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Students' Thinking Skills in Solving HOTS Standardized Problems Based on the SOLO Taxonomy of Economics Subjects at Senior High School

Seri Ningsih[1*], Riyo Riyadi[2], Sudarman[3], Vitria Puri Rahayu[4]
[1,2,3,4]Faculty of Teacher Training and Education, Universitas Mulawarman, Indonesia

*Corresponding Author
Jl. Muara Pahu, Gn. Kelua, Kec. Samarinda Ulu, Kota Samarinda, Kalimantan Timur, Indonesia 75242
e-mail: seriningsih1903@gmail.com

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Abstract: This study aims to analyze the thinking skills of students in solving Higher Order Thinking Skills (HOTS) standardized problems based on the Structure of Observed Learning Outcomes (SOLO) taxonomy in economics subjects at the senior high school level. The research was conducted at SMA Negeri 1 Sangasanga with a qualitative descriptive approach. Participants were 31 students from class XI.3 who selected economics as their specialized subject. Data were collected using written test instruments that consisted of HOTS-oriented economic problems and were analyzed through stages of data reduction, data display, and conclusion drawing or verification. The findings revealed that students' thinking abilities were varied and aligned with multiple levels of the SOLO taxonomy. None of the students were categorized at the Pre-structural level. A total of 8 students (26%) were at the Uni-structural level, indicating the ability to recall and identify basic concepts. Nineteen students (61%) achieved the Multi-structural level, demonstrating the ability to process multiple aspects independently. Meanwhile, 6 students (13%) reached the Relational level, showing the capacity to integrate and apply concepts holistically. These results suggest that while most students have developed foundational analytical skills, there remains a need for learning strategies that enhance deeper, integrative thinking to advance toward higher SOLO levels such as Extended Abstract.

Keywords: Students' Thinking Skills, HOTS, SOLO Taxonomy

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INTRODUCTION

Education in Indonesia continues to improve the quality of graduates who are able to compete in the global era. (Hariyanti *et al*., 2023). This shows that the education system in Indonesia continues to develop to produce graduates who not only have knowledge, but also skills that are relevant to the demands of the times. Zega (2024) explained that one of the efforts made is to implement a curriculum that is oriented towards the development of higher order thinking skills. Therefore, it is important to apply to students' thinking ability to analyze, rotate, and create new ideas, not just memorize and remember information.

Research by Sari et al., (2019) states that for students, this thinking ability is very important in the context of learning, because what is needed is not only memorizing information, but also analyzing, evaluating, and applying the knowledge gained in real situations. Thus, students who have good thinking skills will be better able to face academic and daily life challenges, and contribute positively to society.

Based on the PISA results in 2023, it is known that the learning performance of Indonesian students who have high thinking skills is at 25.46% and is ranked 68th, far below the OECD average of 73.75%. This indicates that high thinking skills must play an important role in the success of education in Indonesia. This indicates that higher order thinking skills must play an important role in the success of education in Indonesia. Furthermore, data from the Ministry of Education and Culture in 2023 showed that only about 25-30% of students at the high school level were able to reach the high critical thinking category. This shows that students are still less able to solve problems related to the ability to analyze, evaluate, create, and logic and reasoning. Pusparini & Mistiani, (2023) mentioned that one of the factors causing this is that students in Indonesia are not trained in solving HOTS standard questions. From this phenomenon, to achieve an increase in students' higher thinking skills, one of the approaches that can be applied is the use of Higher Order Thinking Skills (HOTS) standard questions, which focus on developing high-level thinking skills.

Surasa et al., (2017) revealed that students are expected not only to be able to understand the basic concepts of economics, but also to be able to apply them in solving complex economic problems that are relevant to daily life. Thus, students are expected to be able to apply this knowledge in real contexts, especially in dealing with more complex economic problems.

According to Cahyani & Setyawati, (2016), to improve students' problem solving skills, it is very important to be supported by appropriate teaching methods and through varied materials. This ability reflects students' level of understanding, analysis, and synthesis of the given topic, especially in economics subjects. In line with Yulianti et al., 2019) Economics, as one of the important subjects in shaping students' knowledge and understanding of the economic system, also requires HOTS skills.

Newman and Wehlage (in Yuyun *et al.*, 2023) stated that HOTS can play a major role in supporting students' academic achievement. With HOTS, students can solve problems, choose ideas or opinions, make hypotheses, discuss wisely, and be able to master more complex situations. According to Anderson & Krathwohl, (2017) HOTS is learning that stimulates students to have knowing how reasoning, namely how the ability to learn by thinking critically, creatively and solving problems. Thomas & Throne (dalam Manik & Ngurah, 2020) explaining HOTS is a critical thinking skill that is more than just memorizing facts or concepts. HOTS requires students to do something about these facts. Students must understand them, analyze each other, categorize, manipulate, create new ways creatively and apply them in finding solutions to new problems. Thus, HOTS can be applied in education so that students' skills and character can be improved.

