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Students Thinking Processes in Generalizing Patterns Based on The Personality of RIASEC Holland Theory

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ABSTRACT

Generalizing patterns is a fundamental mathematical skill with widespread applications. However, only 7.1% of students demonstrate high proficiency in generalizing patterns, indicating significant challenges in identifying and applying rules. This study explores the thinking processes of students who succeed and fail in generalizing linear patterns, analyzed through the lens of Holland's RIASEC personality model. Employing a qualitative phenomenological approach, data were collected through pattern generalization tests, RIASEC questionnaires, and interviews conducted with seven junior high school students in Bandung, selected based on communication skills and varied personality types. The findings reveal that students with investigative personalities are most successful, exhibiting critical thinking and problem-solving abilities aligned with pattern generalization tasks. In contrast, unsuccessful students predominantly rely on numerical data or recursive strategies without effectively connecting visual configurations. This research identifies three distinct thinking processes: focusing solely on numerical data, combining numerical data with operational adjustments, and refining generalizations using visual patterns. The study underscores the importance of leveraging visual aids and trial-and-error methods in teaching pattern generalization. Differentiated instruction, tailored to students' cognitive and personality traits, is recommended to address diverse learning needs and enhance mathematics education quality. This study contributes to understanding the interplay between personality and cognitive strategies in mathematical problem-solving. It also emphasizes the necessity for inclusive teaching strategies that cater to varied student profiles to foster success in generalizing patterns and developing essential mathematical skills.

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1. INTRODUCTION

Generalization is a fundamental concept observable in various aspects of life. For instance, generalizing patterns is essential in everyday activities, such as analyzing global sales trends (Nurmawanti & Sulandra, 2020). Generalizing patterns was also a critical skill in ancient times, as people sought to explore and interpret large-scale phenomena, which we now recognize as history (Fay et al., 2008). Generalizing involves identifying trends, examining sequences, and linking different levels of mathematical thinking in innovative ways. Mathematics helps us think clearly and equips us with the tools to solve complex problems. Generalization often uncovers new insights and knowledge, even without precise language; through observation and experimentation, we gain valuable experiences. However, generalization does not always lead to a single conclusion and may involve interpreting evidence to identify broader patterns, such as Simpson's rule or concepts in higher-dimensional spaces. Research has also demonstrated the potential for generalizing multimedia-object functions (Tuah, 2022; Masud, 2024).

Understanding and generalizing patterns is a critical skill for students, particularly with patterns in number sequences that follow simple forms (Tanişli & Özdaş, 2009; Setiawan, 2019; Septiahani et al., 2020; Setiawan, 2020). For example, the difference between adjacent terms in a linear pattern forms a constant first difference and is expressed as $Un = an + b$, with $a \neq 0$ (Setiawan, 2020). However, many students struggle to generalize linear patterns, often making errors when concluding data (Mariam et al., 2019; Handayani et al., 2020; Maryani

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& Chotimah, 2021; Putri et al., 2021). Studies indicate that only 26.31% of students perform well, and only 7.1% demonstrate high proficiency in pattern generalization (Damayanti & Kartini, 2022; Dahlan et al., 2014). Students frequently face challenges in understanding and solving number sequence problems (Pirmanto et al., 2020; Wulandari & Setiawan, 2021), which is crucial for tackling pattern generalization (Sutarto & Hastuti, 2015). Furthermore, students often struggle with expressing mathematical structures clearly and identifying generalization rules (Mulligan, 2011; Ellis et al., 2017). These difficulties highlight the need for improved instructional strategies to help students overcome these challenges and succeed in generalizing patterns (Ariyanti & Setiawan, 2019; Kresnadi et al., 2023; Sari et al., 2016; Suryowati & Tristanti, 2022).

Previous studies on pattern generalization have primarily focused on the strategies students use to identify linear patterns (Dinarti & Qomariyah, 2022,2019; Hashemi et al., 2013; Lannin et al., 2006; Setiawan, 2019; Suherman, 2015). One notable finding is using recursive and various other strategies in generalizing patterns. Additional research has explored the thinking process in pattern generalization through different lenses: cognitive styles, such as field-dependent and field-independent (Nirfayanti & Nurdiah, 2023; Setiawan, 2019); reflective cognitive styles (Hayuningrat & Listiawan, 2018); and learning styles (Firdaus, 2023).

Setiawan (2020) investigated students' mental processes, which initially failed but eventually corrected their mistakes in generalizing patterns. However, prior research lacks a detailed discussion of students' thinking processes in generalizing patterns from the perspective of learning styles. Including this perspective would complement existing studies by offering a more holistic understanding of students' cognitive processes. Furthermore, it is essential to examine the thinking processes of both successful and unsuccessful students in generalizing patterns, considering their personality types as categorized by the RIASEC model.

The RIASEC model stems from the Holland Code of Occupational Interest (HCOI), introduced by American psychologist John Holland in 1965 (Blustein et al., 2005; Holland, 1997). This model was designed as an occupational classification system to help individuals understand their tendencies and interests. According to Holland's theory, a person's unique character develops from genetic and environmental factors (Amalianita & Putri, 2019). Holland's system categorizes work preferences into six types: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C) (Holland, 1997; Mangesa & Mappalotteng, 2023; Wei, 2024). Each category represents distinct talents and interests, providing a framework for analyzing individual differences.

According to the RIASEC model, an individual's personality is influenced by their preferences for and aversions to certain activities. Research investigating the correlation between interests, as categorized by the RIASEC model, and students' academic achievement has shown a very strong correlation of 0.823, based on a study involving 44 students (Yuline, 2024; Heinze et al., 2005). This correlation highlights that personality types can significantly influence problem-solving abilities, as problem-solving requires a thinking process shaped by individual characteristics, including those described in the RIASEC model (Huda et al., 2021).

Personality types, in general, impact the learning process, including mathematical learning, and are closely linked to students' thinking processes when solving mathematical problems (Cahya, 2022). This connection underscores the relationship between personality, learning, and mathematical reasoning. From the perspective of career pathways, many studies based on Holland's RIASEC model have explored its six personality types for future careers. However, few have examined their direct influence on academic results. For instance, studies have linked the RIASEC model to career interests in science (Dierks et al., 2016), general career pathways (Ambiel et al., 2018; Martins et al., 2024; McKay & Tokar, 2012; Wille & De Fruyt, 2014; Xu & Tracey, 2017), STEM fields (Babarović et al., 2019), and talent detection (Hidayat & Wahyuni, 2019).

Building on this framework, the present study examines the relationship between the RIASEC personality types and students' thinking processes when generalizing linear patterns. The assumption underlying this study is that students who struggle to generalize linear patterns may exhibit weaker academic performance, while those who succeed are likely to demonstrate stronger cognitive abilities. This research aims to bridge the gap between personality theory and mathematical reasoning, offering new insights into how personality influences learning outcomes.

2. MATERIAL AND METHOD

Research Design

This study aims to investigate the thinking processes of students who struggle with generalizing patterns and to approach those who succeed from a theoretical and academic perspective of personality. We adopted a

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qualitative phenomenological method to explore students' experiences in generalizing patterns to achieve this. Data were collected through interviews to gain deeper insights into students' reasoning and thought processes (Creswell, 2013).

The research was conducted in October 2024 at a junior high school in Bandung. This site was selected because previous studies indicated that students at this school faced significant challenges in solving pattern generalization problems. Given the critical role of pattern generalization in mathematical thinking, the study aimed to delve further into this essential topic and understand how students at this location approach and reason through pattern-related problems.

Participants

Initially, 18 eighth-grade students who had completed the pattern generalization material agreed to participate in the study. However, the final selection was narrowed to seven students based on their excellent communication skills. This criterion enabled the researcher to gain deeper insights into the subjects' thinking processes, as students with strong communication abilities could articulate their thoughts more clearly. By expressing what occurred in their minds when presented with the material, these students provided uninterrupted streams of thought, allowing for a more thorough analysis of their reasoning.

Conversely, suppose a participant struggles to communicate their thoughts effectively. In that case, it becomes challenging for the researcher to delve into their cognitive processes and understand their approach to solving pattern generalization problems. Communication is not merely a process of transmitting information; it also creates contexts and reveals phenomena that facilitate deeper understanding (Budiasih, 2014). Thus, selecting participants with strong communication skills was crucial for achieving the study's objectives and exploring the complexities of students' reasoning.

Instruments

This study explores the thinking processes of students who fail and those who succeed in generalizing linear patterns based on their RIASEC personality types. The researchers played a central role in collecting the data, supported by several essential instruments: a test instrument, interview guides, and a questionnaire.

The **test instrument** was designed to uncover the students' thinking processes in generalizing patterns, serving as the foundation for the data collection. Interview guides were employed as supplementary tools to ensure the authenticity and reliability of the data. These guides helped probe specific answers from the test, allowing researchers to gather additional insights into the students' reasoning processes. The interviews provided an in-depth exploration of how students approached pattern generalization tasks.

A questionnaire instrument was also used to determine the students' RIASEC personality types. This enabled the researchers to link personality traits with cognitive strategies, offering a more comprehensive understanding of the relationship between personality and mathematical thinking. These instruments are detailed in the subsequent sections, highlighting their role in achieving the study's objectives.

Test Instrument

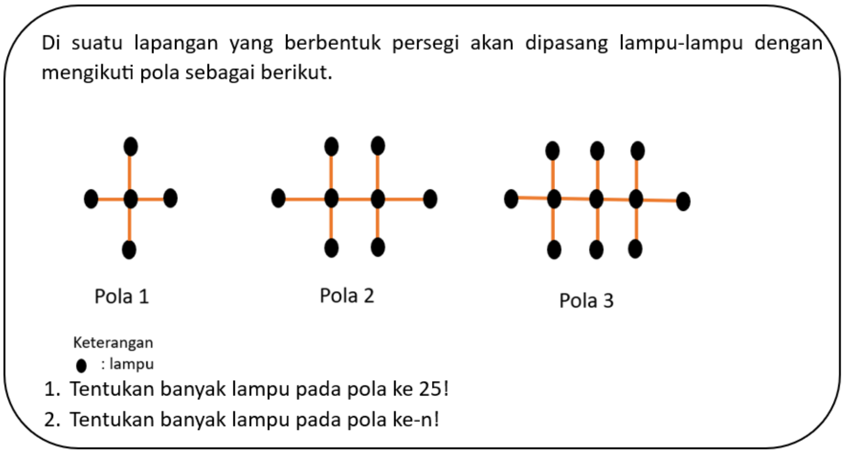

Figure 1. Test Instruments

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The test instrument, consisting of one stimulus and two questions, was designed to reveal the students' thought processes. To ensure its clarity and effectiveness, the researcher conducted a readability test involving three students with varying abilities—low, medium, and high. The feedback from this readability test was then reviewed by expert teachers, who provided additional suggestions and comments for improvement. By taking these two steps, the researcher refined the instrument and tested it with 18 students to establish its validity. This rigorous process ensured the reliability of the test instrument, which is presented in Figure 1.

