the context of 21st-century mathematics learning, the rapid development of globalization, science, and technology demands that students be equipped with higher-order thinking skills (HOTS) to effectively process and utilize abundant information. Mathematics education plays a crucial role in fostering these competencies by emphasizing not only conceptual understanding but also the ability to analyze, evaluate, and create solutions to complex problems. Therefore, mathematics learning must be designed as a strategic medium to develop students' critical thinking, problem-solving, and reasoning abilities. In this knowledge-driven era, the goals of mathematics education are aligned with 21st-century skills, particularly the 4Cs: communication, collaboration, critical thinking and problem solving, as well as creativity and innovation—which are essential for enabling students to adapt, learn continuously, and generate meaningful mathematical ideas in diverse contexts (Admoko et al., 2021; Arifin, 2017; Rusmini et al., 2021).

The current education system emphasizes a framework related to the development of knowledge, skills, and attitudes. This is a way for students to cope with societal change and growth, particularly in learning, including mathematics (Noviyanti et al., 2019). Mathematics instruction focuses not only on transferring knowledge about the material but also on developing students' problem-solving skills.

Some experts argue that problem-solving and argumentation skills are essential skills for every individual. According to Admoko et al. (2021), these two skills are inseparable, one of which is argumentation. Argumentation is considered crucial for understanding ideas (Agoestanto et al., 2019). Students' thought patterns and deepening of their understanding of a concept can be seen in argumentation skills.

Argumentation skills are essential for every student to develop in problem-solving. Some of the stages students generally must go through include formulating the problem, selecting an appropriate strategy, and using various arguments to support the validity of the chosen answer. According to Indrawati & Febrilia (2019), solving math problems requires students to formulate the problem, choose an appropriate strategy, and use arguments to support the validity of the solution provided.

Argumentation skills are necessary for students to solve problems, starting from understanding the problem to explaining the solution that is considered appropriate and correct. Argumentation skills can train students to be free in deciding solutions to solve a problem. Students choose various methods and determine the method that is considered appropriate without hesitation and provide a logical explanation of the solution to the problem. This can occur because in arguing, students are required to obtain concepts through collecting evidence and reasons that can be accounted for from various sources so that students distinguish between facts and opinions (Nurinda et al., 2017). Supported by Indrawati & Febrilia (2019), that argumentation is very necessary for students to explain logically and decide on the right method or solution to solve their problems.

Argumentation is the ability to provide answers and reasons for a problem, supported by sufficient and appropriate evidence in the form of data and theories. According to Ufairah (2022), in mathematics, mathematical argumentation is the ability to express personal ideas about mathematical concepts and principles in one's own language without ignoring existing mathematical conventions such as signs, notations, symbols, and signs in mathematics. Personal ideas are the result of adjustments to teacher explanations in class regarding mathematical material or other learning resources. Bharath & Umlan (2020) explain that mathematical

argumentation is a reasoning process or the ability to show or explain why a mathematical result or answer to a problem is correct.

Argumentation skills need to be trained because they are integral to problem-solving. Several studies examining students' argumentation skills indicate that they are relatively low, with the average argumentation score still below 50% (Syerliana et al., 2018). Research by Agustiniingsih & Effendi-Hasibuan (2021) also indicates that students' argumentation skills are relatively low in terms of level. Students express their opinions but are unable to provide reasons and evidence to support them. Ufairah (2022) also stated that high school students generally reach the third level, where they are only able to make claims, provide relevant data, and connect claims with data.

Students' argumentation skills consist of 6 components, namely, 1) data: students identify information and are able to state what information is in each step of the solution, 2) claim: students state which steps are correct and which steps are wrong. 3) warrant: students provide reasons for the claims issued by students, 4) backing: students provide evidence to support warrants, 5) qualifier: students show the level of confidence in the claim given, 6) rebuttal: students reject the statement and explain the conditions under which the statement does not apply (Handayani, 2015).

Supardi (2015) states that basic thinking processes are used to analyze arguments and generate understanding of certain meanings and interpretations. Decision-making in basic thinking processes is used to choose the best method among several options. As for creative thinking, basic thinking processes are used for the discovery of new things, works of art, constructive ideas related to perception or concepts, which emphasize both intuitive and rational aspects in thinking. Siswono (2007) states that mathematical foundations are shown by creative thinking processes based on arguments found in the intrinsic mathematical properties of the components involved in the thinking process. The theory states that mathematical argumentation skills and creative thinking are related, namely that both are used to obtain various valid solutions in solving mathematical problems.

Students' mathematical argumentative abilities do not necessarily mean expressing mathematical ideas exactly the same as those expressed by the teacher. Students are encouraged to grasp the meaning or idea of a mathematical concept, rule, or principle using existing signs, symbols, emblems, or other agreements. A person's ability to argue is called argumentative ability.

Previous studies have examined students' mathematical argumentation using the framework of Stephen Toulmin and creative, including analyses of argument structures and proof concepts through qualitative approaches (Alexandre et al., 2000; Cankaya & Aydoğan, 2022; Conner, 2007; Trisanti, 2019; Trisanti et al., 2016, 2017; Trisanti & Nusantara, 2021; Whitenack & Yackel, 2002), as well as evaluations of argumentation-based learning such as Toulmin Argumentation Pattern (TAP), cooperative learning, and problem-based learning in improving mathematical argumentation abilities (Azizah et al., 2025; Fukawa-Connelly & Silverman, 2015; Robertshaw & Campbell, 2013; L. B. Trisanti & Nusantara, 2022; L. Trisanti & Nusantara, 2023; L.B. Trisanti et al., 2025; Lia Budi Trisanti & Nusantara, 2021). However, these studies are generally conducted separately and tend to focus either on argument structure or instructional effectiveness, while in the context of solving Systems of Linear Equations in Two Variables (SPLDV), research is still dominated by an emphasis on procedural accuracy without deeply examining how students construct arguments to justify their solutions. Moreover, there is still limited research that analyzes mathematical argumentation based on levels of creative thinking, particularly in terms of the completeness of argumentation components such as data, claims, warrants, backing, and qualifiers; therefore, this study aims

to fill this gap by providing a more comprehensive understanding of students' reasoning processes.

