BD CENTER 2013

International Journal of Learning and Teaching
ISSN 1986-4558

Volume 17, Issue 2, (2025) 39-53

IJLT International Journal of Learning & Teaching

https://un-pub.eu/ojs/index.php/ijlt/index

Lack of truth-seeking behaviors among senior high students in solving mathematics problems

Shinta Yuliana [a], University of Jember, JL. Kalimantan No. 37, Jember 68131, Indonesia, shintay29@gmail.com, 0000-0002-0729-8909
Dian Kurniati [b]*, University of Jember, JL. Kalimantan No. 37, Jember 68131, Indonesia, dian.kurniati@unej.ac.id, 0000-0002-9108-0434
Ervin Oktavianingtyas [c], University of Jember, JL. Kalimantan No. 37, Jember 68131, Indonesia, rvienokta@gmail.com, 0000-0002-2346-8576

Suggested Citation:
Yuliana, S., Kurniati, D., & Oktavianingtyas, E. (2025). Lack of truth-seeking behaviors among senior high students in solving mathematics problems. *International Journal of Learning and Teaching, 17*(2), 39-53. https://doi.org/10.18844/ijlt.v17i2.9708

Received from July 12, 2024; revised from December 18, 2024; accepted from March 2, 2025.
Selection and peer review under the responsibility of Assoc Prof. Dr. Jesus Garcia Laborda, Alcala University, Spain.

©iThenticate Similarity: 9%

Abstract

This study aims to identify patterns in students' truth-seeking behavior when solving mathematics problems involving an unknown universe of discourse. As a qualitative descriptive study, the research followed a structured process including the preparation and validation of instruments, data collection, subject selection, analysis, triangulation, and conclusion drawing. The participants were 42 high school students who demonstrated ideal problem-solving abilities. Findings indicate that students generally lack truth-seeking tendencies in mathematical problem-solving. They often neglect essential behaviors such as verifying universal sets, explicitly identifying and defining these sets, articulating relevant formulas aligned with problem objectives, detailing procedural steps, adhering to those steps during problem-solving, and evaluating outcomes against the intended goals. Furthermore, students frequently fail to re-examine their solutions, reflecting an implicit assumption that teacher-provided problems are inherently accurate and not subject to further scrutiny. These results underscore the need for instructional practices that foster critical thinking and truth-seeking dispositions in mathematical reasoning.

Keywords: Critical thinking; mathematics education; problem-solving; qualitative research; truth-seeking.

* ADDRESS FOR CORRESPONDENCE: Shinta Yuliana, University of Jember, JL. Kalimantan No. 37, Jember 68131, Indonesia.
E-mail address: shintay29@gmail.com

1. INTRODUCTION

The competencies needed currently, based on the opinion contained in the US-Partnership for 21st Century Skills (P21), are the 4Cs, namely communication, collaboration, critical thinking, and creativity. These competencies are agreed upon so that students can succeed in the world of work when they graduate from education. One of the competencies contained in the standard graduate competency indicators set by the Indonesian government, from elementary school to university education, is critical thinking. One of the goals of learning in schools to universities is to develop and habituate students to think critically.

Critical thinking is frequently examined and evaluated to measure and determine the capacity for future problem-solving (Akinoğlu and Karsantik, 2016). Defined as a reflective and rational process concerning decisions about actions and beliefs, critical thinking involves deliberate and reasoned judgment (Ennis, 1996). The development of critical thinking skills and dispositions is considered essential for both individual advancement and effective participation in social contexts (Arslan and Demirtaş, 2016). The ability and habit of critical thinking can help a person understand and accept other people's opinions well; besides that, people who think critically tend to have open-mindedness towards various opinions that are different from others and are wise in responding to them (Arslan & Demirtas, 2016). Critical thinking is a process of individual thinking when faced with a problem by considering known evidence and facts. Students must fulfill two components of critical thinking, namely the ability and disposition to achieve basic educational goals (Kizilhan & Demir, 2022). Critical thinking consists of 5 components, one of which is identifying an assumption implicit in a problem based on the evidence obtained (Arifin et al., 2020).

Critical thinking disposition is a component of critical thinking that does not directly describe the skills possessed by a person (Facione et al. 1995). Critical thinking disposition is closely related to prudence in deciding to solve the problem at hand. Students will check the truth behind the problem and classify these things first before solving the given problem if the student masters the disposition of critical thinking (Kurniati & Zayyadi, 2018). There are seven scales in the CCTDI (California Critical Thinking Disposition Inventory) instrument used to define a person's critical thinking disposition, namely truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity (Facione et al., 1995).

Individuals exhibiting a critical thinking disposition are typically engaged in activities oriented toward the pursuit of truth (Cheng & Wan, 2017). Truth-seeking refers to the habitual effort to revisit and evaluate the factual basis of a given problem to achieve a comprehensive understanding that supports reliable conclusions (Kurniati et al., 2020). This process involves actively seeking factual accuracy, formulating and posing questions, conducting objective observations, and reassessing previously held beliefs when new evidence aligns with observable reality. The development of a critical thinking disposition among students can be enhanced through regular engagement with structured questions that incorporate established indicators of critical thinking.