Figure 1 illustrates the test instrument, which consists of one stimulus and two questions. The stimulus begins with a narrative describing the installation of lamps in a field, where the positions follow a specific pattern depicted in an accompanying image. Below the image, **Question 1** prompts students to determine the value of the 25th term based on the pattern. **Question 2** then requires students to derive the general formula for the nnn-th term of the sequence. This structure is designed to analyze students' thinking processes and ability to generalize patterns effectively.

Non-Test Instrument
Questionnaire

Questionnaires were used in this study to determine students' personality types based on RIASEC. The explanation of RIASEC is shown in the following Figure 2.

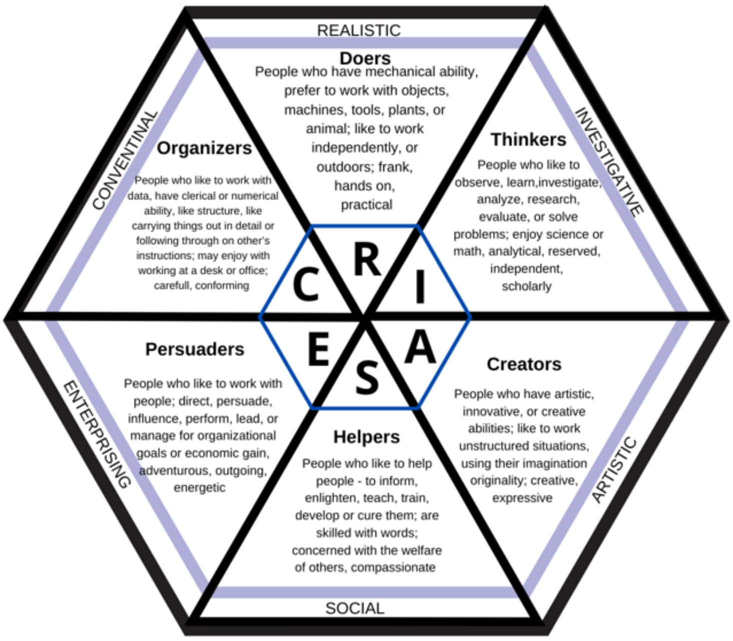

Figure 2. Personality Type of RIASEC (Holland, 1997)

A total of 18 students participated in the study by completing the RIASEC questionnaire, adapted from an International Labour Organization compilation. Before the experimental procedures, students were administered the questionnaire in a structured format. The questionnaire began by collecting basic information, asking students to identify themselves and list their hobbies, aspirations, and positive attributes. Students were also asked to reflect on their strengths and weaknesses.

In the next section, students were prompted to list five and five subjects they disliked. This was followed by the main component of the questionnaire, consisting of 66 questions with two answer options for each: "appropriate" or "inappropriate."

The RIASEC personality test uses the Guttman scale, where each personality type has 11 indicators. Responses marked as "appropriate" for an indicator were scored 1, while "inappropriate" responses scored 0. The scores for each personality type's indicators were summed to obtain a total score. If the score for one personality type exceeded the others, the student was categorized under that type. The results of the RIASEC Personality Type Questionnaire, including the distribution of personality types among the students, are presented in **Table 1**. This data provided the foundation for analyzing the relationship between personality types and students' thinking processes in generalizing linear patterns.

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Table 1. Personality Type Questionnaire Results

No	Personality Type	Number of Students
1	Realistic	0
2	Investigative	7
3	Artistic	7
4	Social	4
5	Enterprising	0
6	Conventional	0

Interview Guidelines

Interview guidelines were used in this study to acquire a deeper insight into the test results. Field Semi-structured interviews were used as in this research where the outlines did not strive to formalize all questions; the remaining ones were in part developed on the scene of interviews with those surveyed, going along with what they meant so that they are still in context without being slipped off track somehowA research interview guide of this kind asks how students arrive at their generalizations from a pattern. This kind of interview guide, beginning with a "how," gets at the thought process of student interviews, which were carried out one by one, and the subjects were students who had emerged with good communication from those interviewees entering into TOK classes. At the same time, this paper was still being written.

Data Collection

The data collection procedure began with all 18 students completing the RIASEC personality type questionnaire on the first day. On the second day, each student completed a 30-minute test to assess their ability to generalize linear patterns. Following the test, interviews were conducted with seven students selected based on their strong communication skills, as they demonstrated the ability to convey their thoughts effectively.

To uphold ethical standards, students received a respondent consent form before data collection commenced. This form outlined their voluntary participation, assured them that the research would not cause harm, and guaranteed the confidentiality of their identities. Measures were taken to protect their privacy, including arranging anonymous phone interviews when necessary and ensuring that participants' identities were safeguarded under appropriate conditions, such as police protection if required. These precautions ensured the study was conducted ethically and responsibly, maintaining trust and transparency with all participants.

Data Analysis

Data analysis was carried out in conjunction with data collection and writing findings. To analyze the data, refer to the opinion of Miles and Huberman (Miles & Huberman, 1984), which contains reduction data, data presentation, and conclusions.

Data Reduction

Data reduction activities were conducted to select, focus, and eliminate irrelevant data, ensuring the resulting data was more structured and aligned with the study's objectives. These activities were carried out using ATLAS. ti software, which not only streamlined the process but also enhanced the reliability and replicability of the research, allowing other researchers to validate the findings.

The data reduction process with ATLAS. ti involved several steps. First, open coding was performed to identify and label key data points. Next, similar codes were categorized, irrelevant data were excluded, and overlapping or identical data were merged. This systematic approach helped refine the dataset into a more cohesive and manageable form.

The final output of the data reduction process was a research data mind map created by ATLAS.ti software, which provided a visual representation of the structured data. This mind map offered a clear and concise overview of the study's findings. An example of the data reduction process using ATLAS. ti software is presented in **Figure 3**.

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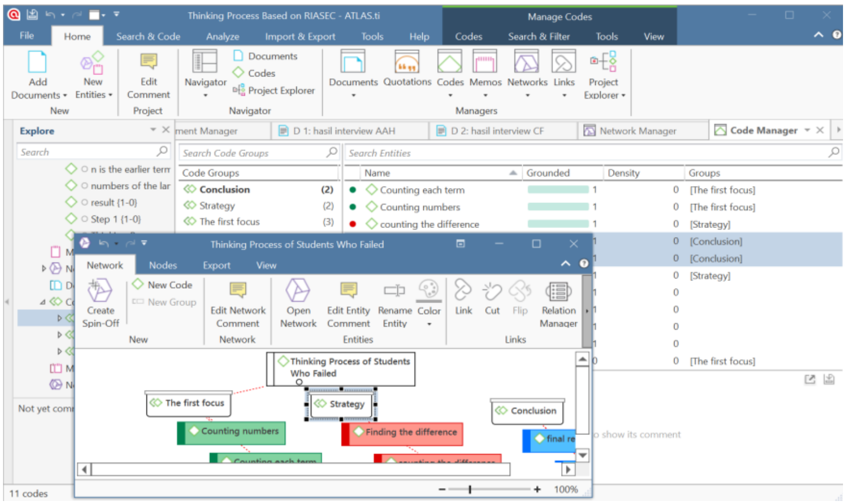

Figure 3. Data Reduction Process Using ATLAS.ti

Data Presentation

Data presentation activities involved organizing the reduced data into tables, matrices, or diagrams to enable clear visualization and facilitate analysis. In this study, the results of the data reduction process were conducted using ATLAS.ti software was presented in the form of a table. The table provided a structured comparison of the thinking processes between different personality types as categorized by the RIASEC model. This format allowed for a clear understanding of how each type approached generalizing linear patterns, highlighting similarities and differences in their cognitive strategies. The tabular representation ensured the findings were accessible, easy to interpret, and effective for drawing meaningful insights.

Conclusion

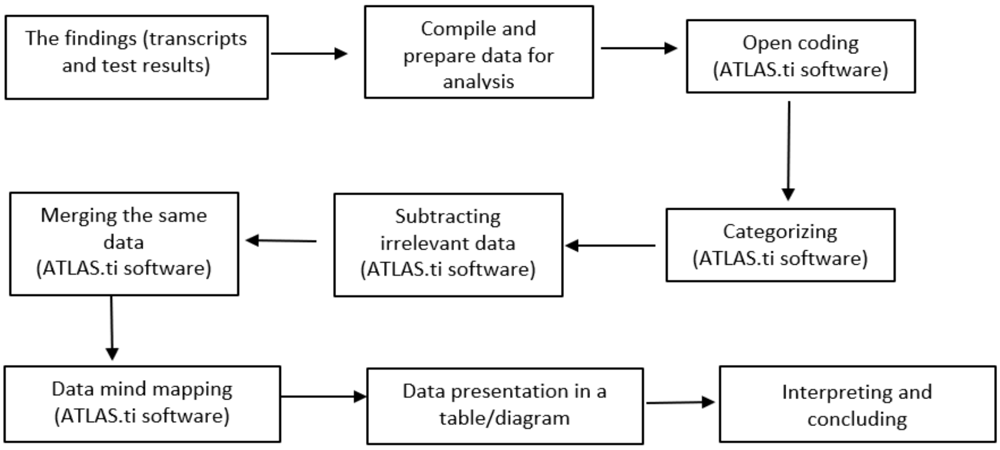

Figure 4. The Flowchart of Data Analysis Process

At this stage, the data in the table was transformed into a more abstract and conceptual form to find deeper meaning through interpretation and correlating the findings with existing theories. Based on this, conclusions were drawn to produce new findings. The Flowchart of the data analysis process is presented in Figure 4.

3. FINDINGS

The Students Test and Questionnaire

From the perspective of personality types, this study primarily focuses on comparing students who successfully generalized linear patterns and those who failed. The analysis is based on data collected and

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examined in a controlled environment.

Regarding the **Subject Test results** presented in **Table 2**, while the name of a school in Florida appears in the data, it is not considered actual data from that institution. To ensure the security and privacy of the students, all names have been replaced with coded identifiers. This measure preserves confidentiality while maintaining the integrity of the research findings.