Several studies have examined students' argumentative abilities, examining them from various perspectives. Nisa (2017) research revealed differences in argumentative abilities among students with high, medium, and low self-actualization. Other research indicates differences in argumentative abilities between male and female students, with female students' argumentative abilities being higher than male students' (Sholihah et al., 2021). It appears that no previous research has addressed mathematical argumentative abilities in problem-solving based on their level of creative thinking. Mathematical argumentative abilities are based on this level of thinking because most people are assumed to be creative, but their levels of creativity vary (Solso, 1995). This is demonstrated by evidence of the creative work of certain individuals in technology and knowledge. On the other hand, there are those who do not create but only use or lack any knowledge or skills at all. A person's level of creative thinking can be viewed from the lowest to the highest. This situation indicates that there are different levels or degrees of creative thinking in individuals. Krulik & Rudnick (1999) revealed that indicators in students' creative thinking (fluency, flexibility, and novelty) use problem solving. These three components to assess creative thinking in mathematics review different things and are independent of each other, so that students with different abilities and backgrounds have different abilities according to their level of ability or environmental influences. Thus, it is possible that there is a level or degree of creative thinking according to students' achievements of these three components of creative thinking. Therefore, this study will describe the ability of mathematical argumentation in solving problems based on the level of creative thinking in SPLDV material.

One of the most important mathematics subjects for students to master is systems of linear equations in two variables, also known as SPLDV (Rizqia et al., 2022). Rezky & Jais (2020) argue that SPLDV material is closely related to everyday life, and questions about SPLDV are included in exams administered by schools and the government. Students need to have strong reasoning skills to master SPLDV material. According to Ramadani (2019), SPLDV is a subject taught in the first semester of eighth grade in junior high schools. SPLDV requires advanced reasoning skills. In SPLDV material, students are encouraged to transform real-world problems into mathematical models. Students rely not only on memorization but also on their ability to interpret problems that require advanced reasoning skills. Systems of Linear Equations in Two Variables (SPLDV) are well-suited for examining mathematical argumentation because they require not only procedural accuracy but also students' ability to explain and justify each step of the solution. The use of multiple methods, such as elimination, substitution, and graphical representation, encourages students to provide logical reasons for their chosen strategies, while contextual problems require the construction of mathematical models that naturally involve components of argumentation such as data, claims, and warrants within the framework of Stephen Toulmin. Therefore, SPLDV provides an appropriate context to reveal how students construct and communicate their mathematical arguments.

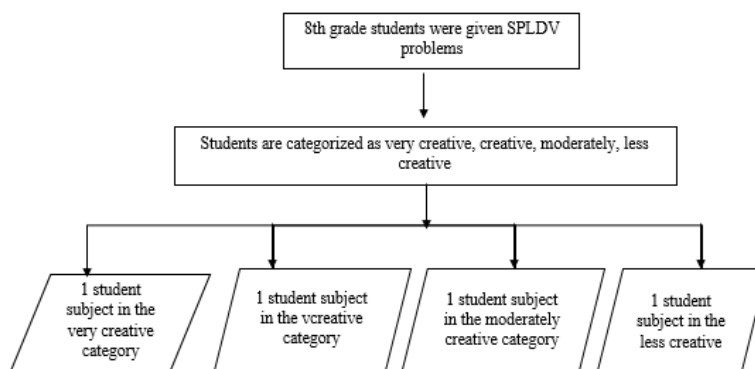
This study analyzes students' mathematical argumentation based on their level of creative thinking. Consistent with Putra (2021), who stated that everyone has different levels of creativity. The creativity possessed by each person is an existing potential that can be measured and developed. This indicates the existence of different levels of creative thinking in individuals. The definition of creative thinking levels is a hierarchical level of thinking with the basis of categorization in the form of creative thinking products (Muliani, 2020). Creative thinking levels (CBT) are divided into five levels: CBT 4 (very creative), CBT 3 (creative), CBT 2 (quite creative), CBT 1 (less creative), and CBT 0 (not creative) (Fatahillah et al., 2017). Each CBT is classified based on three components of creative thinking: fluency, flexibility, and novelty.

2. Methods

This research is a qualitative descriptive study. The data analyzed in this study are consistent. The descriptive approach aims to describe students' mathematical argumentation skills in solving SPLDV problems based on their level of creative thinking. A descriptive approach is used because it is used to explain this research. The instruments used in this study are the primary instrument and supporting instruments. The primary instrument is, of course, the researcher. The supporting instruments include a mathematical argumentation test, a mathematical argumentation test interview guide, a creative thinking test, and a creative thinking test interview guide. These instruments have been validated by expert validation. This instrument is suitable for use when it has been declared valid by expert validation.

The subjects used were 25 ninth-grade students. They were selected using purposive techniques. The researcher selected research subjects based on the creative thinking test and those with good communication skills. The subjects consisted of four junior high school students in Jombang: one subject categorized as very creative, one subject categorized as creative, one subject less creative, and one subject categorized as moderately creative. The procedure for selecting research subjects is as follows:

Figure 1
Subject determination flow



The subjects were then given a mathematical argumentation test until the data was deemed stable. After data collection, the researchers conducted data analysis using the following steps: data reduction, which involves selecting, focusing, and simplifying the raw data obtained in the field with the goal of providing a clearer picture and facilitating subsequent data analysis. Data presentation follows the reduction process. The research subjects were junior high school students who had received SPLDV material and demonstrated good communication skills. Credibility in this study was assessed using triangulation. Time triangulation was used to assess the consistency of the data obtained. The following is the research flow after determining the research subjects:

interview, the subjects conveyed what was asked in the problem. This is consistent with research by Rambe & Afri (2020), which revealed that each student's problem-understanding ability varies. Students with high problem-solving skills are more in-depth in providing what is known and what is asked in the problem. Soekisno (2015) stated that developing arguments is a long process that requires experience and repeated practice. Furthermore, improved argumentation skills result from problem-focused learning that provides students with opportunities to gain a deep understanding of knowledge, facts, and applications, demonstrating efficient and accurate communication skills, both verbally and in writing.

The mathematical argumentation skills of subjects in the very creative category were demonstrated in providing preliminary results for SPLDV problems. Subjects provided several preliminary answers before performing calculations. Elsavani & Hidayati (2023) suggested that teachers should provide students with opportunities to present preliminary work results according to their interests, talents, and learning styles, allowing students to present their work in writing, drawings, and other forms. Indrawati & Febrilia (2019) argued that students identified the data in the problem but did not write it down because they were focused on the hypothesis, they were about to present.

The mathematical argumentation skills of subjects in the very creative category were demonstrated in writing down the steps to solve SPLDV problems. Subjects solved the given problem by writing down the steps, but not in detail. Writing down the steps can minimize errors in calculations. In line with Nuryah et al. (2020), students' errors in formulating plans were observed based on the results of students' work, which did not include the methods and steps they used to solve the mathematical models they had created. Indrawati & Febrilia (2019) revealed that students' arguments regarding data, claims, evidence, and reasoning do not fully use previously acquired concepts and knowledge. Sometimes students use intuition if they are unable to provide evidence/reasoning.