Eight types of mathematical problems possess the potential to enhance students' thinking dispositions, including problems characterized by an unknown universe of discourse (As'ari et al., 2019). Problems involving an unspecified universe of discourse are designed to stimulate analytical thinking and elicit diverse student responses (Szabo et al., 2020). A common approach among students when solving mathematical problems is to proceed immediately without first identifying the universe of discourse, often assuming by default that it consists of all real numbers. This tendency is supported by findings from Rahmawati et al. (2021), indicating that truth-seeking behavior remains underdeveloped when students encounter problems with an unknown universe of discourse, largely due to the absence of instructional emphasis on this concept within mathematical problem-solving contexts. The present study focuses on mathematical problems related to the topic of Systems of Linear Equations in Three Variables. This topic involves systems comprising three distinct variables, and effective engagement with such problems necessitates explicit clarification of the universe of discourse.

Critical thinking disposition is related to skills in solving mathematical problems. One theory that can be used to solve mathematical problems is the IDEAL problem-solving theory. The IDEAL theory of problem solving is a theory that is useful for increasing thinking skills in solving a given problem (Bransford & Stein, 1993; Park & Lee, 2023). There are 5 stages in the IDEAL problem-solving theory, namely identifying problems, determining goals, looking for possible strategies, implementing strategies, looking back, and evaluating results.

1.1. Conceptual background

Truth seeking is a component of a critical thinking disposition that must be owned by someone with a critical thinking disposition (Facione et al., 1995). According to Facione (1990), the special characteristics of someone with a critical thinking disposition are (1) clarifying information from problems, (2) seeking information that is appropriate to problems, (3) thinking rationally in choosing or applying a concept to solve problems, (4) working on complex problems coherently, (5) focusing on the main problem, (6) solving problems diligently even though they encounter difficulties when working on them, and (7) paying close attention to the subject and situation. A student who can do truth-seeking in this process is characterized by (1) leading to an understanding of the situation conveyed in the problem, (2) emphasizing evidence and reasons, (3) questioning his beliefs to people who are more expert, such as teachers, and (4) paying attention to the important details contained in the questions (Facione, 2015; Nguyen & Yang, 2024). One indicator of a critical disposition put forward by Ennis (1985) is that students with a critical thinking disposition always pay attention to any information or questions contained in math problems.

Truth-seeking is a person's habit of looking back at the truth contained in a given problem, which aims to get the best understanding in determining something that can be trusted to be true (Kurniati et al., 2020; Chavez & Reynolds, 2023). A similar statement was also put forward by Facione (2015) that truth seeking is a habit of someone who wants a good understanding of a particular situation. If it is characterized more specifically related to students who behave truth seeking in solving math problems, namely (1) seeing the truth of all the information contained in math problems (Kurniati & As'ari, 2019), (2) fixing it by changing illogical problems into logical problems (Kurniati & As'ari, 2019), (3) looking for all information related to the problem given (Nugroho et al., 2018), and (4) being honest and objective in questioning the truth of the information obtained (Alper, 2010; Smith & Liu, 2021).

The theory used in this research is IDEAL problem solving. IDEAL problem solving is a theory that is used to improve the ability to think and solve problems presented (Bransford and Stein, 1993). The name IDEAL problem solving is obtained from the word "IDEAL," which means I (Identify problem), D (Define goal), E (Explore possible strategies), A (Anticipate outcomes and act), and L (Look back and learn). The strategies used in IDEAL problem solving are (1) identifying problems, (2) determining or defining goals, (3) looking for various strategies that might be used in solving a problem, (4) implementing strategies that will be used in a problem, and (5) review and evaluate the results obtained (Pratiwi et al., 2021).

According to Bransford and Stein (1993), there are 5 stages in IDEAL problem-solving theory, namely identifying problems, defining goals, exploring possible strategies, anticipating results and acting (anticipate outcomes and act), looking back and learn (look back and learn). The first step in the IDEAL problem-solving theory is to identify the problem. Someone intentionally identifies a given problem and makes it an opportunity to do something different according to the creations of each individual (Stein et al., 1984). When someone deliberately identifies a problem and sees an opportunity to change, then this provides an opportunity to change the existing reality.

The second step is to develop an understanding of the identified problem and try to define the desired goal in the problem (Rubenstein et al., 2020). In setting different goals with identifying problems, a problem can be solved depending on the goals set, and this affects the solution or answer to the problem. The goal setting of each individual is not always the same, and the differences that occur can be a benchmark in seeing how a person's ability to understand, think, and solve problems.

The third step of IDEAL problem solving is to explore (explore) possible strategies or ways and evaluate (evaluate) these strategies to suit the goals set in the second step (Stein et al., 1984). Meanwhile, Brookhart (2010) put forward the opinion that "this step applies the strategy which they choose to solve the problem", and the point is that the stage of exploring the problem is a continuation of the previous stage, so that the solution or answer to the problem can be determined. Some of the strategies used in solving problems are very general or can be used in almost all existing problems, but some strategies can only be used in certain cases.

used in solving problems are very general or can be used in almost all existing problems, but some strategies can only be used in certain cases.

The fourth stage involves anticipating outcomes and executing the selected strategy. Once a strategy has been identified, it is essential to consider potential results and implement actions aligned with the chosen approach. Anticipation of outcomes serves to minimize future regret and enhances decision-making quality. This stage is closely associated with problem-solving processes based on the possibilities outlined in the preceding phase.

The final step of IDEAL problem solving is to look back at the consequences of the strategies used and learn from the experiences gained. Not all problems can be solved in one go; sometimes the answers or solutions obtained are not in accordance with the goals set (Johnson & Taylor, 2022; Ruppert et al., 2022). After getting results that are by the problems given, students provide conclusions for each of the possibilities contained in the problem.