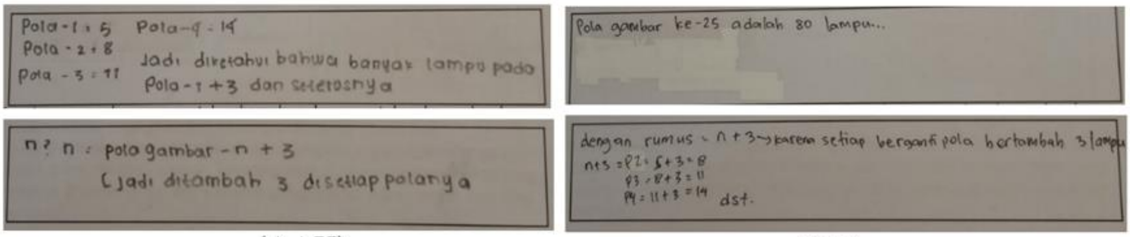
Table 2. Results of Students' Test and Questionnaire

No	Subjects	Personality Type	Generalization Pattern	Communication	Selected Student
1	AH	Investigative	Succeed	Good	V
2	AS	Artistic	Fail	Less	-
3	AAH	Investigative	Fail	Good	V
4	AN	Investigative	Fail	Less	-
5	CF	Social	Fail	Good	V
6	FQ	Investigative	Succeed	Good	V
7	HT	Investigative	Succeed	Good	V
8	KV	Artistic	Fail	Less	-
9	KD	Social	Fail	Less	-
10	MA	Artistic	Succeed	Good	V
11	NAN	Investigative	Fail	Less	-
12	NS	Investigative	Fail	Less	-
13	NA	Artistic	Fail	Less	-
14	NM	Artistic	Fail	Less	-
15	NEN	Artistic	Fail	Less	-
16	SA	Social	Fail	Less	-
17	SAP	Artistic	Fail	Less	-
18	TA	Social	Succeed	Good	V

In summary, we investigated subjects with strong communication skills across various personality types. Based on **Table 2**, the following selections were made: from the Investigative type, subjects AH, AAH, FQ, and HT were chosen. For the artistic type, the subject MA was selected; however, no suitable subjects were found in the realistic (UN) or enterprising (ER) categories. For the Social type, subjects CF and TA were selected. Lastly, subject D was chosen from the Conventional type. No other subjects from the remaining groups met the criteria for inclusion in the study.

The Students Who Failed in Generalizing of Pattern

There were two subjects, namely AAH, which has an investigative type, and CF, with a social type, who failed to generalize the pattern chosen to study the thinking process more deeply. The following Figure 5 shows the results of AAH and CF's work.



(AAH) (CF)

Figure 5. Result of AAH and CF Subject Work

The following is an excerpt from an interview between the researcher (P) and AAH and CF subjects. Interviews were conducted not at the same time.

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P: Can you explain how you got the results $U_n = n + 3$?

AAH: I counted the number of lamps each term; the first term was 5, the second was 8, and the third was 11. I found the difference, and I wrote n + 3.

CF: There were five lamps in the first term; then I counted the second term again, which was 8. Then, the third term was 11. So, the difference in each term was 3. So, n + 3.

P: How about "n" from n + 3?

AAH: "n" That is the term. I saw earlier that each term is added to 3, so n + 3.

CF : "n" That is the number of the previous term.

The Students Who Succeed in Generalizing Pattern

Out of the 18 students, five successfully generalized the pattern. These five students were selected for further investigation of their thought processes. The subjects chosen for this analysis are AH, FQ, HT, MA, and TA. The results of their work are presented in **Figure 6** below.

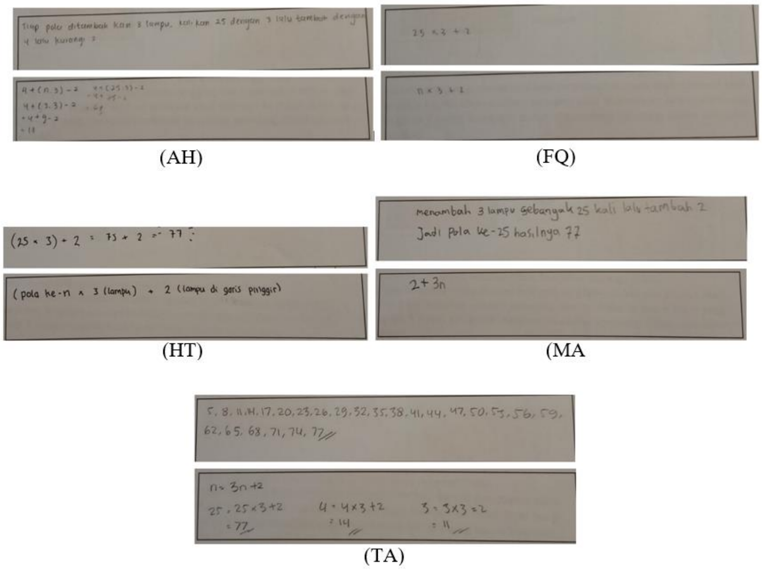

Figure 6. Result of AH, FQ, HT, MA, and TA Subjects Work

To clarify the answers of the subject, it was confirmed through interviews. The following is an excerpt of an interview between the researcher (P) and AH, FQ, HT, MA, and CF subjects. Interviews were conducted not at the same time.

P: Can you explain how you got the results $U_n = 3n + 2$?

AH : At first, try it. However, the first attempt was wrong. However, I tried again, and it turned out that it could. I found three$3n + four$ at the first. I got four because there are four lamps outside of the first term, but in the second term, it is the first term plus three lamps, which means there is one lamp at the top, at the right end, and at the bottom. The third term is also the same as the second term, plus three lamps with the same position. So, I wrote $U_n = 4 + 3n$ at first, where four is from the number of the lamp in the first term, and then there are the lamps that always increase in each term. However, when I tried the formula, the result was wrong. So, it is minus 2; the final result is $U_n = 4 + 3n - 2$.

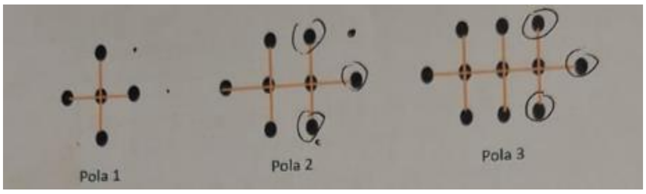

Figure 7. Subject Scribbles in Compiling Generalizations

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FQ: I see the 1st, 2nd, third term. As the term moves, the number of vertical lines also increases. Where there were three lamps on the vertical line. The first term has one vertical line, the second has two vertical lines, and the third has three vertical lines, so the n-th term has n vertical lines. Then, there is one lamp on the right end and one lamp on the left end. So, $3 \times$ *It is added by 2. So,* $U_n = n \times 3 + 2$.

HT: At first, I saw a line in the middle. When the first pattern fits, there is one line in the middle. In the second term, there are two lines in the middle, and in the third term, there are three lines in the middle. So if the n-th term, there are n lines in the middle. Because what is asked is how many lamps, I tried to calculate the lamps, and it has three lamps in the middle line. So if the first term has three lamps in the middle, the second term has six lamps in the middle, so if the n-th term has $n \times 3 + 2$*, and two are from two lamps on the right and left of the line on the edge (horizontal, pen).*

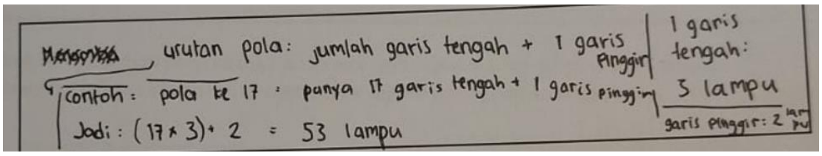

Figure 8. HT Subject Scribbles in Pattern Generalization

MA: Because from the beginning, two lamps were on the side. This is the one line in the middle that has not been calculated. This is the first term. In the second term, the two lamps will still be the same on the side. But three more lamps in the middle. So, e… And so in the third term, the lamps on the sides are still the same, and three in the middle increase by three according to the term. So I conclude 2 + 3n.

TA: At first, because I did not know the formula, I manually calculated the first term, second term, and so on. I got three as a difference for each pattern. After sorting, I look for a number that I think makes sense when viewed from the picture; that is what I calculated. "$n \times 3$*". e.g., the third term, "*$3 \times$ *n the result is 9. It still lacks two because it should be 11, so I add 2. After I got 3n + 2, I tried to put it in another term; It turns out that the formula is included.*

4. Discussion

Analysis of RAISEC Personality Types and Generalization Success

According to the results, seven respondents were classified as Investigative, seven as Artistic, and four as Social. Among these, 42.9% of students with the Investigative personality type succeeded in generalizing patterns, making this group the most successful. The Artistic type accounted for 14.3% of successful students, while 25% of students with the Social personality type were successful. Students with an Investigative personality type demonstrated the highest success rate in generalizing patterns, consistent with Holland's (1997) characterization of Investigative individuals as "thinkers" who enjoy observing, learning, analyzing, researching, and solving problems, particularly in science and math.

Holland's description aligns with the concept of habits of mind, which Costa and Kallick (2000) define as behaviors that enhance critical thinking and problem-solving skills. According to Miliyawati (2014b), habits of mind play a crucial role in the learning process, helping individuals address and solve problems effectively. These habits are also strongly linked to developing students' critical thinking skills (Alhamlan et al., 2017).

Generalizing patterns (identifying similarities within sequences (Setiawan et al., 2019)) is essential for developing critical thinking and problem-solving skills, which help students connect number patterns to object configurations. This highlights the advantage Investigative students have, as their natural inclination toward analytical thinking and interest in math and science fosters stronger performance in tasks requiring pattern generalization. Moreover, a strong interest in mathematics has been shown to positively impact performance, as noted by Zhang et al. (2020). This underscores the significant role of personality traits and interest in achieving success in mathematics-related tasks.

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Challenges in the Generalization of Linear Patterns

According to **Figure 5** and the excerpt from the interview with the principal subjects, Mr. AAH and Mrs. CF failed to generalize the patterns. This failure is reflected in their incorrect answers, which stem from focusing on the number of lamps in each term rather than interpreting the problem through the given figure representation. Their focus on numerical data suggests a reliance on surface-level observations. Both subjects identified differences between terms and attempted to count the lamps sequentially, using a recursive strategy.

