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Analysis of Students' Conceptual Difficulties in Solving Sequence and Series Problems Based on SOLO Taxonomy

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Abstract

Conceptual difficulties remain a major obstacle for students in understanding sequences and series. This study aims to analyze students' conceptual difficulties in solving problems on sequences and series based on the Structure of Observed Learning Outcomes (SOLO) taxonomy. The research employed a descriptive qualitative method with 30 tenth-grade students of SMK Negeri 3 Tasikmalaya as subjects. Data were collected through written tests and interviews, and analyzed using the Miles & Huberman model. The findings indicate that students were distributed across four SOLO levels: prestructural (20%), unistructural (23.3%), multistructural (33.3%), and relational (23.3%). Conceptual errors varied by level: prestructural students failed to grasp basic concepts, unistructural students relied on a single formula, multistructural students used multiple formulas without integration, and relational students connected concepts correctly but still made technical errors. This study contributes by providing a detailed mapping of conceptual difficulties at each level of understanding, offering valuable insights for teachers in designing more targeted instructional strategies.

Keywords: conceptual difficulties, sequences and series, SOLO taxonomy, mathematical understanding

Abstrak

Kesulitan konsep masih menjadi kendala utama siswa dalam memahami materi barisan dan deret. Penelitian ini bertujuan untuk menganalisis kesulitan konsep peserta didik dalam menyelesaikan masalah barisan dan deret ditinjau dari taksonomi Structure of Observed Learning Outcomes (SOLO). Metode penelitian yang digunakan adalah kualitatif deskriptif dengan subjek 30 peserta didik kelas X SMK Negeri 3 Kota Tasikmalaya. Data dikumpulkan melalui tes uraian dan wawancara, kemudian dianalisis menggunakan model Miles & Huberman. Hasil penelitian menunjukkan bahwa peserta didik berada pada empat level SOLO, yakni prastruktural (20%), unistruktural (23,3%), multistruktural (33,3%), dan relasional (23,3%). Kesalahan konsep berbeda pada tiap level: siswa prastruktural cenderung tidak memahami konsep dasar, siswa unistruktural hanya mengingat satu rumus, siswa multistruktural menguasai beberapa rumus namun tidak menghubungkannya, sementara siswa relasional sudah mampu mengaitkan konsep namun masih terjebak pada kesalahan teknis. Penelitian ini berkontribusi dalam memberikan pemetaan detail mengenai kesulitan konsep pada setiap level pemahaman sehingga dapat menjadi dasar bagi guru dalam merancang strategi pembelajaran yang lebih tepat sasaran.

Kata kunci: kesulitan konsep, barisan dan deret, taksonomi SOLO, pemahaman matematika

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INTRODUCTION

Mathematics is a fundamental science that plays an important role in the development of science and technology (Stacey & Wiliam, 2012). In mathematics learning, conceptual understanding is the main foundation for students to master the material meaningfully (Niss, 2007). Without a good conceptual understanding, students tend to only memorize formulas and problem-solving procedures. This leads to difficulties when faced with contextual problems that require deep understanding (Taşar, 2010). Therefore, conceptual understanding in mathematics education must be a serious focus in mathematics education research (Branca, 1980; Kazak et al., 2015).

One of the topics that often causes difficulties for students is sequences and series. This topic requires students to identify patterns, understand numerical regularities, and make generalizations

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(Pirmanto et al., 2020). However, many students only study sequences and series procedurally, for example, by memorizing the formula for the nth term or the sum of the first n terms. As a result, students are unable to explain the mathematical meaning of the process they are performing (Hartati, 2021). Research by Yesiliana & Roesdiana (2024) shows that 75.9% of students have not mastered story problems involving sequences and series, indicating a weak understanding of the concepts in this subject matter.

Conceptual difficulties are one of the main factors contributing to low student achievement in sequences and series. Conceptual difficulties can include an inability to understand definitions, forgetting names or symbols, and incorrectly applying formulas to the context of a problem (Kazak et al., 2015; Niss, 2007). In this context, students tend to master mechanical procedures but fail to connect them to more abstract underlying concepts. This condition impacts students' inability to solve non-routine problems (Apriliyana et al., 2023). Therefore, a thorough analysis of students' conceptual difficulties in sequences and series is essential.