This study refers to truth-seeking indicators that have been adapted to the IDEAL problem-solving theory. Indicators of truth-seeking behavior in this study are in table 1.

Table 1

Truth-seeking indicator based on IDEAL problem solving

IDEAL's Problem Solving	Truth Seeking Indicator
Identifying problems	Determine the information contained in the problem
	Check the universal set of discussion contained in the problem
Determining or defining goals	Look for the problems asked in the questions
	Write down and determine the universe of conversation on the problem
Looking for various strategies	Write down the formula or formula used to solve the problem according

IDEAL's Problem Solving	Truth Seeking Indicator
that might be used in solving a problem	to the purpose Write down the steps used
Implementing strategies that will be used in a problem	Using all the information and universe of conversations that have been determined Do the questions according to the steps that have been determined before
Review and evaluate the results obtained	Write down all the solutions based on all the universes of conversation that have been determined Evaluate the results obtained, whether by the objectives set or not

1.2. Purpose of study

Based on this explanation, research is needed that focuses on students' truth-seeking behavior in solving math problems with an unknown universe of conversation. The formulation of the problem in this study is how the tendency of students' truth-seeking behavior in solving mathematical problems with an unknown universe of conversation on the material system of three-variable linear equations based on the IDEAL problem-solving theory.

2. METHODS AND MATERIALS

This study uses descriptive qualitative research because it describes qualitatively the truth-seeking behavior of students in solving mathematical problems with an unknown universe in the material of a system of three-variable linear equations based on the IDEAL problem-solving theory. The data were obtained from observation data, tests, and interviews, which explained in detail the tendencies of students' truth-seeking behavior in solving problems.

2.1. Participants

There are several stages in this study, including (1) instrument preparation and validation, (2) data collection, (3) subject determination, (4) data analysis, (5) triangulation, and (6) conclusions. The subjects in this study were students of class X MIPA 2 SMA Negeri 1 Jember who had studied the Three Variable Linear Equation System material. Students who were asked to solve math problems with an unknown universe were 42 students.

2.2. Data collection instrument

The instruments used in this study were question instruments and observation sheets. The instrument questions are 2 mathematical problems with an unknown universe in the system of equations of three variables. The observation sheet instrument is used when making direct observations when students solving the problems given. The validation test was carried out on the three instruments used, namely the problem instrument and the observation sheet. The validation test was carried out by two lecturers from the Mathematics Education University of Jember. The following are 2 mathematical problems with an unknown universe on a system of equations of three variables, material that has been validated:

a. The values of x, y, and z that satisfy the system of equations

$$\begin{cases} 2x - y + 2z = -10 \\ x + 4y + 10z = -5 \\ -x + 5y + 4z = 7 \end{cases} \begin{cases} 2x - y + 2z = -10 \\ x + 4y + 10z = -5 \\ -x + 5y + 4z = 7 \end{cases}$$

b. The values of p, q, and r that satisfy the system of equations

$$\begin{cases} \frac{p-2q}{4} = r+1 \\ -\frac{p}{3}+2 = q+4r \\ \frac{3p+4r}{3} = 2q+8 \end{cases} \begin{cases} \frac{p-2q}{4} = r+1 \\ -\frac{p}{3}+2 = q+4r \\ \frac{3p+4r}{3} = 2q+8 \end{cases}$$

The two questions were given to 12 students of class X MIPA 2 SMA Negeri 1 Jember. When students solve problems, all student activities are recorded to support statements during data analysis, and direct observation is carried out with 4 observers. Students are asked to carry out a think-aloud and record it. Then, students conducted in-depth interviews based on interview guidelines to confirm the results of students' work in solving mathematical problems with unknown universes of conversation.

2.3. Data analysis technique

The stages contained in the IDEAL problem-solving are used in analyzing the results of the data obtained. Furthermore, an analysis was carried out on the results of solving test questions and the results of observations, then 3 research subjects were taken who met the indicators of solving test questions based on the IDEAL problem-solving theory and some students met the indicators of truth-seeking behavior in solving mathematical problems with an unknown universe, even though not all indicators on truth-seeking behavior are met. Interviews were conducted with 3 students who met the indicators of completing test questions based on the IDEAL problem-solving theory to confirm test results and observations. The next research stage is to analyze the tendency of students' truth-seeking behavior in solving math problems with an unknown universe of conversations on a system of equations of three variables material based on the IDEAL problem-solving theory.

equations of three variables material based on the IDEAL problem-solving theory.

The triangulation stage is the stage to ensure the validity of the data obtained. The triangulation used in this research is method triangulation. Method triangulation is to confirm the data obtained from observations and tests, then compare and review the validity of the data using the interview method. The conclusions of this study are based on the results of data triangulation that has been done.

3. RESULTS

3.1 Student truth-seeking behavior when solving question number 1

The research subjects were given mathematical problems with unknown universes of conversation. The first problem is as follows: The value of x, y, and z which satisfies the system of equations.

$$\begin{cases} 2x-y+2z=-10 \\ x+4y+10z=-5 \\ -x+5y+4z=7 \end{cases} \begin{cases} 2x-y+2z=-10 \\ x+4y+10z=-5 \\ -x+5y+4z=7 \end{cases}$$

Three students completed the four stages outlined in the IDEAL problem-solving model while addressing problem number one. The stages implemented included problem identification, goal determination, strategy implementation, and result review and evaluation. Based on test outcomes and observational data, the problem identification stage was conducted by extracting all relevant information presented in the problem. Each student began by reading the problem and writing the known system of equations. Students S01 and S03 first reviewed the work instructions before engaging with the problem statement, whereas student S02 immediately began with question number one. This variation reflected differences in individual problem-solving habits grounded in the IDEAL framework. Student S01 demonstrated familiarity with the IDEAL model when approaching word problems. Student S03 consistently performed the problem identification stage across various mathematical tasks but lacked regular engagement with the goal-setting stage, prompting an initial review of work instructions before problem analysis..