Research has shown that when students approach pattern generalization problems using recursive relationships (Becker & Rivera, 2005; Chua, 2009; Hourigan & Leavy, 2019; Lannin et al., 2006; Setiawan et al., 2019; Tanişli & Özdaş, 2009), they often struggle to formulate general rules. In this case, the students' failure is due to their inability to effectively connect observed regularities within the pattern. For instance, while students could recognize some regularity term by term, they struggled to link this to a broader generalization. This aligns with findings by Ellis et al. (2017), which highlight difficulties students face in connecting similar items across patterns.

Another critical error observed was misinterpreting the variable "n" (representing the nnn-th term). Students incorrectly assumed that "n" directly depended on the preceding term (i.e., n−1), resulting in partial and indirect manipulations. These mistakes align with Watson's Theory of Errors (Maryani & Chotimah, 2021) and earlier research, highlighting similar challenges in students' attempts to generalize patterns (Yao & Elia, 2021; Kama, 2023).

The two subjects who failed to generalize patterns belonged to the Investigative and Social personality types. While investigative types are typically associated with stronger analytical and problem-solving skills, their failure in this instance suggests that the difficulties faced are not inherently tied to personality type. Instead, external factors seem to play a significant role. These obstacles can be categorized as epistemological (related to the nature of the knowledge being learned), didactical (stemming from the teaching approach), and ontogenic (arising from the students' developmental stage), as outlined by Brousseau (2002). These external learning barriers likely contributed to both subjects' challenges in generalizing patterns.

Role of RIASEC Personality Traits in the Thinking Process

According to **Table 2**, AH, AAH, FQ, and HT were selected from the Investigative personality types, MA from the Artistic type, and CF and TA from the Social type. Based on **Figure 3** and the interview excerpt with AAH and CF, it is evident that these subjects began with an incorrect approach to answering the problem. The error is clear: the subjects counted the number of lamps in each term sequentially, starting with the first term (5 lamps), followed by the second term (8 lamps), and the third term (11 lamps). Observing these terms, they concluded that the difference between consecutive terms was 3. However, when attempting to generalize the nnn-th term, the subjects incorrectly added 3 to nnn, leading to an incorrect result.

Figure 9 illustrates the thinking process of a subject who fails to generalize linear patterns. This process consists of three stages. The first stage is to focus on the number of objects and then count the number of objects to form the pattern. The subjects focus on the previous and different terms in the second stage. The previous term is "n," and the difference is b. In the third stage, the subject writes. This is not the correct answer to our problem.

Five of the 18 students succeeded in generalizing linear patterns by accurately transferring them from one representation to another. These five students (AH, FQ, HT, MA, and TA) were selected for further analysis of their thought processes. Three distinct types of thought processes were identified from these subjects, each described in the following sections.

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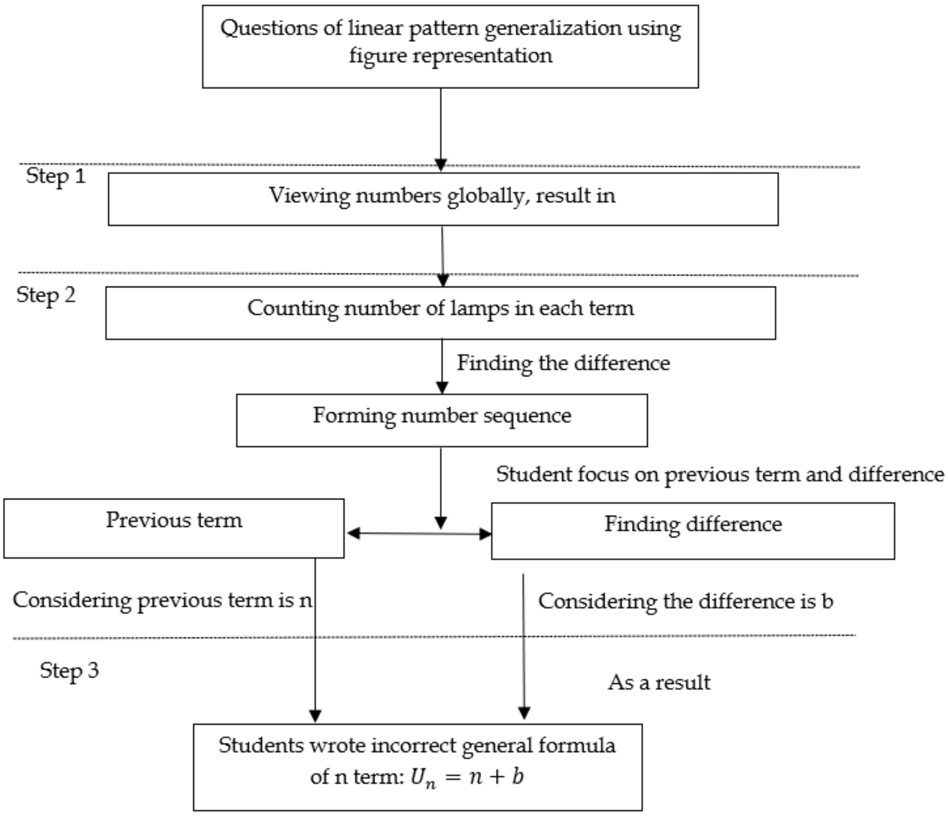

Figure 9. Failed Students'Thought Process

Type I Thinking Process

AH's approach illustrates the Type I thinking process. According to **Figure 4** and the results obtained from analyzing the data, AH provided the formula for the nn-th term.

Initially, the subject observed the arrangement of lamps in each term and focused on counting the number of lamps in the first term. The subject overlooked some lamps located further from the focus area, concentrating instead on those nearest. This led the subject to count only four lamps in the first term. When moving to the second and third terms, the subject observed that each subsequent term added three more lamps, forming a pattern as seen in **Figure 5**.

By compiling the pattern from the images provided, as shown in **Figure 6**, AH noted that the first term had four lamps, and each subsequent term added three lamps. Although AH attempted a trial-and-error approach, the initial result was incorrect. Upon reviewing and adjusting the process, the subject correctly derived the formula.

As demonstrated by AH, this thinking process highlights the step-by-step reasoning involved in identifying and generalizing the pattern. The subject's approach is detailed in **Figure 10**, which visually represents the thought process leading to the correct solution.

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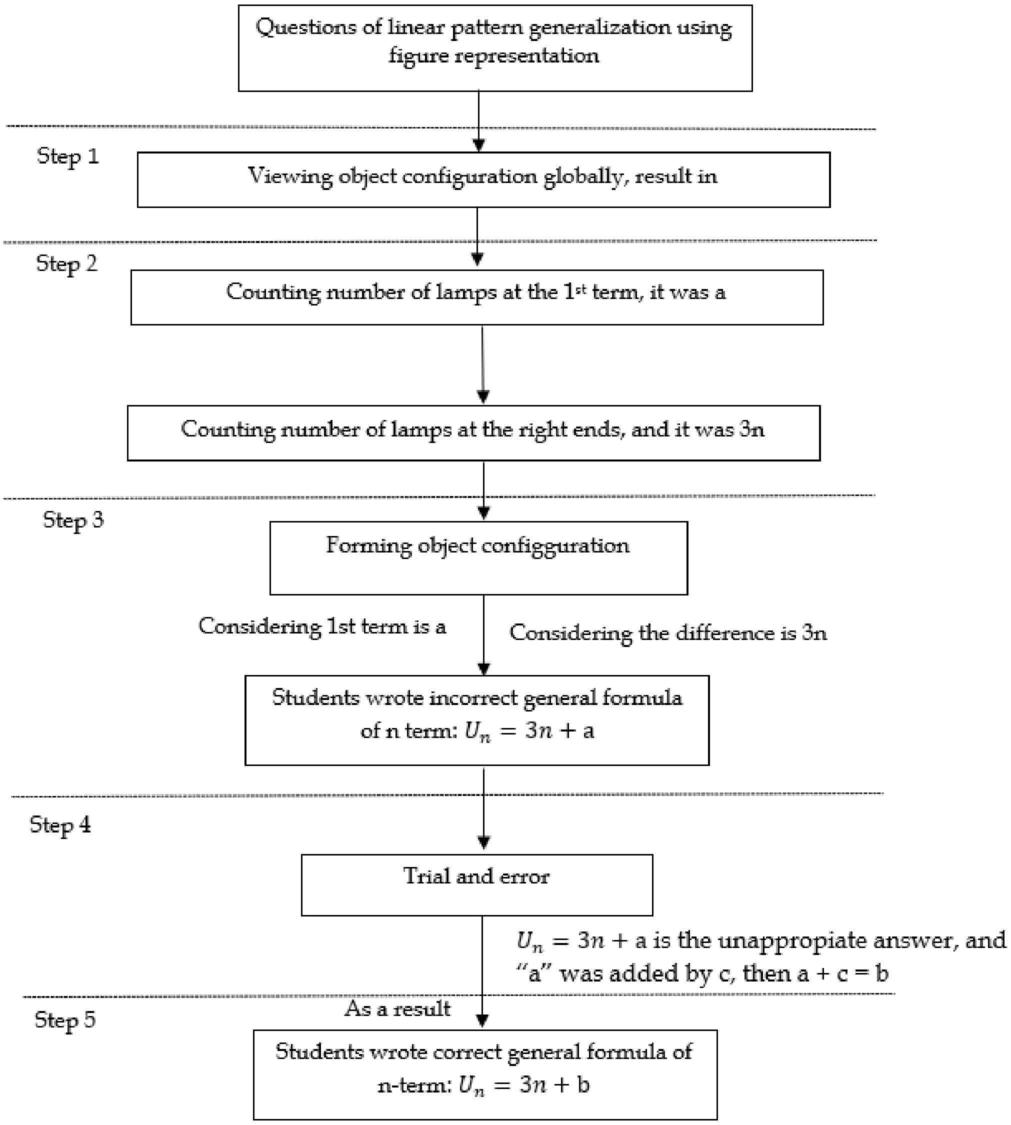