To analyze students' level of understanding, one theoretical framework that can be used is the Structure of Observed Learning Outcomes (SOLO) taxonomy. The SOLO taxonomy developed by Biggs & Collis (1982) classifies students' understanding into five levels, namely pre-structural, unistructural, multistructural, relational, and extended abstract. This framework is capable of describing the quality of students' answers based on the complexity of their thinking. In the context of mathematics education, SOLO is used to identify how students progress from merely understanding pieces of information to being able to generalize concepts (Hasan, 2017; Ismawati et al., 2023). Therefore, SOLO is relevant for mapping students' conceptual difficulties in sequences and series.

Previous studies have utilized the SOLO taxonomy to describe students' mathematical problem-solving abilities. For example, Hardina & Jamaan (2018) found that high-ability students were at the relational level, while low-ability students only reached the pre-structural or unistructural level. Research by Herliani (2016) also showed that low-ability students could only reach the multistructural level in the SOLO taxonomy. Meanwhile, Hasan (2017) explored students' response characteristics based on the SOLO taxonomy in solving geometry problems. However, these studies primarily focused on the general distribution of students' ability levels. There are still few studies that highlight the specific conceptual difficulties that arise at each SOLO level.

Furthermore, the application of SOLO taxonomy is also widely used in measuring the quality of student understanding. Biggs et al. (2022) emphasize that SOLO provides a systematic framework for assessing learning outcomes based on cognitive complexity. Hattie & Brown (2004) also found that SOLO can help teachers in designing learning that is appropriate to the level of student understanding. Meanwhile, Sudihartinih (2019) reviewed the SOLO taxonomy as a means of helping students understand three-dimensional geometry. This indicates that SOLO is not only relevant in Indonesia but is also recognized globally as a valid evaluation framework. However, these studies have not extensively addressed conceptual difficulties in specific topics such as sequences and series.

Based on a review of the literature, research related to difficulties in learning mathematics generally discusses three types of difficulties, namely conceptual, principled, and verbal difficulties (Epriyanti, 2016). However, the focus of the research is more directed at difficulties in general without mapping the relationship with the SOLO level. This has led to a lack of detailed understanding of how conceptual difficulties arise differently at each level of student understanding (Sudihartinih, 2019). Yet, such analysis is crucial to help teachers tailor instructional interventions to students' thinking levels. Therefore, this study will specifically focus on conceptual difficulties within the SOLO framework.

Research linking conceptual difficulties with the SOLO taxonomy in sequence and series material is still very limited. Research by Susmina & Marlina (2024) shows that most students are only at a moderate level of conceptual understanding, but the study does not map the results based on SOLO levels. Meanwhile, Rahayu (2018) reviewed students' understanding of statistics using Bloom's taxonomy. This indicates there is room to deepen the analysis by using SOLO as a classification framework. Thus, this study offers a new perspective on understanding how students experience conceptual difficulties according to their level of understanding. Such mapping is expected to provide educators with a more detailed picture.

Based on the above description, there is a research gap that needs to be filled. Most studies only highlight general mathematical problem-solving abilities or SOLO level distribution without focusing on conceptual difficulties. In fact, conceptual difficulties are the root cause of many students' problems in sequences and series. Therefore, this research is important to analyze students' conceptual difficulties in solving sequence and series problems from the perspective of the SOLO taxonomy. This study is expected to contribute to the literature and practice of mathematics education, particularly in designing learning strategies that align with students' levels of understanding.

METHODS

This study uses a qualitative approach with a descriptive research type. Descriptive qualitative research was chosen because it aims to describe in depth the phenomenon of conceptual difficulties experienced by students in solving mathematics problems. The focus of this study is to analyze students' conceptual difficulties in sequences and series based on the SOLO taxonomy level of understanding. The research subjects were 30 students in grade X at SMK Negeri 3 Kota Tasikmalaya in the even semester of the 2018/2019 academic year. The subjects were selected purposively, namely by selecting students who could represent each SOLO level (pre-structural, unistructural, multistructural, and relational) based on the consideration of the subject teacher.