The three students did not check the universe of conversation contained in question number 1 in the problem identification stage. Students do not determine the universe of conversation because students still do not know about the universe of conversation. This happens because students have never been taught to solve problems with an unknown universe of conversation. The next stage in the IDEAL problem-solving theory is to determine goals. The truth-seeking indicator carried out by the three students at this the stage was looking for the problems asked in the questions. Students did not write down and determine the universe of discussion in the questions because students did not know about the universe of conversation in accordance with excerpts from interviews that had been conducted before. Students determine the purpose of the questions in the form of the values of the variables in question number 1, namely x, y and z.

s the stage was looking for the problems asked in the questions. Students did not write down and determine the universe of discussion in the questions because students did not know about the universe of conversation in accordance with excerpts from interviews that had been conducted before. Students determine the purpose of the questions in the form of the values of the variables in question number 1, namely x, y and z.

the stage was looking for the problems asked in the questions. Students did not write down and determine the universe of discussion in the questions because students did not know about the universe of conversation in accordance with excerpts from interviews that had been conducted before. Students determine the purpose of the questions in the form of the values of the variables in question number 1, namely x, y and z.

The stage involving the exploration of possible problem-solving strategies was omitted by all three participants. Formulas and procedures used in solving the problems were not recorded in accordance with the instructional objectives, and the sequential steps were not systematically documented. Four recognized methods for solving systems of equations with three variables were known, including the elimination method, the substitution method, the mixture method, and the determinant method. Test items were approached immediately using the mixture method, which was considered the most accessible strategy. According to the response from participant S02, the mixture method was the most easily recalled during the problem-solving process. The other three methods were not written down, although all were known and acknowledged as valid strategies for solving problems involving systems of three-variable equations. The fourth stage in the IDEAL problem-solving theory is implementing the strategy. The truth-seeking indicator carried out by the three students at this stage was to use all the information that had been determined at the stage of identifying the problem. The students did not determine the universe of discussion on the questions so that students did not use the universe of discussion when doing calculations. Students do not work on the questions in accordance with the previously determined steps, because students do not write down the steps to be used during calculations.

The research subjects wrote down all the solutions that had been obtained in the calculation results in accordance with the objectives of the questions previously determined. Students do not write conclusions based on the universe of conversation because students still do not understand the universe of

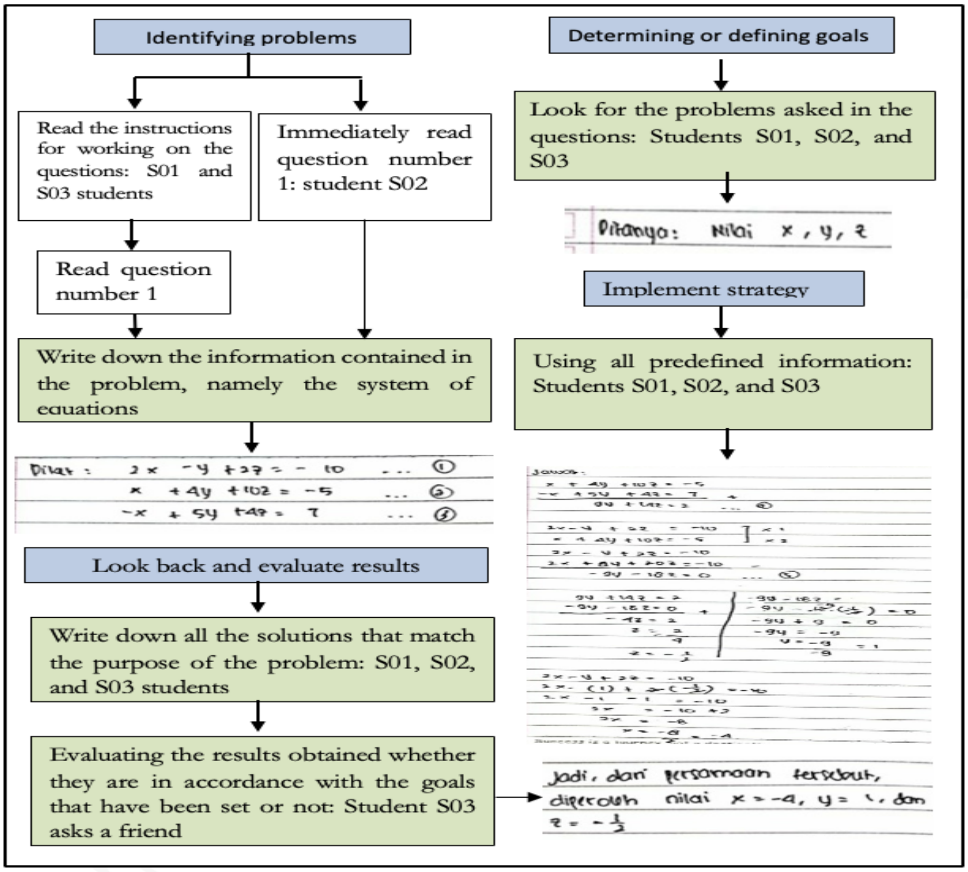
Yuliana, S., Kurniati, D., & Oktavianingtyas, E. (2025). Lack of truth-seeking behaviors among senior high students in solving mathematics problems. *International Journal of Learning and Teaching, 17*(2), 39-53. https://doi.org/10.18844/ijlt.v17i2.9708

conversation. Students S01 and S02 try to work on the questions given independently without asking friends or the teacher. The two students did not try to evaluate whether the results obtained were appropriate or with the goals set. Student S03 asks friends whether the answers and strategies they use are correct or not. The student tries to evaluate the results by asking friends. The two students who did not evaluate the results thought that the time allotted for the question was insufficient, so the two students immediately read question number 2 and worked on it.