However, in reality in the field, based on observations of researchers looking at student practice assignments and many of the students are still unable to analyze the problems given properly. During an interview with the economics teacher at school, the teacher revealed that from several examples of HOTS standardized problems given, only 6.45% of 31 students were able to answer HOTS standardized questions. While the rest are still fixated with the answer of one concept only and there are also those who are unable to understand the questions given. This shows that there is still a big challenge in improving students' critical and analytical thinking

skills, as well as in implementing learning that can support the development of HOTS skills effectively.

Based on these problems, to find out whether the student understands the concept or not, a tool is needed to analyze the student's ability to solve a problem. The function of the tool is to determine the ability of students when solving economic problems based on levels. One of the measuring instruments that can be used to analyze students' thinking skills in solving HOTS questions in economics subjects is SOLO Taxonomy (Structure of Observed Learning Outcomes). In line with Partinem, (2023) said SOLO Taxonomy is an effective tool in measuring and understanding students' thinking skills. This is due to its ability to provide a clear picture of the level of student understanding of the concepts taught. According to Biggs and Collis, the five levels are pre-structural, uni-structural, multi-structural, relational, and extended abstract.

In response to these challenges, the Structure of Observed Learning Outcomes (SOLO) Taxonomy, developed by Biggs and Collis, offers a comprehensive framework for assessing the depth of students' understanding. The taxonomy delineates five hierarchical levels: pre-structural, uni-structural, multi-structural, relational, and extended abstract, each representing a progressively complex mode of thinking and understanding. By utilizing the SOLO Taxonomy, educators can systematically evaluate students' cognitive development, moving beyond surface-level comprehension to deeper, more abstract reasoning. This approach not only aids in identifying students' current cognitive stages but also informs instructional strategies to facilitate progression to higher-order thinking levels. Recent studies have highlighted the effectiveness of the SOLO Taxonomy in enhancing critical thinking skills, particularly in subjects requiring analytical and evaluative competencies, such as economics (Triana et al., 2023).

Therefore, this study aims to analyze senior high school students' thinking skills in solving HOTS-standardized problems in economics by employing the SOLO Taxonomy framework. By mapping students' responses to the taxonomy's levels, the research seeks to identify prevalent cognitive stages and uncover specific areas where students struggle with higher-order thinking tasks. The findings are expected to provide valuable insights for educators to design targeted interventions that promote deeper understanding and enhance students' analytical and critical thinking abilities in economics education.

METHOD

This study employed a descriptive qualitative research design to explore senior high school students' thinking skills in solving Higher Order Thinking Skills (HOTS) standardized problems in economics, analyzed through the Structure of Observed Learning Outcomes (SOLO) taxonomy. A qualitative approach was chosen to capture the depth and complexity of students' cognitive processes, allowing for a nuanced understanding of their problem-solving abilities beyond quantitative measures (Kalu & Bwalya, 2017). The research was conducted at SMA Negeri 1 Sangasanga during the 2024/2025 academic year, specifically from December 2024 to January 2025. The participants comprised 31 students from class XI.3 who had selected economics as their specialized subject, providing a focused cohort for in-depth analysis.

Data collection utilized a combination of written tests, semi-structured interviews, and classroom observations to ensure a comprehensive assessment of students' thinking skills. The written tests consisted of HOTS-oriented economic problems designed to elicit responses across different levels of the SOLO taxonomy. Semi-structured interviews provided insights into students' reasoning and conceptual understanding, while classroom observations offered contextual information on their engagement and problem-solving behaviors. Data analysis

followed the interactive model proposed by Miles and Huberman, encompassing data reduction, data display, and conclusion drawing or verification (Saleh, 2017). This iterative process facilitated the identification of patterns and themes related to students' cognitive levels as defined by the SOLO taxonomy.

To ensure the credibility and validity of the findings, the study employed methodological triangulation, integrating multiple data sources and collection methods. Triangulation enhances the robustness of qualitative research by cross-verifying data, thereby reducing potential biases and increasing the trustworthiness of the results (Donkoh & Mensah, 2023). By comparing and contrasting data from tests, interviews, and observations, the study aimed to provide a holistic understanding of students' thinking skills in economics. This approach aligns with best practices in qualitative research, where triangulation is recognized as a key strategy for establishing the validity of study findings (Bhandari, 2023).

RESULTS AND DISCUSSION

Reseacrch Results

Written result data is seen from the work of economic questions of class XI.3 SMA Negeri 1 Sangasanga students in the 2024/2025 school year. Thus, this test allows researchers to measure students' thinking skills in answering HOTS standardized questions. There are five questions about the description of class XI economic material. Analyzing the description of student work by looking at each student's answer, the percentage of student scores is obtained as follows.