The research data consisted of primary data in the form of essay test results on sequences and series material and interview results. The main research instrument was the researcher himself, supported by auxiliary instruments in the form of essay test questions and interview guidelines. The essay test was used to reveal students' understanding and conceptual difficulties in solving sequence and series problems. Subsequently, unstructured interviews were conducted to explore deeper information related to conceptual difficulties that emerged based on the SOLO level. Triangulation techniques were used to ensure data validity, namely by comparing test results, interview results, and documentation.

Data analysis was conducted using the Miles & Huberman (1994) model, which includes data reduction, data presentation, and conclusion drawing. In the data reduction stage, students' test answers were analyzed to identify conceptual difficulties and grouped based on the SOLO taxonomy level. The results were then combined with interview data to reinforce the findings. Next, the data was presented narratively to describe the conceptual difficulties experienced by students at each SOLO level. From this analysis, the researchers drew conclusions about the characteristics of students' conceptual difficulties in the subject matter of sequences and series.

RESULT AND DISCUSSION

Categories of students based on SOLO taxonomy levels

To obtain an overview of the distribution of students at each SOLO taxonomy level, the results of the sequence and series tests were first categorized according to the students' level of understanding. This categorization is based on an analysis of written answers and interviews, thereby providing information about the conceptual errors made by students at each level. Thus, the following table presents a summary of the number of students at the pre-structural, unistructural, multistructural, and relational levels.

Table 1. Distribution of students who experienced conceptual errors as viewed from the SOLO Taxonomy

Level of SOLO	Number of Students	Percentage (%)	Subject
Prastructural	6	20%	S4, S9, S10, S13, S21, S28
Unistructural	7	23.3%	S1, S3, S5, S8, S12, S19, S24
Multistructural	10	33.3%	S7, S14, S16, S17, S18, S20, S23, S25, S27, S30
Relational	7	23.3%	S2, S6, S11, S15, S22, S26, S29
Total	30	100%	-

Based on the results of the written test on sequences and series, students were grouped into four levels of SOLO taxonomy understanding. The results showed that most students were at the multistructural level, namely 10 students or 33.3%. Seven students were at the unistructural level and seven others were at the relational level, each accounting for 23.3%. Meanwhile, six students or 20% were at the pre-structural level. This data shows that the distribution of students is quite diverse, but the majority are still at the intermediate level (multistructural) and not many have reached the advanced level.

This distribution shows that the majority of students are still at the stage of understanding several concepts but are not yet able to connect them comprehensively. This condition is in line with the findings of Napfiah (2016) and Herliani (2016), who stated that most students are only able to reach the multistructural level and have difficulty advancing to the relational level. This indicates a gap in learning that still emphasizes the use of formulas separately without linking concepts, as is characteristic of the unistructural level (Ghunaimat & Alawneh, 2024). Additionally, students at the pre-structural and unistructural levels demonstrate weak foundational understanding, such as incorrectly identifying types of sequences or misinterpreting symbols. Thus, these level differences indicate significant variations in the quality of students' understanding.

These results are also in line with the research by Biggs & Collis (2014), which states that students' cognitive development moves gradually from pre-structural to extended abstract. Most students will remain at the multistructural level if learning is only procedural in nature (Hasan, 2017). Biggs et al. (2022) emphasize that in order to reach the relational level, students must be given the opportunity to connect different concepts in contextual situations. Therefore, the distribution of students in this study indicates that learning about sequences and series still needs to be directed toward strengthening conceptual understanding (Kazak et al., 2015). With this strategy, students at lower levels can move up to higher levels in the SOLO hierarchy.

Characteristics of conceptual errors made by students at the pre-structural level

Based on Table 1, it can be seen that S10 is at the pre-structural stage. The test results obtained by S10 are shown in Figure 1 below

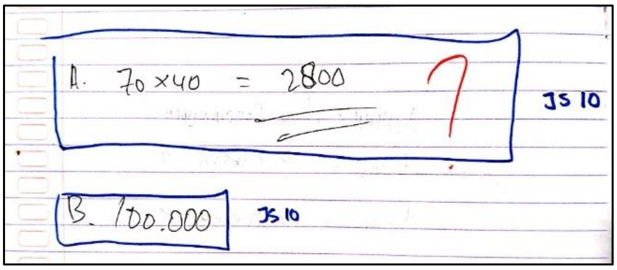

Figure 1. Subject 10’s answer

Based on the results of S10's work in Figure 1, it shows that S10 is only able to write answers, but there is no connection to the questions. This indicates that S10 does not use the information provided and is unable to understand the problems given. These results are reinforced by the researcher's interview with S10, as presented in Figure 2.