The research subjects completed four stages of the IDEAL problem-solving framework, namely identifying problems, determining goals, implementing strategies, and reviewing and evaluating results. The stage involving the exploration of possible strategies was not carried out. The stages of reviewing and evaluating results were completed by each student. However, variations were observed in how this stage was executed. Students S01 and S02 demonstrated truth seeking behavior by formulating conclusions or solutions based on the obtained calculation results in alignment with the defined goals. In contrast, student S03 evaluated the obtained results through peer discussion following the formulation of conclusions. A pattern of student tendencies in solving problem number one based on the IDEAL problem-solving framework is illustrated in Figure 1.

Figure 1

Patterns of truth-seeking behavior of students when solving problem number 1



3.2 *Student truth-seeking behavior when solving question number 2*

The research subjects were given mathematical problems with unknown universes of conversation. The first problem is as follows: The value of p, q and r which satisfies the system of equations.

$$\begin{cases} \frac{p-2q}{4} = r + 1 \\ -\frac{p}{3} + 2 = q + 4r \\ \frac{3p+4r}{3} = 2q + 8 \end{cases}$$

The research subjects carried out the 4 stages contained in the IDEAL problem-solving theory when solving problem number 2. The stages carried out were identifying problems, determining goals, implementing strategies, and reviewing and evaluating results. Based on the test results and observations, students carried out the problem identification stage by determining all the information contained in the problem. Students read the problem first, then write down the system of equations that are known in the problem. Student S01 reads the problem 4 times because the student is trying to understand the problem. Students mentioned that question number 2 was a question that was rarely given in system of equations of three variables material and students tried to remember how to form the system of equations contained in the problem into a system of general equations.

The three students did not check the universe of conversation contained in question number 2 in the problem identification stage. Students do not determine the universe of conversation because students still do not know about the universe of conversation. The stage of identifying the problem students do not check the universe of conversation, so students do not write down and determine the universe of conversation at the stage of determining goals. Students look for the problems asked in question number 2, namely the values of the variables p, q and r.

Students do not do the third stage of the IDEAL problem-solving theory, namely looking for possible strategies. Students did not carry out 2 truth-seeking behavior indicators at the search for possible strategies stage. The two indicators are writing down the formula or formula used to solve the problem according to the purpose, and writing down the steps used. Students actually know that there are 4 methods that can be used in solving system of equations of three variables material questions, but the three students solve problems using mixed methods. Student S03 thinks that mixed method is an easy method.

Students use all the information that has been determined when doing calculations using mixed methods. Students do not use the universe of speech when doing calculations. Students do not work on questions according to the steps previously determined. Each student performs calculations to determine the value of the variable in a different way, even though the three students use the same method, namely the mixed method in solving problem number 2. The results obtained from the three students are the same, namely $p = 3$, $q = -2$, and $r = \frac{3}{4}$. The three students changed the system of equations contained in the problem into the general form of a three-variable system of linear equations first before doing the calculations.

The final stage in the IDEAL problem-solving theory is to look back and evaluate the results. The research subjects wrote down all the solutions that had been obtained from the calculation results in problem number 2. Students did not write conclusions based on the universe of conversation because students still did not understand the universe of conversation. Students understand a little about the universe of speech after being given a little explanation about the universe of speech. Students can mention that the solution written in the conclusion is a solution with a universe of real numbers.

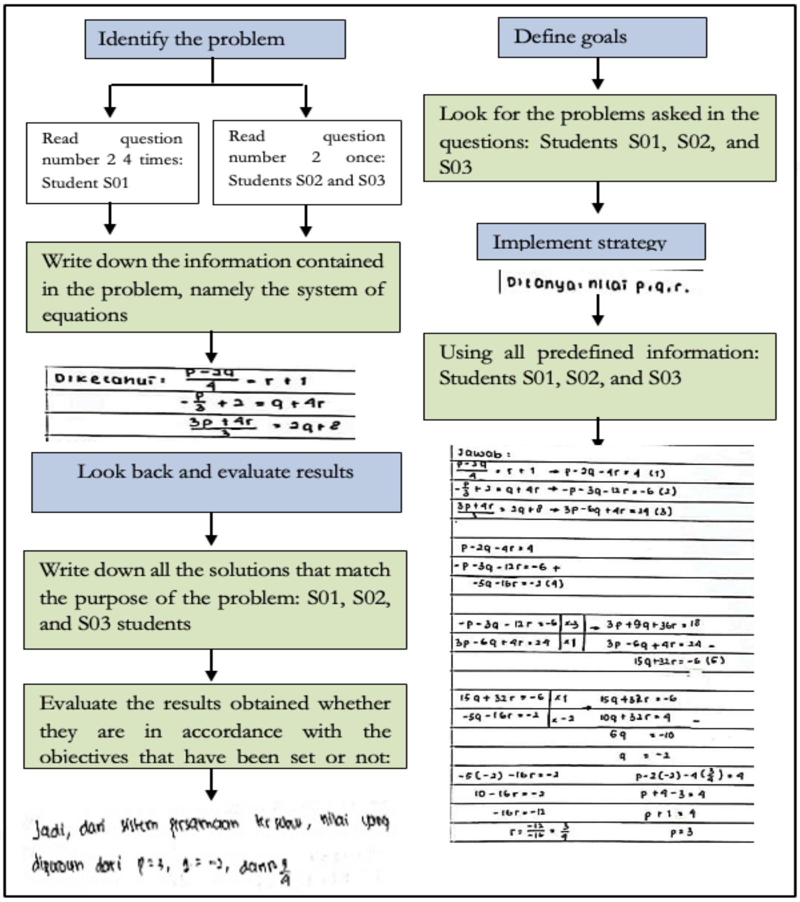
Students S01 and S02 did not check again after writing their conclusions and immediately collected their work. Student S03 checks again on the results obtained, because students have more time to make corrections from the results of their work.