The mathematical argumentation skills of subjects in the very creative category demonstrated their creative reasoning based on the solutions they generated for SPLDV problems. Subjects provided the rationale for their chosen solutions. Subjects had diverse characteristics. In addition to those who directly provided claims and reasons, there were also those who required stimulation to express their opinions (Devi et al., 2019). Ambarawati et al. (2021) found that argumentation skills are important to analyze in students because, among other things, they can guide students in providing reasons or evidence based on facts.

The mathematical argumentation skills of subjects in the very creative category demonstrated their creative ability in selecting appropriate theories to support their arguments. Subjects did not specify the theories used to support their arguments. However, they did present their theories during interviews. This is supported by Mubarok et al. (2016), who stated that relevant theories or supporting evidence serve to strengthen justification. Consistent with Karlina & Alberida (2021), argumentation-based learning activities can encourage students to engage in providing valid evidence, data, and theories to support their opinions on a problem.

The mathematical argumentation skills of subjects in the very creative category demonstrated their creativity in assigning levels of truth to each preliminary result. They assigned levels of truth based on the solutions provided. They were confident in their final answers. However, they were unsure about their preliminary answers. This aligns with Pasaribu & Sijabat (2022) statement that self-confidence is a person's belief in their ability to perform certain behaviors or achieve specific goals. This implies that self-confidence is how each individual perceives and reflects beyond conscious awareness.

The mathematical argumentation skills of subjects in the very creative category demonstrated their creativity in writing conclusions based on the results of solving SPLDV problems. They did not write conclusions, but did provide them during interviews. This is in line with Rofi'ah et al. (2019) who found that students tended not to write conclusions because they were not accustomed to reviewing their answers. This is supported by Zulainy et al. (2021), who stated that students drawing conclusions based on available evidence constitute reasoning, even if they did not write conclusions. Zulainy et al. (2021) also stated that reasoning can be defined as the process of drawing conclusions based on existing evidence or assumptions. When reasoning occurs, one develops arguments to convince others or oneself of a particular claim.

3.2 Profile of Mathematical Argumentation Skills of Students in the Creative Category

The mathematical argumentation skills of students in the creative category are as follows:

Figure 4

Result of students in the creative category

$$\begin{array}{l}
 \text{Kel 1: } (5) \text{ anak } (10) \text{ dewasa} = 185.000 \\
 \text{Kel 2: } (5) \text{ anak } (5) \text{ dewasa} = 125.000 \\
 \hline
 \phantom{\text{Kel 1:}} \phantom{\text{Kel 2:}} 310.000 \\
 \text{Uang yg ada} = 330.000 \\
 \text{kembali} = 20.000
 \end{array}$$

The mathematical argumentation skills of creative subjects in writing down what is known in SPLDV problems. The subjects did not write down what was known about the given problem. They conveyed the known information in the problem as it was during the interview. This is in line with Vendiagrys et al. (2015), who found that students tend to express information in problems as it is and precisely as written in the same sentence form. Hidayati & Widodo (2015); Nugraha & Pujiastuti (2019) stated that students who can explain what is known and what is asked are able to provide evidence or reasons for the correctness of the given solution.

The mathematical argumentation skills of creative subjects in writing down what is asked about SPLDV problems. The subjects did not write down what was asked. After the interview, the subjects conveyed what was asked in the problem. The subjects determined the method used based on the information obtained and what was requested in the problem. This indicates that the subjects understood the problem. This is consistent with the research results of Agsya et al. (2019), students who know the elements contained in the problem are characterized by understanding the problem and can then determine the strategy to be used to solve the presented mathematical problem. Yunian & Rizki (2017) stated that the tendency to think creatively is to re-explain the given problem in one's own words, mention and write down the known and asked elements, and relate it to previous knowledge.

The mathematical argumentation skills of creative subjects were demonstrated in providing preliminary results for SPLDV problems. Subjects provided preliminary answers to the given problems. They conducted several experiments to obtain the answers requested by the problem. Research by Darmawan et al. (2019) suggests that problem-solving using a trial-and-error strategy requires a more in-depth analysis of the given problem, and only students who understand the problem can solve it correctly. Soekisno (2015) revealed that students are said to have a meaningful understanding of the problem if they express reasons, data, guarantees, ideas, and even claims. This is because it assesses students' problem-posing abilities and can be assessed through their oral presentation of mathematical arguments.

The mathematical argumentation skills of creative subjects were demonstrated in writing down the steps for solving SPLDV problems. Subjects did not write down the steps in detail. However, they did provide detailed explanations based on the steps provided. Research by Rahmatiya & Miatusun (2020) revealed that students who clearly and in detail explain the problem-solving steps for each question they have completed are those with high resilience. One of the uses of argumentation skills is to explain interrelated relationships, facts, procedures, concepts, and solution methods. The higher a student's mathematical argumentation skills, the better their ability to justify a solution or answer (Soekisno, 2015).

The creative category demonstrated mathematical argumentation skills in providing reasons based on the solutions generated for SPLDV problems. The subjects provided reasons for the solutions provided. These reasons were used to support their answers. This aligns with research by Purbaningrum (2017), who found that students who analyze information accurately, understand the intent of the question correctly, and provide accurate reasons/evidence demonstrate evaluation skills. (Soekisno, 2015) stated that the important parts of mathematical argumentation skills that students need to have are the ability to put forward reasons accompanied by data and relevant theoretical support for a mathematical problem, both orally and in writing.

The mathematical argumentation skills of creative subjects were demonstrated in selecting appropriate theories to support their reasoning. They chose theories that supported their reasoning based on the solution to the given problem. This is in line with Setiawati & Nurlaelah (2017) who stated that proving truth in an argument requires the use of logical principles. A broad pattern of thinking (logic) is a characteristic of reasoning, thus establishing a link between reasoning and argumentative ability.

The mathematical argumentation skills of creative subjects were demonstrated in assigning levels of truth to each preliminary result. Subjects assigned levels of truth to the solutions provided. During interviews, subjects expressed confidence in their answers. This aligns with Muhmin (2018) statement that self-confidence in every complete individual is characterized by emotional and intellectual stability, consistent self-awareness, and self-control. Research by Triani et al. (2023) revealed that students tend to express their opinions verbally. Mathematical argumentation skills are important for students to express their opinions, make decisions, and solve problems in everyday life.

The creative category of subjects' mathematical argumentation skills demonstrated their ability to write conclusions based on solving SPLDV problems. The subjects did not write conclusions based on the results and solution of the problem. However, they did convey their conclusions from the problem solving during interviews. This is consistent with the research findings of Apriyani & Alberida (2023), which state that reasons and conclusions are necessary for an argument as a form of justification.