Table 1. Percentage of Students' Score on Each Problem

Question Number	**1**	**2**	**3**	**4**	**5**
Max Score	3	3	4	4	6
Total Score	70	61	99	81	123
Total Max Score	93	93	124	124	186
Percentage (%)	75,26%	65,59%	79,83%	65,32%	66,12%

The table above shows the percentage of student scores on each question. The maximum score for question number 1 is 3, so that if 31 students participating in the test get a score of 3 each multiplied by 31 is 93. However, in reality, the maximum score obtained by 31 students is 70, so the percentage score of students' answers to question number 1 from these results is 75.26%. This shows that the answer score of 31 class XI.3 in solving problem number 1 has only reached 75.26%. Likewise for other questions, so that the percentage score of students' answers in question number 2 was 65.59%, question number 3 was 79.83%, question number 4 was 65.32%, and question number 5 was 66.12%. Based on the results in Table 1, the percentage of completeness of learning outcomes based on KKM for each level of student ability is also obtained, it can be seen in the following table.

Table 2. Percentage of KKM Completion

Description	**Number of Students**	
	Completed	**Not Completed**
KKM	17	14
Percentage	55%	45%

The table above shows the completeness of students' KKM on the results of the HOTS standardized economic subject test. Of the 31 students, 17 students (55%) managed to reach the

minimum criteria completeness, indicating that more than half of the students have a fairly good understanding in answering HOTS standardized questions. Students have been able to demonstrate the ability to understand economic concepts and the learning that has been given is quite effective. Meanwhile, 14 students (45%) still did not reach the minimum criteria, indicating that almost half of the students in the class still had difficulty in understanding and answering HOTS standardized questions.

Analyzing the description of further student work for each problem, the researcher groups the answers of students who have almost similar or the same solution. Then the researcher gets a percentage of the quality of student responses in completing the written test presented in the following table.

Table 3. Students' Thinking Ability Level based on SOLO Taxonomy

SOLO Taxonomy Levels	Total of students	Percentage
Pre-structural	0	-
Uni-structural	8	26%
Multi-structural	19	61%
Relational	4	13%

Shown in table 3 it can be concluded that the level of thinking ability of students based on SOLO Taxonomy by taking the average value of each respondent with the largest average respondent is already at the multi-structural level with a percentage of 61% or totaling 19 students out of a total of 31 students.

Discussion

Based on the research results described above, the researchers conducted interviews with students from the uni-structural, multi-structural, and relational groups. The analysis focused on responses to questions number 1 through 5, where the results of written tests were compared with interview data to validate the students' cognitive processes. The findings were presented in the form of students' thinking skills in solving HOTS-standardized questions in economics subjects based on the SOLO Taxonomy. Through the process of data reduction, data presentation, and verification, researchers identified varying levels of thinking ability among students. Some were able to understand and answer questions correctly, some provided answers that were incorrect or partially correct, and others seemed to copy answers from peers, as evidenced by the identical phrasing in their responses. This indicates that while some students demonstrate independent thinking, others still rely heavily on external input to complete cognitive tasks.

The uni-structural group primarily demonstrated a basic understanding of economic concepts, often limited to memorization or recognition of key terms without deeper elaboration. During interviews, students in this group tended to give brief answers and had difficulty connecting the concepts to real-world contexts. This level of response reflects surface-level learning and highlights the importance of reinforcing conceptual clarity through interactive and inquiry-based learning strategies. It also suggests a need for more engaging classroom discussions and problem-based activities that challenge students to move beyond rote recall and develop deeper comprehension.

In contrast, students in the multi-structural group were able to identify and describe multiple relevant concepts, although their answers were often fragmented and lacked integration. These students could explain individual points well but struggled to synthesize them into a

cohesive analysis. This indicates a moderate level of thinking skill where learners understand the components of a problem but have not yet developed the ability to see relationships among them. Interviews revealed that while these students showed enthusiasm, they required guidance to connect ideas and apply them systematically in problem-solving. Therefore, teaching approaches that incorporate concept mapping and case analysis may be effective in helping students advance to the relational level.

The relational group, although fewer in number, exhibited higher-order thinking skills by integrating multiple concepts and applying them in a structured and logical manner. Their written test responses were well-developed, with justification based on economic theory and real-life examples. Interviews with these students showed that they were able to articulate their reasoning clearly and often reflected metacognitive awareness by evaluating their own answers critically. This suggests that these students have internalized the learning objectives and are capable of abstract reasoning. Encouraging peer collaboration with these students as mentors or discussion leaders could foster a culture of reflective thinking within the classroom and elevate the overall cognitive performance of their peers.