The research subjects only carried out 4 stages in the IDEAL problem-solving theory, namely identifying problems, determining goals, implementing strategies, reviewing and evaluating results. The step that is not carried out is to look for possible strategies. The return stage and evaluating the results is carried out by each student, the difference is that students S01 and S02 carry out truth-seeking behavior in writing conclusions or solutions based on the results of the calculations obtained according to the goals that have been determined, while students S03 evaluate the results obtained after writing the conclusions.

There is a pattern of student tendencies in solving problem number 2 based on the IDEAL problem-solving theory in the following figure 2.

Figure 2

Patterns of student truth-seeking behavior when solving question number 2



4. DISCUSSION

Students S01 and S02 did not engage in any post-conclusion verification and submitted their work immediately. In contrast, student S03 conducted a review of the results, utilizing the remaining time for corrections. The research subjects executed four stages of the IDEAL problem-solving model, including problem identification, goal determination, strategy implementation, and the review and evaluation of results. The stage involving the exploration of potential strategies was omitted. Although all students performed the review and evaluation stage, variations were observed in execution. Students S01 and S02 demonstrated truth seeking behavior by drawing conclusions based on their computational outcomes in alignment with predetermined goals, whereas student S03 verified the conclusions through peer discussion.

Students generally performed several stages within the IDEAL problem-solving framework. This included problem identification, goal determination, strategy implementation, and result evaluation. However, the strategy implementation stage was rarely articulated in written form. A predominant focus on obtaining solutions, calculations, and final answers was observed. Familiarity with the IDEAL framework in solving word problems appeared to be well-established; however, difficulties emerged when addressing mathematical problems lacking specific procedural instructions. Students tended to extract only the systems of equations presented in the problems without considering the underlying domain of discourse required for appropriate problem resolution.

Understanding of the domain of discourse remained limited due to the absence of explicit instruction in prior mathematics education. As a result, problem solving did not begin with domain identification, and assumptions defaulted to the set of real numbers. Instruction on how to define and utilize the appropriate domain of discourse was not incorporated into students' mathematical training. According to Yang et al. (2021), such behavior can be explained through behaviorist theory, wherein learning is shaped by stimulus and response interactions. The absence of truth-seeking behavior when faced with undefined domains was linked to individual attitudes and subjective norms. This is consistent with Ajzen's (1991) theory, which posits that truth seeking behavior is influenced by attitudes, subjective norms, and perceived behavioral control. Individual attitudes were rooted in habitual assumptions that mathematical problems inherently operate within the domain of real numbers. Consequently, verification of the problem's contextual framework was not pursued. The subjective norm in this case refers to the absence of teacher guidance in addressing nonroutine problems, as supported by Darby and Rashid (2017). Interviews revealed that while the term "domain of discourse" was unfamiliar to students, comprehension improved when illustrative examples involving number sets were provided.

Responses to the test items generally included only the variables mentioned in the problem, without exploration of alternative domains that might influence the interpretation of these variables. Two students identified the purpose of the problem after reading the instructions; however, when instructions were not explicitly read, the stage of goal determination was omitted. Encouraging students to carefully examine problem statements and embedded information is essential for developing critical thinking skills, particularly in truth seeking. This development can be fostered through exposure to problems with unspecified domains, a practice aligned with Thorndike's (1927) law of exercise, which emphasizes the role of repeated stimulus response interactions in behavior modification.

Students demonstrated a tendency to neglect the consideration of multiple strategies, despite awareness of various available methods. Problem solving efforts remained centered on calculations aimed at obtaining accurate results. All students opted to use either the mixture method or a combination of elimination and substitution strategies. This behavioral pattern was associated with limited conceptual understanding and the absence of pre-solution strategic planning, as described by Kurniati et al. (2020). Student S03 perceived the mixture method as the most straightforward option. The reliance on memorized formulas over conceptual comprehension reflected a preference for rote learning, as noted by Gazali (2016).

All known information from the problems, specifically the system of equations, was utilized in the solutions. Although calculation methods varied among students, a common objective was to ensure accuracy and consistency with the stated goals. Conceptual limitations affected the ability to handle systems involving nonstandard equation forms, indicating incomplete understanding of three variable systems. These findings correspond with Kurniati's (2020) observation that a lack of truth-seeking behavior can stem from past experiences in problem solving.