3.3 Profile of Students' Mathematical Argumentation Skills in the Moderately Creative Category

The mathematical argumentation skills of students in the moderately creative category are as follows:

Figure 5

Result of students in the moderately creative category

The image shows a handwritten mathematical problem and its solution. The problem asks for the amount of money needed to buy tickets for 25 people (15 adults and 10 children) to a museum, with the goal of getting the maximum refund. The solution provides two options: Option 1 (5 children, 7 adults) to the museum for 155,000, and Option 2 (5 children, 8 adults) to a water park for 161,000. The total cost is 316,000 and the refund is 14,000.

- Diket: Uang = Rp 330.000
Dewasa = 15
Anak = 10

- Ditanya: Berapa uang yang harus dibayar agar cukup untuk membayar tiket masuk 25 orang dengan kembalian semaksimal mungkin?

- Jawab: Keti 1: 5 anak, 7 dewasa → Museum Tembakau: 155.000
Keti 2: 5 anak, 8 dewasa → Waterpark: 161.000

Total = 316.000
Kembalian = 14.000

Subjects in the moderately creative mathematical argumentation category demonstrated their ability to write down what is known in SPLDV problems. They wrote down what they knew based on the given problem. Students understand the problem by writing down what they know (Purwandari et al., 2020). Research by Handayani (2015) revealed that, based on the data, 92% of students understood the questions posed in the problems, indicating that students provided information about what they knew.

Subjects in the moderately creative mathematical argumentation category demonstrated their ability to write down what is asked in SPLDV problems. They wrote down what was asked based on the given problem. This is consistent with research by Hidayati et al. (2023), which found that in mathematics learning, soft skills related to problem-solving involve the ability to write or explain in one's own words known information or questions raised when solving a problem. (Nuryandi & Rusdiana (2016) stated that providing data and reasons motivates students to think more critically and build self-confidence.

The mathematical argumentation skills of the subjects in the category are quite creative in providing preliminary results for SPLDV problems. The subjects provide preliminary results, but the subjects seek more appropriate solutions. This is in accordance with Haryanto (2015), who states that a person's way of thinking is encouraged to find the correct answer to a problem that has vertical, focused, systematic, dependent, and predictable characteristics. The results of research by Suartha et al. (2020) revealed that students have conveyed claims accompanied by data or reasons, argumentation skills must be supported by conceptual knowledge so that the arguments produced by students have a higher level of reliability.

The mathematical argumentation skills of subjects in the moderately creative category demonstrated their creativity in writing down the steps for solving SPLDV problems. They wrote down the steps in detail, including the known information, the question asked in the problem, and the solution. They also explained the steps used during the interview. This is in line with Faelasofi et al. (2015), who stated that the most important aspect of nonverbal mathematical communication lies in the ability to visualize mathematical concepts, clarify understanding, and solve mathematical problems. Alysia et al. (2023) explained that students' written warrants demonstrate a mature understanding of the principles and concepts of the material presented.

The mathematical argumentation skills of subjects in the moderately creative category demonstrated their creativity in providing reasons based on the solutions they generated for SPLDV problems. The subjects provided reasons based on the solutions they generated. This is consistent with research by Nusantara & Trisanti (2021), which found that a person is considered to have a deep understanding of a problem when they accurately convey reasons, data, warrants, ideas, and claims related to the problem.

The mathematical argumentation skills of subjects in the moderately creative category demonstrated their creativity in selecting appropriate theories to support their reasoning. Subjects choose the theory used to support their reasoning. The statement about the importance of argumentative skills in learning is highly relevant to the findings of Hidayati et al. (2023), who extensively explored the development of soft skills, including critical thinking and argumentative skills, in the context of mathematics learning. Furthermore, argumentative skills also provide students with the opportunity to explain everyday phenomena using mathematical concepts or theories as a foundation. The research findings of Alysia et al. (2023) state that students understand that to construct evidence, they must first understand the facts and then construct arguments related to the facts and information obtained using valid reasoning.

Subjects in the moderately creative mathematical argumentation skills demonstrated their ability to assign levels of truth to each preliminary result. Subjects assigned levels of truth based on their answers. They expressed confidence in their answers. Research by Rofiki (2013) found that subjects with low mathematical ability were confident in their answers because they lacked alternative solutions. When re-evaluating their solutions, they could use alternative methods that still yielded the same answer. Furthermore, two different approaches could be used to prove the validity of their answers (Polya, 2004). Alysia et al. (2023) revealed that the qualifier component emerges when students correctly present claims, data, and warrants.

Subjects in the moderately creative mathematical argumentation skills demonstrated their ability to write conclusions based on the results of solving SPLDV problems. Subjects provided conclusions based on the results of their problem solving. This aligns with Jannah et al. (2018) statement that argumentative skills mean possessing a statement that can be used to convince others that a given statement or conclusion is true.

3.4 Profile of Mathematical Argumentation Skills of Students in the Less Creative Category

The mathematical argumentation skills of students in the less creative category are as follows:

Figure 6

Result of students in the less creative category

Diket : Uang : 330.000
 Dewasa : 15
 Anak - anak : 10
 Ditanya : - membagi menjadi 2 kelompok
 - kembauan semaksimal mungkin

Jawab :

kel 1 : 5 anak , 7 dewasa : 155.000 (Museum Sembakau)
 kel 2 : 5 anak , 8 dewasa : 161.000 (Waterpark)
 = 316.000
 Kembauan : 14.000

The mathematical argumentation skills of the subjects in the less creative category were demonstrated when writing down the known information in SPLDV problems. The subjects wrote down the known information on the answer sheet. This is consistent with Fitriyana & Sutirna (2022), who stated that in planning problem solving, students align their plans by

adjusting the known data to the problem and applying the correct calculation process to ensure accurate results. Siswanto et al. (2014) found that practicing argumentation skills requires the ability to provide sound reasons to strengthen arguments for a problem, including claims, data, justification, and support.

The mathematical argumentation skills of the subjects in the less creative category were demonstrated when writing down the questions in SPLDV problems. The subjects wrote down the questions asked in the given problem. This is consistent with Fatmawati et al. (2018), who stated that students with argumentative skills possess the ability to think critically and logically about the relationships between concepts and situations. Through this ability, students explain the interconnected interactions between facts, procedures, concepts, and solution methods.