Figure 10. Type 1 Thinking Process

Based on Figure 10, it can be seen that the subject's successful thinking process in generalizing linear patterns consists of five stages. The initial stage involves focusing on the configuration of objects, which is crucial for understanding the underlying structure of the pattern. This aligns with the findings of Setiawan, who emphasizes the importance of recognizing object configurations in the context of linear patterns in mathematics education (Setiawan, 2023). The subjects then count the number of objects, forming a foundational understanding of the pattern's structure (Mulligan & Mitchelmore, 2009). In the second stage, the subjects concentrate on identifying the first term and any subsequent different terms. This step is critical as it sets the groundwork for establishing a formula that accurately represents the pattern. Research indicates that recognizing the first term is a common strategy students employ when dealing with linear patterns (Akkan, 2013). In the third stage, subjects formulate an expression for the nth term, represented by the threthree $U_n = 3n + a$ where a = 4. This formulation reflects a common approach in mathematical reasoning where students attempt to generalize patterns through algebraic expressions (Kiliç, 2017). The fourth stage involves testing the derived formula, a vital part of mathematical thinking. However, the subjects discover that their initial formula yields incorrect results. This iterative testing and refinement process is supported by literature highlighting

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verification's significance in mathematical problem-solving (Hendriana et al., 2018). The subjects then adjust their formula, leading to the final stage where they arrive at the correct formulathrethrethrethrethrethree$U_n = 3n + b$ with b = 2. This adjustment showcases the dynamic nature of mathematical thinking, where students learn from errors and refine their understanding through critical evaluation (Yerizon et al., 2022). The overall success of the subjects in generalizing the linear pattern is attributed to their ability to test and revise their formulas. This iterative process is essential in developing critical thinking skills in mathematics, as noted by Firdaus et al., who emphasize the importance of problem-solving and critical evaluation in enhancing students' mathematical abilities (Firdaus et al., 2015). Furthermore, the ability to adapt and modify mathematical expressions based on testing outcomes is a key component of effective mathematical reasoning, as highlighted by various studies in mathematics education (Laili & Siswono, 2021; Wedastuti, 2022).

Type II Thinking Process

Type II thinking process is found in FQ, HT, and MA. Based on Figure 4 and an interview with FQ, It is obtained that to obtain $U_n = n \times 3 + 2$ or $U_n = 3n + 2$ From observing the vertical line drawing, one lamp is at the left end, and one is at the right end each term. In the first term, there is one vertical line and two lamps at the right and left ends; in the second term, there are two vertical lines and two lamps at the right and left ends; and in the third term, there are three vertical lines and two lamps on the right and left. Then, the subject counts many lamps on a vertical line, with three lamps on each vertical line. Furthermore, the subject assumes 3n as many lamps on the vertical line in the n-th term and two as the many lamps on the right and left ends. In the end, the subject concludes. $U_n = n \times 3 + 2$ or $U_n = 3n + 2$.

Based on Figure 4 and interviews, It can be seen that HT writing the n-th term is a n-th term x 3 (lamps) + 2 (lamps on the edge line). In other words,, $U_n = 3n + 2$ 3 indicates lamps, n indicates a term, and 2 shows the lamps on the left and right ends. HT Wrote down $U_n = 3n + 2$ From observing the line drawing in the middle (vertical, etc.), one lamp is on the left, and one is on the right for each term. In the first term, there is one center line and two lamps at the right and left ends; in the second term, there are two middle lines and two lamps at the right and left ends; and in the third term, there are three center lines and two lamps on the right and left. Then, the subject counted the number of lamps on the centerline in each term, with three lamps on each centerline. Furthermore, the subject assumes 3n as many lamps on the center line in the n-th term and two as the lamps on the right and left ends. In the end, the subject concluded many lamps n-th term = (n-term x 3 lamps) + 2 lamps that are on the right and left ends or $U_n = 3n + 2$.

Furthermore, from Figure 4 and the interview with MA, it is obtained that the subject finds $U_n = 2 + 3n$ Starting with observing many lamps on the right and left ends and then observing many vertical lines in the middle, including counting the many lamps on the vertical line. Then, MA compiled the image term starting from the 1st, second, and third terms. In the next step, MA concluded that $U_n = 2 + 3n$3n is an increase in lamps each term, and 2 are the lamps at the right and left ends.

Based on the description above, three subjects, FQ, HT, and MA, have similar thought processes. The thinking process of the three subjects can be seen in Figure 11. Based on Figure 11, It can be seen that the successful thinking process of the subject in generalizing linear patterns consists of three stages. The first stage focuses on the object's configuration and then calculates the configuration of the object formed to compile the pattern of the object's configuration. This step is crucial as it lays the groundwork for understanding the spatial and numerical relationships inherent in the configuration. Research indicates that recognizing and analyzing object configurations is fundamental in developing mathematical reasoning, particularly in pattern recognition(Setiawan, 2023). Next, in the second stage, the subject focuses on the vertical line and the two lamps on the right and left. The number of lamps on the vertical line is 3n, and the lamps on the right and left ends are 2. This analytical approach reflects a deeper understanding of how different components of a pattern interact and contribute to its overall structure. The ability to discern these relationships is supported by research

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highlighting visualization's role in mathematical problem-solving (Kiliç, 2017). In the third stage, the subject writes cap U sub n equals three n plus b; in this case, b = 2. The subject's success in finding this pattern generalization is due to observing the object's configuration to generalize. This observation process and subsequent generalization is supported by the work of Firdaus et al. (2015), who emphasize the importance of critical thinking and observation in enhancing students' mathematical abilities (Yerizon et al., 2022).

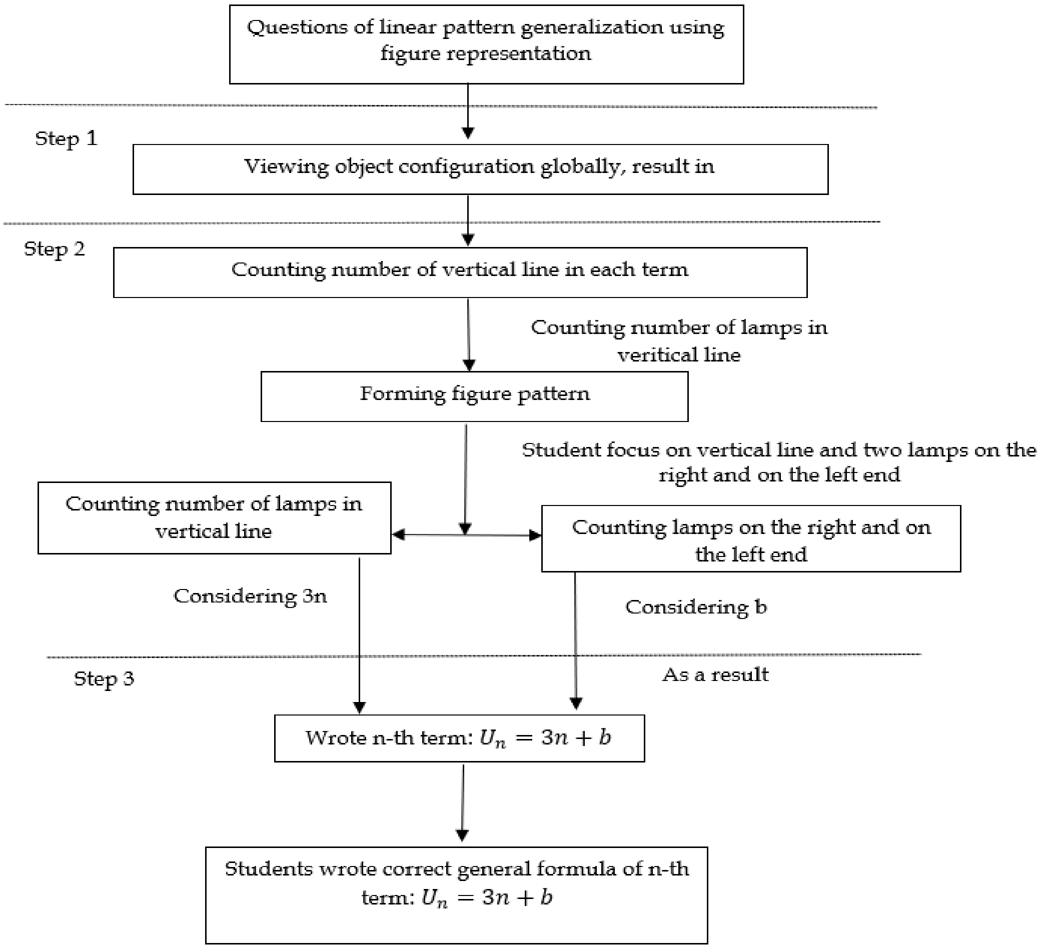

Figure 11. Type II Thinking Process

Type III Thinking Process

From Figure 4 and the results of the interview with TA, it can also be seen that the subject found the formula. $U_n = 3n + 2$ Starting from manually counting many lamps each term, the difference was 3. After that, the pattern of the number sequence is arranged. Based on the observation results in the image, The subject tried to write down the formula 3n. Next, the formula the subject obtains is tested by entering the value "n" by the number 3 for the third term of the number sequence. It turned out that the formula obtained was wrong; the result was 9; it should have been 11. Since there is a difference of 2, then the subject adds 2 to 3n. After finding $U_n = 3n + 2$The next step is to try to enter a value of "n" with some numbers like 25, 4, and 3, and it turns out that the results were appropriate. The subject's thinking process can be seen in the following Figure 12.