Reevaluation of solutions was often neglected due to perceived time constraints. Conclusions aligned with the objectives were still provided, although the review stage was not consistently performed under timed conditions. When granted extended time, such as during homework assignments, students were more likely to engage in reviewing and evaluating results. One student was accustomed to reviewing and even revisiting calculations twice, though attention remained focused on the numerical aspects rather than the full problem context. This behavior corresponds with a form of doubt, identified by Kurniati (2020), which represents an essential element of truth seeking and critical thinking as described by Facione (1990). In many instances, final results did not align with initially defined goals, underscoring the necessity of reexamining both the solution process and the calculations performed. Each student ultimately completed the review and evaluation stage by formulating conclusions that reflected the goals defined earlier in the process.

5. CONCLUSION

Students can complete a problem-solving test with an unknown universe of conversations on system of equations of three variables material based on the IDEAL problem-solving theory. Patterns of student behavior in solving problems with an unknown universe based on the IDEAL problem solving theory, namely (1) reading questions to understand the problem then writing down the information contained in the problem at the problem identification stage, (2) finding and writing down the problems asked in questions at the stage of setting goals, (3) using all the information that has been determined at the stage of implementing the strategy, and (4) writing conclusions and checking results at the stage of reviewing and evaluating results.

The truth-seeking behavior carried out by students is determining the information contained in the problem, looking for the problem asked in the problem, using all the information that has been determined, and writing down all the solutions according to the goals that have been determined. Truth-seeking behavior that is not carried out by students is checking the universe of discussion contained in the problem, writing and determining the universe of discussion on the problem, writing down the formula or formula used to solve the problem in accordance with the objectives, writing down the steps used, working on the questions according to the predetermined steps, and evaluate the results obtained whether in accordance with the goals set or not.

Conflict of Interest: The authors declare no conflict of interest.

Ethical Approval: The study adheres to the ethical guidelines for conducting research.

Yuliana, S., Kurniati, D., & Oktavianingtyas, E. (2025). Lack of truth-seeking behaviors among senior high students in solving mathematics problems. *International Journal of Learning and Teaching, 17*(2), 39-53. https://doi.org/10.18844/ijlt.v17i2.9708

Funding: This research received no external funding.

REFERENCES

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179–211. https://doi10.1080/10410236.2018.1493416

Akinoglu, O., & Karsantik, Y. (2016). Pre-Service Teachers' Opinions on Teaching Thinking Skills. *International Journal of Instruction*, *9*(2), 61-76. https://eric.ed.gov/?id=EJ1106330

Alper, A. (2010). Critical Thinking Disposition of Pre-Service Teachers Öğretmen Adaylarının Eleştirel Düşünme Eğilimleri. *Education*, *35*(158). https://core.ac.uk/download/pdf/236384648.pdf

Arifin, S., Setyosari, P., Sa'dijah, C., & Kuswandi, D. (2020). The effect of problem-based learning by cognitive style on critical thinking skills and students' retention. *JOTSE: Journal of Technology and Science Education*, *10*(2), 271-281. https://upcommons.upc.edu/handle/2117/334749

Arslan, S., & Demirtas, Z. (2016). Social emotional learning and critical thinking disposition. *Studia Psychologica*, (4). https://avesis.gazi.edu.tr/yayin/5f303ac5-5624-4756-9b6e-7b904d3520e9/social-emotional-learning-and-critical-thinking-disposition

As'ari, A. R., Kurniati, D., Maharani, S., & Basri, H. (2019). Ragam soal matematis untuk mengembangkan disposisi berpikir kritis. *Universitas Negeri Malang*.

Bransford, J. D., & Stein, B. S. (1993). The IDEAL problem solver. https://digitalcommons.georgiasouthern.edu/ct2-library/46/

Brookhart, S. M. (2010). *How to assess higher-order thinking skills in your classroom*. Ascd. https://books.google.com/books?hl=en&lr=&id=AFIxeGsV6SMC&oi=fnd&pg=PA1&dq=Brookhart,+S.+M.+(2010).+How+to+Assess+Higher-order+Thinking+Skills+in+Your+Classroom.+Virginia+USA:+ASCD.+&ots=W9cuYya8W6&sig=BgsRBTtx8OPfCdQFVHReYHPuJK0

Chavez, P., & Reynolds, T. (2023). Investigating the relationship between truth-seeking behavior and critical thinking in solving complex mathematical problems. *Journal of Mathematics Education, 58*(1), 89-102. https://doi.org/10.1016/j.mathed.2023.02.005

Cheng, M. H. M., & Wan, Z. H. (2017). Exploring the effects of classroom learning environment on critical thinking skills and disposition: A study of Hong Kong 12th graders in Liberal Studies. *Thinking Skills and Creativity*, *24*, 152-163. https://www.sciencedirect.com/science/article/pii/S1871187117300639

Darby, N. M., & Rashid, A. M. (2017). Critical Thinking Disposition: The Effects of Infusion Approach in Engineering Drawing. *Journal of Education and Learning*, *6*(3), 305-311. https://eric.ed.gov/?id=EJ1141673

Ennis, R. H. (1985). A logical basis for measuring critical thinking skills. *Educational leadership*, *43*(2), 44-48. https://jgregorymcverry.com/readings/ennis1985assessingcriticalthinking.pdf

Ennis, R. H. (1996). Critical thinking dispositions: Their nature and assessability. *Informal logic*, *18*(2). https://ojs.uwindsor.ca/index.php/informal_logic/article/view/2378

Facione, P. (1990). Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction (The Delphi Report). https://philarchive.org/archive/faccta

Facione, P. A. (2015). Permission to Reprint for Non-Commercial Uses Critical Thinking: What It Is and Why It Counts. *Insight Assessment*, *5*(1), 1–30.