The mathematical argumentation skills of the subjects in the less creative category were demonstrated when providing preliminary results for SPLDV problems. The subject provides temporary results from the given problem. In line with Ekawati et al. (2013), it is stated that students at the extended abstract level use some data or information then apply concepts or processes then provide temporary results then connect with other data and/or processes so that they can draw relevant conclusions and can make generalizations and the results obtained. Nakhrowi et al. (2023) learning that allows students to argue can be formed using the concept of thinking so that students are accustomed to conveying claims based on information as evidence that strengthens arguments.

The mathematical argumentation skills of subjects in the less creative category were lacking in writing down the steps for solving SPLDV problems. The subjects wrote and explained the steps for solving the given problems in a detailed, clear, and comprehensive manner. This is consistent with Hasanatin et al. (2021) statement that fluency in thinking is the ability to generate various ideas, provide answers, and offer solutions to problems using various approaches. Dianti et al. (2023) study found that students' difficulty providing backing and warrants to support claims or data was due to students' unfamiliarity with answering questions with detailed explanations.

The mathematical argumentation skills of subjects in the less creative category were lacking in providing reasons based on the solutions generated for SPLDV problems. The subjects provided reasons during interviews based on the solutions used. This is consistent with Trisanti (2020) statement that argumentation skills are essential for providing explanations to support or reject an opinion, position, or idea. According to Aini (2014), one aspect of understanding is the ability to explain. This ability to explain is the ability to provide reasons (arguments) for each step in problem-solving.

The mathematical argumentation skills of subjects in the less creative category were lacking in selecting appropriate theories to support their arguments. They chose theories to support their arguments. This theory was revealed during the interview. This aligns with Putri (2018) statement that in presenting arguments, students need a deep understanding of relevant learning concepts. When expressing opinions, the arguments presented must be based on appropriate theories and concepts. Therefore, for students to present arguments scientifically, they must understand the material related to their position. It is important for students to connect existing ideas and evidence by first understanding the concepts and material relevant to the problem. To ensure that the arguments presented are scientific, they must be supported by valid theories as justification. Therefore, students' scientific argumentation skills must go hand in hand with their mastery of concepts, so that when expressing opinions, students have strong and appropriate support and foundation.

The mathematical argumentation skills of subjects in the less creative category were lacking in assigning levels of truth to each preliminary result. The subjects assigned levels of truth to the solutions provided. According to Rumsey & Langrall (2016), argumentation in mathematics can be understood as a social discourse process that produces claims in the form of new mathematical ideas. This process aims not only to generate ideas but also to convince others that the mathematical claims or ideas are true.

The mathematical argumentation ability of the subjects was categorized as less creative in writing conclusions based on the results of solving SPLDV problems. The subjects did not write conclusions based on the results of solving the problems. However, the subjects provided conclusions based on the results of solving the problems during the interview. This is in accordance with Aini (2014) that understanding can be interpreted as the ability to explain a situation or an action. One important aspect of understanding is the ability to draw conclusions. This means the ability to make decisions about the steps that need to be taken in solving a problem, as well as to determine the expected final result. The results of research by Rohmatika & Ro'is (2014) revealed that students often experience difficulty in formulating arguments to be presented, students are silent for a long time after delivering two to three sentences and often repeat arguments that were previously presented. However, when delivering conclusions, students have sequenced arguments correctly.

Based on the explanation above, there is a link between argumentation and creative thinking. Students who are predominantly creative thinkers provide more written arguments than other students. This aligns with the ability to think creatively, which is a crucial element in generating innovation and finding solutions to various problems. By thinking creatively, students can be trained to produce various ideas and opinions and ask various questions (Imaroh et al., 2022).

4. Conclusion

The results of the study of students' mathematical argumentation abilities are as follows: (1) students in the very creative category express data, claims, backing, qualifiers orally. However, they provide warrants in writing. 2) students in the creative category are also the same as students in the very creative category, namely expressing data, claims, backing, qualifiers orally. However, they provide warrants in writing. 3) students in the moderately creative category express claims, backing, qualifiers orally. However, they provide data and warrants in writing. 4) students in the less creative category are also the same as students in the moderately creative category, expressing claims, backing, qualifiers orally. However, they provide data and warrants in writing. This study is expected to provide an overview of students' mathematical argumentation abilities in solving SPLDV problems based on the level of creative thinking, especially for teachers so that they can create learning situations that can train students' mathematical argumentation abilities but still pay attention to the level of students' creative thinking. Overall, students appear to predominantly demonstrate mathematical argumentation skills orally compared to writing.

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6. References

- Admoko, S., Mukhayyarotin, N. R. J., Hariyono, E., & others. (2021). Bibliometric Profile of Science Education Research on Argumentation and The Contribution of Indonesia. *International Joint Conference on Science and Engineering 2021 (IJCSE 2021)*, 502–509.
- Agoestanto, A., Sukestiyarno, Y. L., Isnarto, I., Rochmad, R., & Permanawati, F. I. (2019). Kemampuan Menganalisis Argumen dalam Berpikir Kritis Ditinjau dari Rasa Ingin Tahu. *PRISMA, Prosiding Seminar Nasional Matematika*, 2, 337–342.
- Agsya, F. M., Maimunah, M., Roza, Y., & others. (2019). Analisis Kemampuan Pemecahan Masalah ditinjau dari Motivasi Belajar Siswa MTs: Pemecahan Masalah: Motivasi: Polya. *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education*, 4(2), 31–44.
- Agustiniingsih, N., & Effendi-Hasibuan, M. H. (2021). The Effectiveness of Modified Flip-Based Argumentation Learning in Improving Students' Argumentation Skills About Hydrocarbon. *Jurnal Pendidikan Kimia*, 13(3), 250–260.
- Aini, R. N. (2014). Analisis Pemahaman Siswa SMP dalam Menyelesaikan Masalah Aljabar pada PISA. *Mathedunesa*, 3(2).
- Alexandre, J., Pilar, M., Munoz, P., Cristina, Cuadrado, A., & Virginia. (2000). Expertise , Argumentation and Scientific Practice: a Case Study about Environmental Education in the 11 th Grade. *annual meeting of the national association for research in science teaching (NARST), New Orleans, LA, April (ERIC Document Reproduction Service no ED 439 960)*., 1–21.
- Alysia, R., Seristia, Aisyah, N., Pratiwi, W. D., & Araiku, J. (2023). Deskripsi Struktur Argumentasi Siswa Sekolah Menengah Atas Kelas XII Pada Pembuktian Materi Bangun Ruang. *Edutainment: Jurnal Ilmu Pendidikan dan Kependidikan*, 11(1), 18–25.
- Ambarawati, D. S. H. E., Muslim, M., & Hernani, H. (2021). Analisis Kemampuan Argumentasi Siswa SMP pada Materi Pencemaran Lingkungan. *Inkuiri: Jurnal Pendidikan IPA*, 10(1), 13–17.
- Apriyani, N. D., & Alberida, H. (2023). Pengaruh Model Problem Based Learning (PBL) terhadap Keterampilan Argumentasi Peserta Didik pada Pembelajaran Biologi: Literature Review. *BIOCHEPHY: Journal Of Science Education*, 3(1), 40–48.
- Arifin, Z. (2017). Mengembangkan Instrumen Pengukur Critical Thinking Skills Siswa pada Pembelajaran Matematika Abad 21. *Jurnal Theorems*, 1(2), 92–100.
- Azizah, L. ., Trisanti, L. B., & Iffah, J. D. N. (2025). Development of e-comic-based teaching module to enhance students' mathematical argumentation skills. *Jurnal Pendidikan MIPA*, 26(4), 2283–2307.
- Bharath, S., & Umlan, K. (2020). Argumentation in Mathematics Education. *Springer International Publishing*, 61.
- Cankaya, O., & Aydogan, N. (2022). The Relationship between Argumentation Skills and Cognitive Flexibility of Preservice Science Teachers. *Asian Journal of Education and Training*, 8(2), 51–59.
- Conner, A. M. (2007). *Student teachers' conceptions of proof and facilitation of argumentation in secondary mathematics classrooms*. The Pennsylvania State University.
- Darmawan, P., Prayekti, N., & others. (2019). Strategi Siswa dalam Memecahkan Masalah