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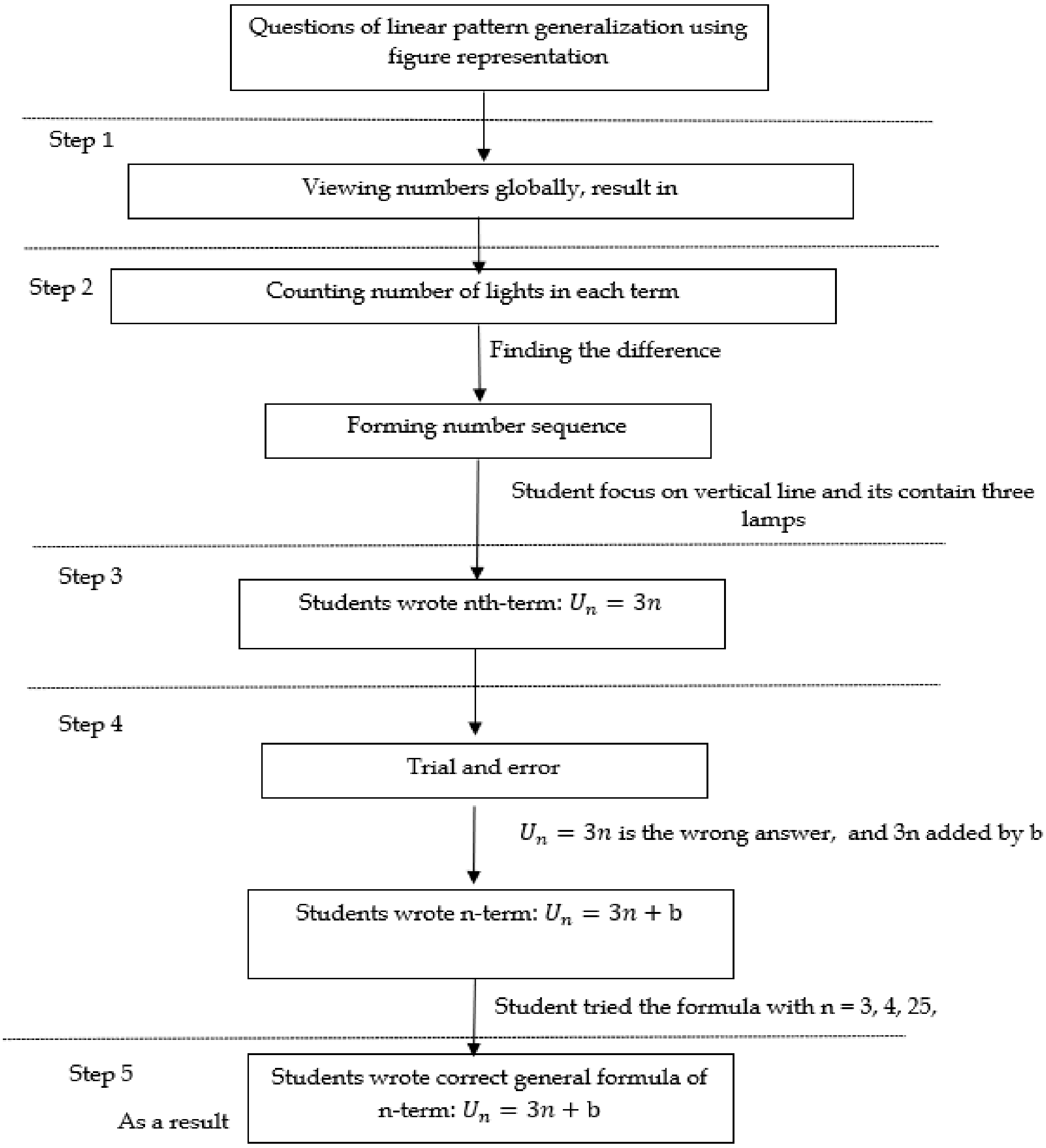

Figure 12. Type III Thinking Process

Based on Figure 12, it can be seen that the subject's successful thinking process in generalizing linear patterns consists of five stages. The first stage is to focus on the number of objects and find differences. The subject uses differences to find the number of objects in each term to arrange a sequence of numbers. Next, in the second stage, the subject focuses on a vertical line containing three lamps and writes. $U_n = 3n$. In the third stage, the subject conducted a trial on $U_n = 3n$ By entering a value n = 3. In the fourth stage, the subject did trial and error. It turned out that the results were not appropriate. Moreover, Finally, the subject found that. $U_n = 3n + b$, in this case, b = 2. However, the subjects again experimented on the formula found by entering n = 25, 4, and 3. It turned out that the results were appropriate. The subject's success in finding this pattern generalization is due to experimenting with the formula that has been found.

Data Reduction

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Based on the results of data reduction through ATLAS.ti software, four components were obtained in the thinking process, namely the first focus, the strategy used, additional steps, and conclusions. The comparison of the thinking process between the seven subjects is presented in Table 3.

Table 3. Comparison of Thinking Processes of Students from Different Personality Types

No	Subjects	Personality Type	The First Focus	Strategy	Additional Step	Conclusion
1	AH	Investigative	Focus on object configuration (Addition of three lamps on the right end)	Different strategy	Trial and error	Successful
2	AAH	Investigative	Numerical data	Recursive strategy	-	Unsuccessful
3	FQ	Investigative	Focus on object configuration (Addition of vertical lines)	Different strategy	-	Successful
4	HT	Investigative	Focus on object configuration (Addition of vertical lines)	Different strategy	-	Successful
5	MA	Artistic	Focus on object configuration (Addition of vertical lines)	Different strategy	-	Successful
6	TA	Social	Numerical data	Recursive strategy	Trial and error	Successful
7	CF	Social	Numerical data	Recursive strategy	-	Unsuccessful

Based on Table 3, the students who had an investigative type and were successful in generalizing patterns had a first focus on the image. There are two types in this case, namely, the focus at the position of the lamps at the right end and the focus at the vertical line in the middle. In this approach, students direct their attention to the specific placement of the lamps located at the right end of the configuration. This focus allows them to identify the contribution of these lamps to the overall pattern, which is essential for establishing a relationship between the components of the pattern and the generalization of the formula. Research suggests that students who concentrate on specific elements of a visual representation are more likely to engage in effective problem-solving strategies, as they can isolate variables and understand their roles within the pattern (Setiawan, 2023). Alternatively, some students may focus on the vertical line that serves as the central axis of the configuration. This focus enables them to analyze the relationship between the vertical line and the other components of the pattern, such as the lamps on either side. By understanding how the vertical line interacts with the surrounding elements, students can derive a more comprehensive view of the pattern, which is crucial for successful generalization. Studies have shown that focusing on the structural components of a pattern can enhance students' ability to recognize and articulate mathematical relationships (Akkan, 2013).

"...because the lamps outside of the first term are four, but in the second term is the first term plus three lamps, it means there is one lamp at the top, right end, and bottom."
"I see the 1st, 2nd, third term. As the term moves, the number of vertical lines also increases. Where there were three lamps on the vertical line."

Unlike investigative-type students who fail to generalize patterns and whose initial focus is on numerical data (e.g., the number of lamps), only 25% of investigative students exhibit this behavior. In contrast, 75% of investigative-type students focus first on the object configuration when generalizing patterns. This suggests that

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most investigative students prioritize the spatial arrangement of objects over numerical data, contributing to their success in generalizing patterns.

Similarly, among artistic-type students who succeed in generalizing patterns, their initial focus is also on the object configuration. According to Holland (1997), investigative types are characterized by their inclination to "observe, investigate, and analyze," while artistic types are noted for their "imagination, originality, creativity, and artistic abilities." These traits likely enable students from both types to better interpret and derive meaning from visual representations of objects.

In contrast, students with a social personality type (whether successful or unsuccessful in generalizing patterns) tend to focus first on numerical data rather than object configurations. This distinction highlights the influence of personality types on cognitive strategies and the initial approaches students use when attempting to generalize patterns.

"In the first term, there were five lamps, then I counted again.."
"At first, I calculated manually because I did not know the formula."

Furthermore, the component in the next thinking process is the use of strategy (Miliyawati, 2014a). For instance, a study by Nurwidiyanto and Zhang highlights that students utilize different strategies in their algebraic thinking processes, which are essential for generalizing visual patterns (Nurwidiyanto & Zhang, 2020). In the investigative type, 3 out of 4 subjects used different strategies and succeeded in generalizing patterns, and only one subject used recursive strategies and failed to generalize patterns. This shows that in this type, most students use different strategies in generalizing patterns. Different strategies are also applied by subjects with artistic types who succeed in generalizing patterns.

".. And so in the third term, the lamps on the sides are still the same, and three lamps in the middle that increase by three according to the term."

A different strategy is a generalization strategy using the result of the reduction in the n-th term by the term (n-1), and this strategy can be an alternative solution for students who fail to generalize and who use recursive strategies (Setiawan et al., 2019). Furthermore, they apply a recursive strategy to generalize patterns in the social type.

"In the first term, there were five lamps; then I counted again in the second term, and it was 8. Then the third term was 11."
"At first, because I did not know the formula, I manually calculated first term, second term, and so on."

In the investigative type of learners, it has been observed that only 1 out of 4 individuals employ trial and error as an additional step in their reasoning process. This suggests that a relatively small percentage of students in this category actively retest the generalization formula derived from their initial findings. The limited use of trial and error may indicate a reliance on more systematic or analytical approaches to problem-solving rather than iterative testing. This is consistent with findings from research conducted by Kerslake, which emphasizes that while trial and error can be a valuable strategy, it is often underutilized by students who may prefer more structured methods of reasoning (Nurwidiyanto & Zhang, 2020).

Conversely, the absence of trial and error as an additional step suggests a different cognitive approach in subjects characterized by artistic types. Artistic learners may rely more on intuition, creativity, and visual representation rather than systematically testing hypotheses. This aligns with the work of Gardner, who posits that individuals with strong artistic inclinations often process information through a more holistic lens, focusing on the aesthetic and conceptual aspects of problems rather than empirical testing (Setiawan, 2023).

In contrast, social-type learners exhibit a more varied approach, with 1 out of 2 subjects utilizing trial and error as an additional step. This indicates that social learners may benefit from collaborative environments where they can engage in discussions and iterative testing of ideas. Research by Vygotsky underscores the

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importance of social interaction in cognitive development, suggesting that learners who engage with peers are more likely to adopt flexible problem-solving strategies, including trial and error (Syawahid, 2022).

> *"That is what I calculated. "$n \times 3$". e.g., the third term, "3 × n the result is 9. It still lacks two because it should be 11, so I add 2. After I got 3n + 2, I tried to put it in another term; It turns out that the formula is included."*

Based on this, the additional trial and error step is not a special characteristic of certain personality types. However, two subjects who applied the additional step of trial and error experienced success in generalizing the pattern.

The last component of the thinking process is to make a generalization conclusion of the pattern. Based on Table 2, it can be seen that three things determine the success of students in generalizing patterns. First, students use the initial focus on object configuration. Second, a different strategy should be used, and third, additional trial and error steps should be used. The initial focus on numerical data and being stuck in a recursive strategy will still experience success if students take additional trial and error steps. However, if they do not take additional trial and error steps, students will fail. A different thing happens to students who have the first focus on object configuration and use different strategies. Although they took no additional steps, they succeeded in generalizing the pattern.

Based on the study's results, it was generally found that the diversity of characteristics in some students affected the diversity of components of the thinking process in generalizing patterns. This aligns with the results of Huda et al. (2021) research that characteristics influence the thinking process. Different components of the thinking process lead to different mathematical problem-solving results, which impact the cognitive abilities of different students. Understanding the cognitive abilities of different students in the classroom can make teachers more aware of organizing learning that accommodates every student's cognitive needs. With this, the learning objectives set are hoped to be successful.