Facione, P. A., Sanchez, C. A., Facione, N. C., & Gainen, J. (1995). The disposition toward critical thinking. *The Journal of general education*, *44*(1), 1-25. https://www.jstor.org/stable/27797240

Gazali, R. Y. (2016). Pembelajaran matematika yang bermakna. *Math Didactic: Jurnal Pendidikan Matematika*, *2*(3), 181-190. https://core.ac.uk/download/pdf/295416394.pdf

Johnson, M., & Taylor, C. (2022). Truth-seeking behaviors in mathematics problem-solving: A critical thinking approach. *Mathematics Education Research Journal, 34*(2), 123-138. https://doi.org/10.1007/s13394-022-00443-x

Kizilhan, P., & Demir, E. (2022). A Study on the Relationship between Teacher Candidates' Attitudes towards Teaching Critical Thinking and Critical Thinking Standards. *Turkish Online Journal of Educational Technology-TOJET*, *21*(4), 1-18. https://eric.ed.gov/?id=EJ1365497

Kurniati, D., & As' ari, A. R. (2019). The Truth-Seeking and Open-Mindedness of Pre-Service Mathematics Teachers in the Solution of Non-Routine Problems. *International Journal of Instruction*, *12*(1), 915-930. https://eric.ed.gov/?id=EJ1201380

Kurniati, D., & Zayyadi, M. (2018). The critical thinking dispositions of students around coffee plantation area in solving algebraic problems. *International Journal of Engineering & Technology*, *7*(2.10), 18-20. https://www.researchgate.net/profile/Dian-Kurniati-2/publication/324526914_The_critical_thinking_dispositions_of_students_around_coffee_plantation_area_in_solving_algebraic_problems/links/5af79a3eaca2720af9d99241/The-critical-thinking-dispositions-of-students-around-coffee-plantation-area-in-solving-algebraic-problems.pdf

Kurniati, D., Purwanto, P., As' ari, A. R., & Sa'dijah, C. (2020). Changes of the students' truth-seeking behaviour during the infusion mathematics learning. *TEM Journal*, *9*(4), 1711. https://www.ceeol.com/search/article-detail?id=914046

Nguyen, A., & Yang, L. (2024). Exploring the critical thinking disposition of mathematics students: Insights into truth-seeking and problem-solving. *Studies in Higher Education, 49*(3), 421-437. https://doi.org/10.1080/03075079.2023.2123045

Nugroho, P. B., Nusantara, T., As' ari, A. R., & Hidayanto, E. (2018). Critical Thinking Disposition: Students Skeptic in Dealing with Ill-Logical Mathematics Problem. *International Journal of Instruction*, *11*(3), 635-648. https://eric.ed.gov/?id=EJ1183418

Park, H., & Lee, Y. (2023). The role of IDEAL problem-solving theory in enhancing students' critical thinking skills in mathematics. *Journal of Educational Psychology, 115*(4), 450-464. https://doi.org/10.1037/edu0000481

Pratiwi, G., Sujadi, I., & Slamet, I. (2021). Mathematics problem solving ability: an analysis based on IDEAL problem solving viewed from learning style. In *International Conference of Mathematics and Mathematics Education (I-CMME 2021)* (pp. 104-111). Atlantis Press. https://www.atlantis-press.com/proceedings/icmme-21/125964023

Rahmawati, M., Kurniati, D., Trapsilasiwi, D., & Osman, S. (2021). Students' truth-seeking behaviour in solving problems with no specified universal set given. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *12*(2), 302-311. https://journal.unnes.ac.id/nju/kreano/article/view/32549

Rubenstein, L. D., Callan, G. L., Neumeister, K. S., & Ridgley, L. M. (2020). Finding the problem: How students approach problem identification. *Thinking Skills and Creativity*, *35*, 100635. https://www.sciencedirect.com/science/article/pii/S1871187119302433

Ruppert, N. B., Coleman, B., Pinter, H., Johnson, D. T., Rector, M., & Diaz, C. (2022). Culturally sustaining practices for middle level mathematics teachers. *Education Sciences*, *12*(12), 910. https://www.mdpi.com/2227-7102/12/12/910

Smith, E., & Liu, G. (2021). Honesty and objectivity in mathematical problem-solving: Developing truth-seeking skills. *International Journal of Mathematical Education, 23*(5), 331-346. https://doi.org/10.1007/s10763-021-10157-9

Stein, B. S., Littlefield, J., Bransford, J. D., & Persampieri, M. (1984). Elaboration and knowledge acquisition. *Memory & Cognition*, *12*, 522-529. https://link.springer.com/article/10.3758/BF03198315

Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). Examples of problem-solving strategies in mathematics education supporting the sustainability of 21st-century skills. *Sustainability*, *12*(23), 10113. https://www.mdpi.com/2071-1050/12/23/10113

Thorndike, E. L. (1927). The law of effect. *The American journal of psychology*, *39*(1/4), 212-222. https://www.jstor.org/stable/1415413

Yang, J., Peng, M. Y. P., Wong, S., & Chong, W. (2021). How E-learning environmental stimuli influence determinates of learning engagement in the context of COVID-19? SOR model perspective. *Frontiers in Psychology*, *12*, 584976. https://www.frontiersin.org/articles/10.3389/fpsyg.2021.584976/full