In the research results, it is known that there are no people or 0 students who are in the pre-structural category, where students do not have an understanding of the problems given, students do not understand what is asked in the problem, students are unable to provide answers, students who have this criterion have not been able to work on the problems given appropriately. This is also explained by Biggs & Collis, (1982) students who are at the pre-structural level, students do not have any understanding, use irrelevant information or as little information and are not interconnected. This finding is in line with research conducted by Oktaviani, (2020) which states that students at the pre-structural level have not been able to understand the problems they are working on and cause the answers written by students to be meaningless and incorrect. Thus, it can be concluded that all students in this study showed a better level of understanding.

In this study, it was found that 8 students were able to understand the problems given, or were at the uni-structural level, students were able to provide answers but were still incorrect, the information provided was incomplete. Seen in the interview results, when the question ordered is to analyze and give an opinion, students who are at the uni-structural level can only mention and not by providing an explanation. Students try to answer the question in a limited way by selecting one information in the question given. According to Suryani, (2024) students who are at the uni-structural level are students who are able to solve relevant problems but have simple conclusions. Azmia & Soro, (2021) also confirmed that students at the uni-structural level are able to use some information to answer the problems contained in the problem but the conclusion is wrong. This happens because during the learning process students do not pay attention and do not understand the material so that the student's solution steps are wrong. Thus, students need to be given more opportunities to connect theory with practice, so that they can develop more complex thinking skills and be ready to face challenges in more difficult problems.

In this study, 19 students were found who were able to answer questions, give opinions, analyze, make and compile systematically but were not complete with conclusions on the answers or were at a multi-structural level. Reinforced by the results of the interview, multi-structural students said that in solving the problem they were able to give the correct answer and identify relevant information. Some students also stated that they understood the concepts being asked but were still hesitant in composing more complex answers or drawing the right conclusions. In line with research Amsikan *et al*., (2021) Students are able to understand the problem such as students write down what is known and asked in the problem and are able to write the solution

correctly but the student's solution steps are not all correct. This shows that they have achieved a good understanding in analyzing information, but still need further guidance to improve their skills in concluding complete answers.

In this study, 6 students were found who were able to understand the relationship between several aspects and how they fit to form the whole and students including the relational level. In the results of interviews with relational students, the understanding in forming structures and already having the competence to compare, analyze, apply theories, explain cause and effect. Students can also provide more than one interpretation of an argument. It can be seen that during the process of solving problems, students who are at the relational level already understand the problem and when they encounter difficulties, students overcome it by looking it up again in books and other references. This is in line with research Waras et al., (2022) which states that at the relational level, students can understand the problems given well, are able to plan their completion, are able to execute the problems and solve them appropriately. Thus, these students show progress in a deeper understanding of concepts when solving the given problems.

Students from low to high levels have the same difficulty in solving problems, by searching through package books and the internet and a little explanation related to the questions and materials from the researcher. However, students who are at the relational level, in addition to answering correctly, students with the relational level are able to give steps and conclusions well. In addition, students at this level demonstrate the ability to argue and explain students' thought processes and assist in better understanding and solving problems. This shows that the improvement of understanding lies not only in the end result, but also in the underlying thought process.

Based on the above explanation, the students' thinking ability in solving HOTS standard questions based on the SOLO Taxonomy of each student is different. The results of this study show that the thinking ability of grade XI students. 3 SMA Negeri 1 Sangasanga in solving HOTS standard questions in economics subjects is quite good. The students with the highest level are at the Relational level, while the lowest level is at the Uni-structural level. Overall, students' thinking ability based on the SOLO Taxonomy class XI.3 is at a multi-structural level where students can understand the problem and can plan correctly but have not been able to solve the problem properly and correctly.

CONCLUSIONS

Based on the results of the research conducted, it can be concluded that the learning outcomes of Grade XI.3 students at SMA Negeri 1 Sangasanga in solving HOTS-standardized questions in economics reached a completeness rate of 70%. This indicates that the overall ability of students to respond to HOTS questions is relatively good. The majority of students demonstrated adequate conceptual understanding, as reflected in their ability to interpret questions and attempt logical responses. However, there is still variability in the depth of their answers, suggesting differences in cognitive processing levels among students.

In general, student responses were predominantly at the multi-structural level, with 19 out of 31 students (61%) classified in this category. This means that while students are capable of identifying and explaining several relevant concepts, they often struggle to connect these ideas cohesively or apply them correctly to solve problems. Although their comprehension of economic principles has shown positive development, a more in-depth, reflective, and integrative learning approach is needed. This is essential to elevate students to higher levels of thinking—such as

relational or extended abstracts, so they can not only understand concepts but also analyze, evaluate, and apply them in various contexts.

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