5. CONCLUSION

The investigative type dominates the number of students who succeed in generalizing patterns because the investigative type is the thinkers with the same characteristics and habits of mind that have an important role in the learning process and development of student's critical thinking and problem-solving. The thinking processes of students who fail and those who succeed in generalizing linear patterns differ. Even though the failed students come from different personality types, their thinking processes are the same. Both use the first step of focusing on numerical data, using a recursive strategy without trial and error. As for the students who succeeded in generalizing patterns, three types of thinking processes were found. Two thinking processes focus on the figure-of-object configurations and use different strategies that support success in generalizing patterns; one type of thinking process focuses on numerical data, using recursive strategies. The same strategies fail to generalize patterns. However, this type takes a step of trial and error to generalize the pattern. In linear pattern generalization learning, a teacher must present a visual image of a given problem to help students find their generalizations. If there is no visual image, then the trial and error step on the formula that has been found needs to be emphasized more by the teacher to the students. Different characteristics can affect different students' thinking processes which cause differences in students' cognitive abilities. Teachers need to understand these cognitive differences so that teachers are more aware to organize learning that accommodates the different cognitive needs of students, namely differentiated instruction, so that learning in the classroom is successful. This research is still incomplete. The subjects studied were only seven people who met the criteria, and not all RIASEC personality types were represented. In the future, it is necessary to conduct research involving more subjects who represent each personality.

6. REFERENCES

Akkan, Y. (2013). Comparison of 6th-8th graders' efficiencies, strategies and representations regarding generalization patterns. Bolema Boletim De Educação Matemática, 27(47), 703-732. https://doi.org/10.1590/s0103-636x2013000400002

Alhamlan, S., Aljasser, H., Almajed, A., Almansour, H., & Alahmad, N. (2017). A Systematic Review: Using Habits of Mind to Improve Student's thinking in Class. Higher Education Studies, 8(1), 25. https://doi.org/10.5539/hes.v8n1p25

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://dx.doi.org/10.20961/ijpte.v8i2.96344

Amalianita, B., & Putri, Y. E. (2019). Perspektif Holland Theory serta Aplikasinya dalam Bimbingan dan Konseling Karir. JRTI (Jurnal Riset Tindakan Indonesia), 4(2), 63–70. https://doi.org/10.29210/3003490000

Ambiel, R. A. M., Hauck-Filho, N., Barros, L. de O., Martins, G. H., Abrahams, L., & De Fruyt, F. (2018). 18REST: a short RIASEC-interest measure for large-scale educational and vocational assessment. Psicologia: Reflexão e Crítica, 31(1), 6. https://doi.org/10.1186/s41155-018-0086-z

Ariyanti, S., & Setiawan, W. (2019). Analisis Kesulitan Siswa SMP Kelas VIII dalam Menyelesaikan Soal Pola Bilangan Berdasarkan Kemampuan Penalaran Matematik. Journal on Education, 1(2), 390–399. https://doi.org/https://doi.org/10.31004/joe.v1i2.79

Babarović, T., Dević, I., & Burušić, J. (2019). Fitting the STEM interests of middle school children into the RIASEC structural space. International Journal for Educational and Vocational Guidance, 19(1), 111–128. https://doi.org/10.1007/s10775-018-9371-8

Becker, J. R., & Rivera, F. (2005). Generalization Strategies of Beginning High School Algebra Students. In H. L. Chick & J. L. Vincent (Eds.). Proceedings of the 29th Conference of the International Group for the Psychology of Mathematics Education , 121–128.

Blustein, D. L., McWhirter, E. H., & Perry, J. C. (2005). An Emancipatory Communitarian Approach to Vocational Development Theory, Research, and Practice. The Counseling Psychologist, 33(2), 141–179. https://doi.org/10.1177/0011000004272268

Brousseau, G. (2002). Theory of didactical situations in mathematics: Didactique des mathématiques (Vol. 19). Kluwer Academic Publishers.

Budiasih, I. G. A. N. (2014). Metode Grounded Theory dalam Riset Kualitatif. Jurnal Ilmiah Akuntansi Dan Bisnis, 9(1), 19–27.

Cahya, S. A. (2022). Korelasi Tipe Kepribadian Terhadap Prestasi Belajar Matematika Kelas V di SDN 1 Tanjung Pandan Kecamatan Lampung Tengah [Doctoral Dissertation]. UIN Raden Intan Lampung.

Chua, B. L. (2009). Features of generalising tasks: Help or hurdle to expressing generality? Australian Mathematics Teacher, The, 65(2), 18–24.

Costa, A. L., & Kallick, B. (2000). Describing 16 Habits of Mind. ASCD. https://peertje.daanberg.net/drivers/intel/download.intel.com/education/Common/my/Resources/EO/Resources/Thinking/Habits_of_Mind.pdf

Creswell, J. W. (2013). Qualitative Inquiry & Reasearch Design: Choosing Among Five Approach (3rd ed.). SAGE Publications, Inc.

Dahlan, J. A., Nurlaelah, E., Bariyah, N., & Kristiani, Y. D. (2024, December 4). Does students' thought structure in object configuration patterns follow cognitive verbs in learning outcomes? The 6th International Seminar on Applied Mathematics and Mathematics Education (ISAMME).

Damayanti, N., & Kartini. (2022). Analisis Kemampuan Pemecahan Masalah Matematis Siswa SMA pada Materi Barisan dan Deret Geometri. Mosharafa: Jurnal Pendidikan Matematika, 11(1), 107–118. https://doi.org/10.31980/mosharafa.v11i1.691

Dierks, P. O., Höffler, T. N., Blankenburg, J. S., Peters, H., & Parchmann, I. (2016). Interest in science: a RIASEC-based analysis of students' interests. International Journal of Science Education, 38(2), 238–258. https://doi.org/10.1080/09500693.2016.1138337

Dinarti, S., & Qomariyah, U. N. (2022). Analisis strategi siswa sekolah dasar dalam memecahkan masalah generalisasi pola ditinjau dari gaya kognitif. AKSIOMA: Jurnal Matematika Dan Pendidikan Matematika, 13(2), 278–292.

Dinarti, S., & Qomariyah, U. N. (2019). Kemampuan generalisasi pola siswa berdasarkan taksonomi Marzano. Seminar Nasional Matematika Dan Pendidikan Matematika (4thSenatik) , 177–197.

Ellis, A., Tillema, E., Lockwood, E., & Moore, K. (2017). Generalization across domains: the relating forming-extending generalization framework. In j. Galindo, e., & Newton (ed.). Proceedings of the 39th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, 677–684.

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://dx.doi.org/10.20961/ijpte.v8i2.96344

Fay, N., Garrod, S., & Roberts, L. (2008). The fitness and functionality of culturally evolved communication systems. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*(1509), 3553-3561.

Firdaus, A. M. (2023). Proses berpikir dalam menggeneralisasi pola bilangan berdasarkan gaya belajar pada siswa kelas VIII SMP. Delta-Pi: Jurnal Matematika Dan Pendidikan Matematika, 12(2), 45–60. https://doi.org/10.33387/dpi.v12i2.6883

Firdaus, F., Kailani, I., Bakar, M., & Bakry, B. (2015). Developing critical thinking skills of students in mathematics learning. Journal of Education and Learning (Edulearn), 9(3), 226-236. https://doi.org/10.11591/edulearn.v9i3.1830

Handayani, T., Hartatiana, H., & Muslimahayati, M. (2020). Analisis kesalahan siswa dalam menyelesaikan soal cerita materi barisan dan deret aritmatika. PHI: Jurnal Pendidikan Matematika, 4(2), 160. https://doi.org/10.33087/phi.v4i2.111

Hashemi, N., Abu, M. S., Kashef, H., & Rahimi, K. (2013). Generalization in the learning of mathematics. The 2nd International Seminar on Quality and Affordable Education a Paper Accepted to Present at ISQAE2013, 208–215. http://eprints.utm.my/id/eprint/37764/

Hayuningrat, S., & Listiawan, T. (2018). Proses Berpikir Siswa dengan Gaya Kognitif Reflektif dalam Memecahkan Masalah Matematika Generalisasi Pola. Jurnal Elemen, 4(2), 183–196. https://doi.org/10.29408/jel.v4i2.752

Heinze, A., Reiss, K., & Franziska, R. (2005). Mathematics achievement and interest in mathematics from a differential perspective. Zentralblatt Für Didaktik Der Mathematik, 37(3), 212–220. https://doi.org/10.1007/s11858-005-0011-7

Hendriana, H., Johanto, T., & Sumarmo, U. (2018). The role of problem-based learning to improve students' mathematical problem-solving ability and self confidence. Journal on Mathematics Education, 9(2), 291-300. https://doi.org/10.22342/jme.9.2.5394.291-300

Hidayat, F. K., & Wahyuni, S. N. (2019). Pendeteksian minat dan bakat menggunakan metode RIASEC. Indonesian Journal of Business Intelligence (IJUBI), 2(1), 32. https://doi.org/10.21927/ijubi.v2i1.1023

Holland, J. L. (1997). Making Vocational Choices: A Theory of Vocational Personalities and Work Environments. In Psychological Assessment Resources.

Hourigan, M., & Leavy, A. (2019). Geometric growing patterns: What is the rule? Australian Primary Mathematics Classroom, 20(4), 31–39.

Huda, S., Agustin, D., & Khikmiyah, F. (2021). Karakteristik metakognisi dalam pemecahan masalah matematika ditinjau dari tipe kepribadian. Mathematics Education And Application Journal (META), 3(1), 20–34. https://doi.org/10.35334/meta.v3i1.2076

Kama, Z. (2023). Sixth-grade students pattern generalization approaches. Journal of Pedagogical Research. https://doi.org/10.33902/jpr.202316928

Kiliç, Ç. (2017). Ortaokul öğrencilerinin sayı örüntülerine dayalı olarak oluşturdukları şekil örüntülerinin yapılarının analiz edilmesi. Mersin Üniversitesi Eğitim Fakültesi Dergisi, 13(1), 65-65. https://doi.org/10.17860/mersinefd.305756

Kresnadi, H., Ghasya, D. A. V., & Pranata, R. (2023). Analisis kemampuan computational thinking berdasarkan tahap generalisasi pola dan desain algoritma siswa di kelas III SDN 03 Toho. Jurnal Review Pendidikan Dan Pengajaran (JRPP), 6(4), 1660–1666. https://doi.org/https://doi.org/10.31004/jrpp.v6i4.21287

Lannin, J., Barker, D., & Townsend, B. (2006). Algebraic generalization strategies : factors influencing student strategy selection prior research on generalization. Mathematics Education Research Journal, 18(3), 3–28.