- Statistika. *Prosiding: Konferensi Nasional Matematika dan IPA Universitas PGRI Banyuwangi*, 1(1), 176–183.
- Devi, N. D. C., VH, E. S., & Indriyanti, N. Y. (2019). Analysis of High School Students' Argumentation Ability in The Topic of Buffer Solution. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, 3(3), 141–151.
- Dianti, P., Sunandar, A., & Setiadi, A. E. (2023). Analisis Penguasaan Konsep dan Kemampuan berargumentasi Siswa dengan Model Argument Driven Inquiry Berbasis Socio-Scientific Issue. *Qalam*, 12(2), 1–14.
- Ekawati, R., Junaedi, I., & Nugroho, S. E. (2013). Studi Respon Siswa dalam Menyelesaikan Soal Pemecahan Masalah Matematika Berdasarkan Taksonomi SOLO. *Unnes Journal of Mathematics Education Research*, 2(2).
- Elsavani, M., & Hidayati, W. S. (2023). Analisis Implementasi Kurikulum Merdeka dalam Pembelajaran Matematika. *Prosiding Conference on Research and Community Services*, 5(1), 254–261.
- Faelasofi, R., Arnidha, Y., & Istiani, A. (2015). Metode Pembelajaran Mind Mapping untuk Meningkatkan Kemampuan Komunikasi Matematik Siswa dalam Pemecahan Masalah Matematika. *JURNAL e-DuMath*, 1(2).
- Fatmawati, D. R., Harlita, H., & Ramli, M. (2018). Meningkatkan Kemampuan Argumentasi Siswa Melalui Action Research dengan Fokus Tindakan Think Pair Share. *Proceeding Biology Education Conference: Biology, Science, Enviromental, and Learning*, 15(1), 253–259.
- Fitriyana, D., & Sutirna. (2022). Analisis Kemampuan Pemecahan Masalah Matematis Siswa Kelas VII Pada Materi Himpunan. *Jurnal Educatio FKIP UNMA*, 8(2), 512–520.
- Fukawa-Connelly, T., & Silverman, J. (2015). The Development of Mathematical Argumentation in an Unmoderated, Asynchronous Multi-User Dynamic Geometry Environment. *Contemporary Issues in Technology and Teacher Education*, 15(4), 445–488.
- Handayani, P. (2015). Analisis Argumentasi Peserta Didik Kelas X SMA Muhammadiyah 1 Palembang dengan Menggunakan Model Argumentasi Toulmin. *Jurnal Inovasi dan Pembelajaran Fisika*, 2(1), 60–68.
- Harahap, E. R., & Surya, E. (2017). Kemampuan Pemecahan Masalah Matematis Siswa Kelas VII dalam Menyelesaikan Persamaan Linear Satu Variabel. *SEMNASATIKA UNIMED*.
- Haryanto, H. (2015). Pembelajaran Konstruktivistik Meningkatkan Cara Berpikir Divergen Siswa SD. *Jurnal Penelitian Ilmu Pendidikan UNY*, 8(1), 124382.
- Hasanatin, N. I., Hidayati, W. S., & Nurmilah, R. (2021). Analisis Kreativitas Siswa dalam Mengimplementasikan Media TASICOTG Berdasarkan Kemampuan Matematika. *Prosiding Conference on Research and Community Services*, 3(1), 545–556.
- Hidayati, A., & Widodo, S. (2015). Proses Penalaran Matematis Siswa dalam Memecahkan Masalah Matematika pada Materi Pokok Dimensi Tiga Berdasarkan Kemampuan Siswa di SMA Negeri 5 Kediri. *Repository Publikasi Ilmiah*, 01(02), 131–143.
- Hidayati, W. S., Trisanti, L. B., & Hidayana, N. A. (2023). Soft Skills Development of Students in Learning Mathematics. *Jurnal Math Educator Nusantara: Wahana Publikasi Karya Tulis Ilmiah di Bidang Pendidikan Matematika*, 9(2), 171–188.
- Imaroh, R. D., Sudarti, S., & Handayani, R. D. (2022). Analisis Korelasi Kemampuan Berpikir Kreatif dengan Model Problem Based Learning (PBL) pada Pembelajaran IPA. 12, 198–204.