P	:	Why did you answer the question in this way?
S10	:	I just answered randomly, sir, as long as it was filled in.
P	:	Why did you answer randomly?
S10	:	Because I forgot the material, sir, and I was too lazy to study again.
P	:	Wait, do you dislike mathematics so much that you are too lazy to study?
S10	:	Yes, sir, I don't like it because the questions are hard to understand. There's a lot of material, it requires calculations, and there are many assignments. So, it's hard for me to study math, sir.

Figure 2. Researcher's interview excerpt with S10

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From the interview results, S10 experienced confusion in understanding the questions because S10 forgot the material taught and did not understand the material presented. S10 demonstrated very basic conceptual errors in solving sequence and series problems. Based on the test results and interview, S10 did not understand the questions, was unable to recognize sequences and series, and even made mistakes in writing symbols or formulas. S10 simply answered without performing the correct mathematical calculations. This indicates that students at the pre-structural level do not yet have a basic conceptual understanding of sequences and series.

These findings are consistent with Epriyanti (2016) research, which found that students at the low level generally fail to understand basic concepts and tend to guess the answers. The errors that appear at the pre-structural level are also similar to the results of research by Mafruhah & Muchyidin (2020) and Rofiki & Alghar (2024) which state that students often make mistakes in recognizing formulas and are unable to interpret the question correctly. This condition indicates weaknesses in mathematics education that do not emphasize conceptual understanding before moving on to problem-solving procedures (Suwanti, 2016). Therefore, students at the pre-structural level require educational interventions that emphasize understanding the meaning of sequences and series, rather than merely practicing calculations.

Futhermore, Biggs & Collis (1982) state that students at the pre-structural stage are generally unable to connect new information with prior knowledge. The errors exhibited by students at this level illustrate what Hattie & Brown (2004) refer to as cognitive gaps, which are failures to understand basic concepts that prevent students from advancing to higher levels of thinking. If instruction does not address these fundamental errors, students will remain stuck at the pre-structural level and fail to develop relational understanding. Therefore, teaching strategies need to provide students with opportunities to reconstruct their conceptual understanding with the help of visual representations, discussions, or scaffolding (Suwanti, 2016).

Characteristics of conceptual errors made by students at the unistructural level

Based on Table 1, it is known that S1 is at the unistructural stage. The test results completed by S1 are shown in Figure 3 below

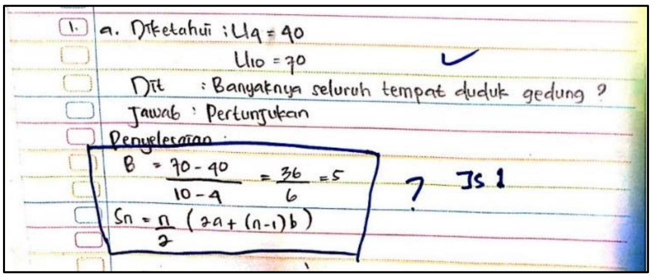

Figure 3. Subject 1’s Answer

Based on S1's work in Figure 3, it is evident that S1 is able to write down what is known and asked, but the completion of the task is not done comprehensively. S1 is able to understand the context of the problem and what is being asked, but S1 uses an inappropriate strategy. Additionally, S1 does not answer the second problem, so S1 only answers one problem. The results of the researcher's interview with S1 regarding the results of the mathematical problem-solving ability test are presented in Figure 4.