Laili, N. and Siswono, T. (2021). The thinking process of secondary-level students in constructing proof by mathematical induction in terms of their attitude toward mathematics. Jurnal Tadris Matematika, 4(1), 121-138. https://doi.org/10.21274/jtm.2021.4.1.121-138

Mangesa, R. T., & Mappalotteng, A. M. (2023). Refleksi Psikologi Pendidikan Kejuruan. Penerbit Indonesia Emas Group.

Mariam, S., Rohaeti, E. E., & Sariningsih, R. (2019). Analisis kemampuan pemecahan masalah matematis siswa madrasah aliyah pada materi pola bilangan. Journal on Education, 1(2), 156–162. https://doi.org/https://doi.org/10.31004/joe.v1i2.40

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://dx.doi.org/10.20961/ijpte.v8i2.96344

Martins, G. H., Ambiel, R. A. M., & do Céu Taveira, M. (2024). Assessment of Vocational Interests by Areas of Psychology: Relations with the Big Five and RIASEC. Trends in Psychology, 1–20. https://doi.org/10.1007/s43076-024-00397-w

Mariani, A., & Chotimah, S. (2021). Analisis Kesalahan Siswa SMA dalam Menyelesaikan Soal Materi Barisan dan Deret Berdasarkan Kriteria Watson. Jurnal Cendekia : Jurnal Pendidikan Matematika, 5(3), 2344–2351. https://doi.org/10.31004/cendekia.v5i3.770

Masud, M. (2024). Numerical integration techniques: a comprehensive review. International Journal of Innovative Science and Research Technology, 2744–2755. https://doi.org/10.38124/ijisrt/ijisrt24sep1327

McKay, D. A., & Tokar, D. M. (2012). The HEXACO and five-factor models of personality about RIASEC vocational interests. Journal of Vocational Behavior, 81(2), 138–149. https://doi.org/10.1016/j.jvb.2012.05.006

Miles, M. B., & Huberman, A. M. (1984). Qualitative Data Analysis: A Sourcebook of New Methods. Sage Publication. https://unesdoc.unesco.org/ark:/48223/pf0000168413

Miliyawati, B. (2014a). Urgensi strategi disposition habits of mind mathematics. Infinity: Jurnal Ilmiah Program Studi Pendidikan Matematika, 3(2), 174–188. https://doi.org/10.22460/infinity.v3i2.p174-188

Miliyawati, B. (2014b). URGENSI STRATEGI DISPOSITION HABITS OF MIND MATEMATIS. Infinity Journal, 3(2), 174. https://doi.org/10.22460/infinity.v3i2.62

Mulligan, J. (2011). Towards understanding the origins of children's difficulties in mathematics learning. Australian Journal of Learning Difficulties, 16(1), 19–39. https://doi.org/10.1080/19404158.2011.563476

Mulligan, J., & Mitchelmore, M. (2009). Awareness of pattern and structure in early mathematical development. Mathematics Education Research Journal, 21(2), 33–49. https://doi.org/10.1007/BF03217544

NCTM. (2000). Principles and Standards for School Mathematics. The National Council of Teachers of Mathematics, Inc.

Nirfayanti, N., & Nurdiah, N. (2023). Kemampuan generalisasi matematis ditinjau dari gaya kognitif siswa SMP. Pedagogy: Jurnal Pendidikan Matematika, 8(1), 353–363. https://doi.org/https://doi.org/10.30605/pedagogy.v8i1.2637

Nurmawanti, I., & Sulandra, I. M. (2020). Exploring of Student's Algebraic Thinking Process Through Pattern Generalization using Similarity or Proximity Perception. Mosharafa: Jurnal Pendidikan Matematika, 9(2), 191–202. https://doi.org/10.31980/mosharafa.v9i2.603

Nurwidiyanto, A. and Zhang, K. (2020). Strategies of pattern generalization for enhancing students' algebraic thinking. Periódico Tchê Química, 17(36), 171-185. https://doi.org/10.52571/ptq.v17.n36.2020.187_periodico36_pgs_171_185.pdf

Organisasi Perburuhan International. (2011). Panduan Pelayanan Bimbingan Karir Bagi Guru Bimbingan Konseling/Konselor Pada Satuan Pendidikan Dasar dan Menengah. Penerbit ILO.

Pirmanto, Y., Anwar, M. F., & Bernard, M. (2020). Analisis kesulitan siswa SMA dalam menyelesaikan soal pemecahan masalah pada materi barisan dan deret dengan langkah-langkah menurut Polya. JPMI (Jurnal Pembelajaran Matematika Inovatif), 3(4), 371–384. https://doi.org/https://doi.org/10.22460/jpmi.v3i4.371-384

Putri, S., Husna, A., & Agustyaningrum, N. (2021). Analisis kesalahan siswa dalam menyelesaikan soal barisan dan deret berdasarkan teori Newman ditinjau dari gaya kognitif. Jurnal Cendekia : Jurnal Pendidikan Matematika, 5(2), 1548–1561. https://doi.org/https://doi.org/10.31004/cendekia.v5i2.637

Sari, N. I. P., Subanji, S., & Hidayanto, E. (2016). Diagnosis kesulitan penalaran matematis siswa dalam menyelesaikan masalah pola bilangan dan pemberian scaffolding. Prosiding Konferensi Nasional Penelitian Matematika Dan Pembelajarannya, 385–394.

Septiahani, A., Melisari, & Zanthy, L. S. (2020). Analisis Kesalahan Siswa SMK dalam Menyelesaikan Soal Materi Barisan dan Deret. Mosharafa: Jurnal Pendidikan Matematika, 9(2), 311–322. https://doi.org/10.31980/mosharafa.v9i2.613

Setiawan, Y. (2023). Characteristics of different strategies in problems solving of linear pattern. International Journal on Emerging Mathematics Education, 6(1), 63. https://doi.org/10.12928/ijeme.v6i1.17336

Setiawan, Y. E. (2019). Pembelajaran Pola Bilangan. Al-Mukmin Yes.

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://dx.doi.org/10.20961/ijpte.v8i2.96344

Setiawan, Y. E. (2020). Proses berpikir siswa dalam memperbaiki kesalahan generalisasi pola linier. Mosharafa: Jurnal Pendidikan Matematika, 9(3), 371–382.

Setiawan, Y. E., Purwanto, P., Parta, I. N., & Sisworo, S. (2019). Generalization strategy of linear patterns from field-dependent cognitive style. Journal on Mathematics Education, 11(1), 77–94. https://doi.org/10.22342/jme.11.1.9134.77-94

Suherman, S. (2015). Kreativitas siswa dalam memecahkan masalah matematika materi pola bilangan dengan Pendekatan Matematika Realistik (PMR). Al-Jabar : Jurnal Pendidikan Matematika, 6(1), 81–90. https://doi.org/10.24042/ajpm.v6i1.57

Suryowati, E., & Tristanti, L. B. (2022). Analisis Kesalahan Siswa dalam Menggeneralisasi Pola Berdasarkan Taksonomi Generalisasi. EDU-MAT: Jurnal Pendidikan Matematika, 10(1), 106. https://doi.org/10.20527/edumat.v10i1.11250

Sutarto, & Hastuti, I. D. (2015). Conjecturing dalam pemecahan masalah generalisasi pola. Jurnal Ilmiah Mandala Education, 1(2), 172–178.

Syawahid, M. (2022). Elementary students' functional thinking in solving context-based linear pattern problems. Beta Jurnal Tadris Matematika, 15(1), 37-52. https://doi.org/10.20414/betajtm.v15i1.497

Tanişli, D., & Özdaş, A. (2009). The strategies of using the generalizing patterns of the primary school 5th grade students. Educational Sciences: Theory and Practice, 9(3), 1485–1497.

Tuah, A. (2022). Analysis of the area under a curve (auc) using c-programming: trapezium and simpson rules techniques. Journal of Ict in Education, 9(1), 143-153. https://doi.org/10.37134/jictie.vol9.1.12.2022

Wedastuti, N. (2022). Scaffolding in mathematics learning social arithmetic material to improve students' mathematical thinking. Qalamuna Jurnal Pendidikan Sosial Dan Agama, 14(2), 455-470. https://doi.org/10.37680/qalamuna.v14i2.3421

Wei, R. (2024). Examining the influence of the RIASEC theory within the Holland code on students' academic performance in their chosen disciplines among the context of higher education. Cogent Education, 11(1), 1–18. https://doi.org/10.1080/2331186X.2024.2391274

Wille, B., & De Fruyt, F. (2014). Vocations as a source of identity: Reciprocal relations between Big Five personality traits and RIASEC characteristics over 15 years. Journal of Applied Psychology, 99(2), 262–281. https://doi.org/10.1037/a0034917

Wulandari, M., & Setiawan, W. (2021). Analisis kesulitan dalam menyelesaikan soal materi barisan pada siswa SMA. JPMI (Jurnal Pembelajaran Matematika Inovatif), 4(3), 571–578. https://doi.org/https://doi.org/10.22460/jpmi.v4i3.p%25p

Xu, H., & Tracey, T. J. G. (2017). Career Decision Ambiguity Tolerance and Its Relations With Adherence to the RIASEC Structure and Calling. Journal of Career Assessment, 25(4), 715–730. https://doi.org/10.1177/1069072716665874

Yao, X. and Elia, J. (2021). Connections between empirical and structural reasoning in technology-aided generalization activities. International Electronic Journal of Mathematics Education, 16(2), em0628. https://doi.org/10.29333/iejme/9770

Yerizon, .. and Musdi, E. (2022). Effectiveness of mathematics learning devices based on flipped classroom to improve mathematical critical thinking ability students. International Journal of Education and Management Engineering, 12(3), 41-46. https://doi.org/10.5815/ijeme.2022.03.05

Yuline, Y. (2024). Pengukuran minat berdasarkan teori Holland dan keterkaitannya dengan indeks prestasi Mahasiswa Prodi Bimbingan dan Konseling FKIP UNTAN angkatan 2021/ 2022. Academy of Education Journal, 15(1), 325–331. https://doi.org/10.47200/aoej.v15i1.2191

Zhang, D., & Wang, C. (2020). The relationship between mathematics interest and mathematics achievement: mediating roles of self-efficacy and mathematics anxiety. International Journal of Educational Research, 104, 101648. https://doi.org/10.1016/j.ijer.2020.101648

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://dx.doi.org/10.20961/ijpte.v8i2.96344