- Indrawati, K. A. D., & Febrilia, B. R. A. (2019). Pola Argumentasi Siswa dalam Menyelesaikan Soal Sistem Persamaan Linear Tiga Variabel (SPLTV). *FIBONACCI: Jurnal Pendidikan Matematika Dan Matematika*, 5(2), 141–154.
- Jannah, A. N., Juniati, D., & Sulaiman, R. (2018). Students Argumentation for Solving Geometry in Junior High School. *Mathematics, Informatics, Science, and Eduaction International Conference*, 158–161.
- Karlina, G., & Alberida, H. (2021). Kemampuan Argumentasi pada Pembelajaran Biologi. *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, 5(1), 1–7.
- Krulik, S., & Rudnick, J. A. (1999). Innovative Tasks to Improve Critical and Creative Thinking Skills. *The National Council of Theachers of Mathemacis*, 138–145.
- Mubarok, O. S., Muslim, M., & Danawan, A. (2016). Pengaruh Model Pembelajaran Berbasis Masalah dengan Pendekatan Saintifik Terhadap Kemampuan Argumentasi Ilmiah Siswa SMA pada Materi Pengukuran. *Prosiding SNPS (Seminar Nasional Pendidikan Sains)*, 3, 381–388.
- Muhmin, A. H. (2018). Pentingnya Pengembangan Soft Skills Mahasiswa di Perguruan Tinggi. *Forum Ilmiah*, 15(2), 330–338.
- Nakhrowi, Z. S., Anshori, D. S., Mulyati, Y., & Setyaningsih, Y. (2023). Berpikir dan Berargumen: Problematika Kemampuan Argumen Siswa Secara Tertulis dan Potensi Berpikir Kritis Sebagai Solusi Pembelajaran. *Seminar Internasional Riksa Bahasa*, 278–289.
- Nisa, K. (2017). Profil Kemampuan Argumentasi Siswa dalam Menyelesaikan Masalah Matematika Ditinjau dari Aktualisasi Diri Siswa. *Jurusan Pendidikan Matematika dan IPA, Prodi Pendidikan Matematika Fakultas Tarbiyah dan Keguruan, Universitas Islam Negeri Sunan Ampel Surabaya*.
- Noviyanti, N. I., Mukti, W. R., Yuliskurniawati, I. D., Mahanal, S., & Zubaidah, S. (2019). Students' Scientific Argumentation Skills Based on Differences in Academic Ability. *Journal of Physics: Conference Series*, 1241(1), 12034.
- Nugraha, T. H., & Pujiastuti, H. (2019). Analisis Kemampuan Komunikasi Matematis Siswa Berdasarkan Perbedaan Gender. *Edumatica*, 9(1), 1–7.
- Nurinda, S., Sajidan, S., & Prayitno, B. A. (2017). Enhancing High School Students's Rebuttals as An Important Aspect of Scientific Argumentation Skill Through Problem Based Learning. *1st Annual International Conference on Mathematics, Science, and Education (ICoMSE 2017)*, 122–125.
- Nuryah, M., Ferdianto, F., & Supriyadi, S. (2020). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Persamaan dan Pertidaksamaan Nilai Mutlak Berdasarkan Langkah Penyelesaian Polya. *Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang*, 4(1), 63–70.
- Nuryandi, & Rusdiana. (2016). Penerapan Dialogical Argumentation Instructional Model (DAIM) untuk Meningkatkan Pemahaman dan Kemampuan Argumentasi Siswa SMA pada Materi Listrik Statik. *Jurnal Penelitian Pendidikan*, 15(3), 76–83.
- Nusantara, T., & Trisanti, L. B. (2021). Pengembangan Model Infusion Learning untuk Meningkatkan Kemampuan Argumentasi Mahasiswa Calon Guru Matematika. *Laporan Tahun Terahir Penelitian Pasca Doktor*.
- Pasaribu, E., & Sijabat, D. (2022). Hubungan Kecemasan Berkomunikasi dan Percaya Diri dengan Hasil Belajar Pendidikan Kewarganegaraan Siswa Sekolah Dasar. *Jurnal Basicedu*,

6(2), 2342–2351.

Polya, G. (2004). *How to Solve It: A New Aspect of Mathematical Method*. Princeton University Press.

Purbaningrum, K. A. (2017). Kemampuan Berpikir Tingkat Tinggi Siswa SMP dalam Pemecahan Masalah Matematika ditinjau dari Gaya Belajar. *Jurnal penelitian dan Pembelajaran matematika*, 10(2).

Purwandari, I., Ekawati, W., & Trisanti, L. B. (2020). Penerapan Model Pembelajaran Problem Based Learning Dengan Media Komat Terhadap Pemecahan Masalah Dan Kecemasan Matematika Siswa. *Jurnal THEOREMS (The Original Research of Mathematics)*, 5(1), 1–12.

Putra, W. (2021). Mutu Pendidikan dalam Penguatan Kreativitas Anak Prasekolah. *Ta'dib*, 11(2), 59–67.

Putri, R. E. (2018). Meningkatkan Kemampuan Argumentasi Ilmiah Siswa SMP Kelas VII melalui Bahan Ajar IPA Terpadu dengan Tema HALO pada Topik Kalor. *SEMESTA: Journal of Science Education and Teaching*, 1(1), 34–46.

Rahmatiya, R., & Miatun, A. (2020). Analisis Kemampuan Pemecahan Masalah Matematis ditinjau dari Resiliensi Matematis Siswa SMP. *Teorema: Teori Dan Riset Matematika*, 5(2), 187–202.

Ramadani, P. S. (2019). Kemampuan Berfikir Kritis Siswa Menggunakan Pendekatan Pembelajaran Realistic Mathematic Education (RME) pada Materi SPLDV. *Jurnal PEKA (Pendidikan Matematika)*, 3(1), 18–22.

Rambe, A. Y. F., & Afri, L. D. (2020). Analisis Kemampuan Pemecahan Masalah Matematis Siswa dalam Menyelesaikan Soal Materi Barisan dan Deret. *AXIOM: Jurnal Pendidikan Dan Matematika*, 9(2), 175–187.

Rezky, R., & Jais, E. (2020). Hyphotetical Learning Trajectory: Pemecahan Masalah Materi Sistem Persamaan Linear Dua Variabel. *Mandalika Mathematics and Education Journal*, 2(2), 92–101.

Rizqia, R., Senjayawati, E., Kadarisma, G., & others. (2022). Analisis Pengaruh Self Regulated Learning Terhadap Kemampuan Penalaran Matematis Siswa Pada Materi Spldv. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 5(3), 741–750.

Robertshaw, B., & Campbell, T. (2013). Constructing arguments: Investigating pre-service science teachers' argumentation skills in a socio-scientific context. *Science Education International*, 24(2), 195–211.

Rofi'ah, N., Ansori, H., & Mawaddah, S. (2019). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Cerita Matematika Berdasarkan Langkah Penyelesaian Polya. *EDU-MAT: Jurnal Pendidikan Matematika*, 7(2).

Rofiki, I. (2013). Profil Pemecahan Masalah Geometri Siswa Kelas Akselerasi SMP Negeri 1 Surabaya ditinjau dari Tingkat Kemampuan Matematika. *Jurnal Prosiding Seminar Nasional Matematika dan Aplikasinya*, 1, 300–310.

Rohmatika, A., & Ro'is, S. (2014). Penggunaan Arel pada Penyampaian Argumen di Klub Debat Bahasa Inggris STKIP PGRI PONOORO. *Dinamika Ilmu*, 14(2), 162–175.