P :	Okay, what is being asked in the question?
S1 :	The total number of seats, the cheapest ticket price, and the total revenue from the cheapest tickets.
P :	Then why didn't you answer question b?
S1 :	Ummm... I forgot, sir. I blanked out a little and wasn't focused.
P :	Then, in this section, why didn't you complete the Sn?
S1 :	I forgot, sir. I suddenly blanked out. The material was taught a long time ago. I also don't really understand Sn, so I just filled it in as best as I could remember. Maybe I didn't pay enough attention.

Figure 4. Excerpt from the researcher's interview with S1

Based on the interview results, S1 showed that he was able to understand the context of the question, but experienced confusion in determining the steps to solve it. This was due to forgetting the solution procedure because the material had been taught a long time ago and during the learning process, S1 did not pay full attention. The main difficulty experienced by S1 falls under the category of conceptual difficulty, namely the inability to recall concepts that had been learned previously due to a lack of focus when the teacher presented the material in class.

This finding is consistent with the research by Hardina & Jamaan (2018), which found that unistructural students tend to only remember one formula or procedure without understanding the context of the question. This condition is also reinforced by Afifah et al. (2024), who mentioned that in the material on sequences and series, some students only stop at the stage of writing down the formula without being able to use it to complete the question. Such errors indicate that students are still at the mechanical thinking stage, where mathematical knowledge is understood in a fragmented manner (Handayani et al., 2020). Therefore, it is important for teachers to emphasize the connection between formula concepts and their application in various contextual situations.

Biggs et al. (2022) emphasize that the unistructural level is characterized by the use of isolated information without connection to other information. This is also in line with Branca (1980) view that conceptual errors often occur when students rely on procedural memory without meaningful understanding. The results of this study show that unistructural students are not yet able to integrate information, making them prone to errors when solving sequence and series problems. To help students advance to the multistructural level, teachers can apply problem-based learning or scaffolding approaches, which allow students to gradually connect one piece of information with another (Ramos et al., 2024; Satmaz & Yabanova, 2024).

Characteristics of conceptual errors made by students at the multistructural level

Based on Table 1, it is known that S23 is at the multistructural stage. The test results completed by S23 are shown in Figure 4 below

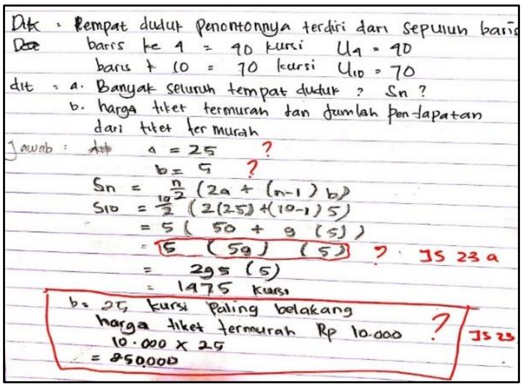

Figure 5. Subject 23 (S23) answer results

Based on S23's work in Figure 5, it shows that S23 is able to write down what is known and asked and the answers. Additionally, the researcher found that S23 still made errors in answering, particularly in arithmetic operations and understanding problem B, as marked in red in Figure 5. This indicates that in problem A, S23 was able to understand the problem, use relevant strategies, and formulate the correct procedure. However, this does not apply when S23 is faced with problem B. On the other hand, S23 is able to use more than one piece of information or concept to solve the problem. Furthermore, the results of the researcher's interview with S23 regarding the results of the mathematical problem-solving ability test are as follows.

P	:	Take a look, you immediately determined a=25 and b=5. Where did this come from?
S23	:	Hmmm... I already calculated it on another piece of paper, sir, but because I was in a hurry, I didn't have time to copy it onto the answer sheet.
P	:	Alright, now look at the part where 10,000 is multiplied by 25. Where did you get the 25 from?
S23	:	Oh, I see, sir. I made a mistake. It shouldn't be 25, but multiplied by the number of seats from the front to the back according to their prices.

Figure 6. Excerpt from the researcher's interview with S10

From the interview results in Figure 6, S23 was able to understand the problem and plan the solution correctly. S23 lacked confidence and was not careful enough in performing the calculations, resulting in errors in answering the question. However, S23 was able to write down the correct solution strategy. On the other hand, the researcher found that S23 was able to answer the question correctly. The difficulty faced by S23 in solving the mathematical problem-solving question was a conceptual difficulty, where S23 misunderstood the concept in question type B, resulting in an inappropriate process in answering the question.