Rumsey, C., & Langrall, C. (2016). Promoting Mathematical Argumentation. *Teaching Children Mathematics*, 22(7), 412–419.

- Rusmini, R., Suyono, S., & Agustini, R. (2021). Development of Critical Thinking Skills and Argumentation Skills Assessment Instruments towards 21st-Century Skills Based on Non-Routine Problems. *International Joint Conference on Science and Engineering 2021 (IJCSE 2021)*, 382–389.
- Setiawati, I., & Nurlaelah, I. (2017). Analisis Profil Kemampuan Berargumentasi Guru Dan Mahasiswa Calon Guru Dalam Pembelajaran Biologi Menggunakan Model Toulmin Argumen Pattern (Tap) Dan Upaya Perbaikannya. *Quagga: Jurnal Pendidikan dan Biologi*, 9(01).
- Sholihah, N. U., Sadieda, L. U., & Sutini, S. (2021). Kemampuan Argumentasi Peserta Didik dalam Menyelesaikan Masalah Pembuktian Kongruensi Segitiga Ditinjau dari Perbedaan Gender. *JRPM (Jurnal Review Pembelajaran Matematika)*, 6(1), 24–38.
- Siswanto, Kaniawati, & Suhandi. (2014). Penerapan Model Pembelajaran Pembangkit Argumen Menggunakan Metode Saintifik untuk Meningkatkan Kemampuan Kognitif dan Keterampilan Berargumentasi Siswa. *Jurnal Pendidikan Fisika Indonesia*, 10(2), 104–116.
- Siswono, T. Y. E. (2007). Pembelajaran Matematika Humanistik Yang Mengembangkan Kreativitas Siswa. *FMIPA Unesa*, 1–16.
- Soekisno, R. B. A. (2015). Pembelajaran Berbasis Masalah untuk Meningkatkan Kemampuan Argumentasi Matematis Mahasiswa. *Infinity Journal*, 4(2), 120–139.
- Solso, R. L. (1995). *Cognitive Psychology*. Needham Heights, MA.
- Suartha, N., Setiawan, G., & Sudiatmika, R. (2020). Pola Argumen Toulmin pada Proses Pembelajaran IPA SMP. *Jurnal Ilmiah Pendidikan dan Pembelajaran*, 4(1), 1–11.
- Supardi. (2015). Peran Berpikir Kreatif dalam Proses Pembelajaran Matematika. *Jurnal Formatif*, 2(3), 248–262.
- Syerliana, L., Setiawan, W., & others. (2018). Argumentation Skill Profile Using “Toulmin Argumentation Pattern” Analysis of High School Student at Subang on Topic Hydrostatic Pressure. *Journal of Physics: Conference Series*, 1013(1), 12031.
- Triani, E., Darmaji, & Astalini. (2023). Identifikasi Keterampilan Proses Sains dan Kemampuan Berargumentasi Siswa. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, 13(1), 9–16.
- Trisanti, L. B., & Nusantara, T. (2021). Identifying Students’ Mathematical Argumentation Competence in Solving Cubes and Pyramid Problems. *Journal of Physics: Conference Series, Vol. 1933, No. 1*, 012118.
- Trisanti, L. B., & Nusantara, T. (2022). The influence of infusion learning strategy on students’ mathematical argumentation skill. *International Journal of Instruction*, 15(2), 277–292.
- Trisanti, L., & Nusantara, T. (2023). The Effectiveness of Infusion Learning Model in Linear Algebra Course. *Education Research International*, 2023(9004072), 1–10. <https://doi.org/https://doi.org/10.1155/2023/9004072>
- Trisanti, L.B., Maf’ulah, S., Umami, R., Irdyanti, C. D., & Fitriani, N. . (2025). Pemanfaatan aplikasi argumen matematis sebagai solusi permasalahan manajemen pembelajaran guru. *JMM (Jurnal Masyarakat Mandiri)*, 9(5), 5034–5043.
- Trisanti, Lia Budi. (2019). The Process Of Thinking By Prospective Teachers Of Mathematics In Making Arguments. *Journal of Education and Learning (EduLearn)*, 13(1), 17~24. <https://doi.org/http://dx.doi.org/10.11591/edulearn.v13i1.6853>

- Trisanti, Lia Budi. (2020). Warrant Deduktif dalam Argumentasi Matematis Mahasiswa Calon Guru. *JOURNAL PROCEEDING*, 2(1).
- Trisanti, Lia Budi, & Nusantara, T. (2021). Improving students' mathematical argumentation skill through infusion learning strategy. *Journal of Physics: Conference Series*, 1783(1). <https://doi.org/10.1088/1742-6596/1783/1/012103>
- Trisanti, Lia Budi, Sutawidjaja, A., As'ari, A. R., & Muksar, M. (2016). The construction of deductive warrant derived from inductive warrant in preservice-teacher mathematical argumentations. *Educational Research and Reviews*, 11(17), 1696–1708. <https://doi.org/https://doi.org/10.5897/ERR2016.2872>
- Trisanti, Lia Budi, Sutawidjaja, A., As'ari, A. R., & Muksar, M. (2017). Types of warrant in mathematical argumentations of prospective-teacher. *International Journal of Science and Engineering Investigations*, 6(68), 68.
- Ufairah, E. H. (2022). *Analisis Kemampuan Argumentasi Matematis Siswa Pada Materi Bangun Ruang Sisi Datar Ditinjau dari Kemampuan Awal Matematika*. Jakarta: FITK UIN Syarif Hidayatullah Jakarta.
- Vendiagrys, L., Junaedi, I., & others. (2015). Analisis Kemampuan Pemecahan Masalah Matematika Soal Setipe TIMSS Berdasarkan Gaya Kognitif Siswa pada Pembelajaran Model Problem Based Learning. *Unnes Journal of Mathematics Education Research*, 4(1).
- Whitenack, J., & Yackel, E. (2002). Making Mathematical Argumens in the Primary Grades: The importance of Explaining and Justifying Ideas. *Teaching Children Mathematics*, 8(9), 524–527.
- Yunian, P., & Rizki, W. (2017). Analisis Proses Berpikir Kreatif dalam Memecahkan Masalah Matematika Ditinjau dari Tipe Kepribadian Guardian dan Idealis. *Nabla Dewantara: Jurnal Pendidikan Matematika*, 2(1), 52–65.
- Zulainy, F., Rusdi, R., & Marzal, J. (2021). Pengembangan Lembar Kerja Peserta Didik Berbasis Realistic Mathematics Education untuk Meningkatkan Kemampuan Argumentasi Peserta Didik. *Jurnal Cendekia*, 5(1), 812–828.