This phenomenon is in line with Rahayu's (2018) research, which found that multistructural students often already know many concepts but fail to organize them into the correct solution strategies. Similarly, Mafruhah & Muchyidin (2020) and Pesona & Yunianta (2018) noted that errors at this level generally occur because students lack the reflective skills needed to check the consistency of their answers. Thus, multistructural students tend to present lengthy procedural answers that remain conceptually incorrect (Napfiah, 2016). This underscores the need for an instructional approach that encourages students to connect concepts comprehensively, rather than merely memorizing formulas.

According to Biggs & Collis (1982), multistructural students have more knowledge than unistructural students, but still see each piece of information as a separate entity. This is in line with the findings of Hattie & Brown (2004), who explain that students often experience fragmented knowledge, which is knowledge that is abundant but isolated. In the context of this study, the errors made by multistructural students underscore that mathematical understanding is not sufficient merely by mastering various formulas. To encourage students to advance to the relational level, instruction must be designed to train them in making connections between concepts through contextual problems and collaborative discussions (Ramos et al., 2024).

Characteristics of conceptual errors made by students at the relational level

Based on Table 1, it is known that S11 is at the relational stage. The test results completed by S11 are shown in Figure 7 below

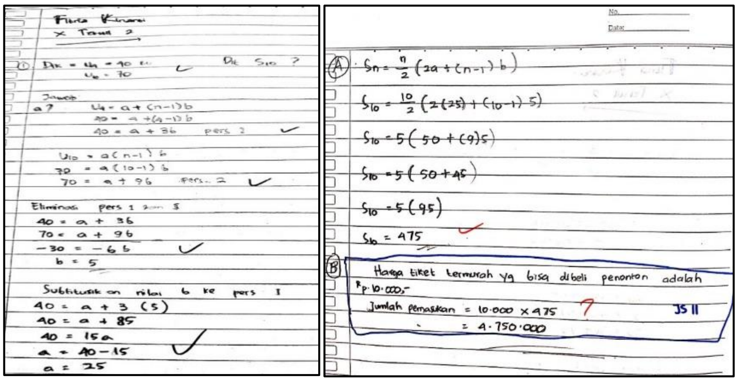

Figure 7. Subject 11 answer result

Based on S11's work in Figure 7, it is evident that S11 is able to understand the problem comprehensively, as demonstrated by their understanding of the questions asked and the information provided. Furthermore, S11 is able to develop a solution strategy and implement the strategy they designed in a well-measured and systematic manner. For type A problems, S11 is able to answer correctly and accurately according to the procedure. On the other hand, in type B answers, S11 made mistakes in answering. However, this indicates that S11 is able to connect more than one concept in solving sequence and series problems. The results of the researcher's interview with S11 regarding their work are shown in Figure 8 below.

P	:	Take a look at section B. You concluded that the profit was Rp4,750,000. Shouldn't the question be about the income from the cheapest tickets?
S11	:	Oh yes, sir, I was wrong. It should be multiplied by 70, right, sir, because the last row shows that there are 70 seats.
P	:	Yes, that’s the correct answer. Why did you immediately conclude to multiply by 475?
S11	:	Umm… I was in a hurry to finish, sir, and I didn’t re-read the question, so I misunderstood the question’s intent, sir.

Figure 8. Excerpt from the researcher's interview with S11

From the interview above, S11 was able to understand the problem, develop a solution plan, and implement the solution strategy correctly. The challenge faced by S11 in solving this sequence and series problem was the conceptual difficulty in problem type B. S11 admitted that they were not careful enough and rushed in understanding problem B. This resulted in S11 answering the question inaccurately, even though their solution strategy was correct.

This finding is in line with the research by Mubarokah et al. (2020), which revealed that students at the relational level are often able to formulate correct solution strategies, but minor errors such as miscalculations and incorrect substitutions still frequently occur. Similarly, Putri & Nasution (2023) that even though students' conceptual understanding is good, weaknesses in accuracy remain an obstacle to obtaining perfect answers. Thus, conceptual errors at the relational level are not due to ignorance but rather a lack of consistency and precision in calculations. Therefore, teachers need to train students to double-check their solutions to prevent technical errors from undermining the quality of their conceptual understanding (Branca, 1980).

Biggs & Collis (1982) explain that the relational level is the stage at which students are able to see the connections between concepts and apply them in a broader context. However, research by Handayani et al. (2020) and Mafruhah & Muchyidin (2020) shows that although relational students understand the relationships between concepts, they are still prone to minor errors in execution. In this study, relational students showed a similar tendency, namely being able to solve problems with the right strategy, but being hindered by technical errors. This confirms that to reach the highest level, students must be trained not only in connecting concepts but also in maintaining accuracy and reflecting on the process they undertake (Taşar, 2010).

Comparison of conceptual errors between SOLO taxonomy levels

To gain a more comprehensive understanding of the conceptual difficulties faced by students, the results of the analysis were then compared between SOLO taxonomy levels. It was found that the types of errors differed not only in terms of the amount of information used, but also in terms of the quality of the conceptual connections made by students. A summary of the comparison of characteristics and dominant conceptual errors at each SOLO level can be seen in Table 2.

Table 2. Perbandingan kesalahan konsep yang dialami peserta didik ditinjau dari Taksonomi SOLO

Level of SOLO	Main characteristics	Dominant types of conceptual errors
Prastructural	Lack of understanding of basic concepts	Misinterpretation of questions, random answers, inability to write formulas
Unistructural	Using information	Only writing 1 formula, incorrect operations, separate answers
Multistructural	Using several separate pieces of information	Writing down formulas but unable to connect them, incorrect operations, incorrect answers
Relational	Connecting information accurately	Accurate strategy but incorrect in technical aspects and rushing to understand the question

The results in Table 2 show differences in the characteristics of conceptual errors between SOLO taxonomy levels. At the pre-structural level, errors are fundamental because students do not understand the concepts of sequences and series at all. At the unistructural level, students begin to recognize one piece of information, such as a formula, but are unable to use it completely. Meanwhile, multistructural students are able to write down more formulas, but cannot connect them, resulting in incorrect answers. At the relational level, students are able to connect concepts correctly, but are still stuck on technical errors and are not careful enough in completing calculations.

These differences in characteristics are consistent with the findings of Ismawati et al. (2023), who reported that as the SOLO level increases, students' errors tend to shift from conceptual errors to technical errors. Similarly, research by Nuroniah et al. (2013) shows that pre-structural and unistructural students need reinforcement of basic concepts, while multistructural and relational students need practice in reflection and verification of answers. This comparison between levels clarifies that each category of error requires a different learning strategy. Teachers should not only provide procedural exercises but also tailor interventions based on students' level of understanding (Taşar, 2010).

Furthermore, the SOLO taxonomy represents the progression of students' cognitive quality from surface understanding to deep understanding (Biggs & Collis, 2014). Hattie & Brown (2004) emphasize that the transition between levels is not merely about the quantity of information, but rather the quality of connections among concepts. The findings of this study reinforce this view, as multistructural students possessed a large amount of information that was not integrated, while relational students demonstrated integrated understanding but still lacked accuracy. This highlights the importance of instructional approaches that emphasize conceptual depth to support students in progressing from partial understanding to relational understanding, and ultimately to the extended abstract level.

CONCLUSION

This study demonstrates that students' conceptual errors in solving arithmetic and geometric sequence problems vary according to their SOLO taxonomy level. At the prestructural level, students failed to grasp the basic concepts, resulting in random and irrelevant answers. At the unistructural level, students relied on a single formula or piece of information without being able to connect it to the context of the problem. At the multistructural level, students were able to write down multiple formulas but could not integrate them, leading to inconsistent answers. Meanwhile, at the relational level, students successfully connected concepts appropriately, yet still made technical errors such as incorrect substitution, arithmetic mistakes, and imprecise conclusions. These variations in errors across levels highlight the need for instructional strategies that are adapted to students' levels of understanding. Therefore, future studies are recommended to explore instructional interventions based on conceptual connections and reflective practices to support students' transition toward higher levels of understanding.

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