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# Construction Errors in Students' Mathematical Problem-Solving Based on Scaffolding Analysis

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

In mathematics learning, concept construction errors often occur when learning Systems of Linear Equations with Three Variables (SPLTV). This research aims to determine the process of students' concept construction errors, the causal factors, and how students overcome problems by providing scaffolding in SPLTV material. Data was obtained from test results and interviews with six students as research subjects. From the research results, data was received that the errors experienced by students in solving mathematical problems on SPLTV material were that the method used needed to match what was taught, made mistakes in calculations, did not make conclusions, and made mistakes at the previous stage. It was found that the factors that caused students' errors were lack of accuracy, misunderstanding of concepts, or needing to be more fixated on example questions. After being given the scaffolding stages, namely environmental provisions, explaining and reviewing, restructuring, and developing conceptual thinking, students know where their mistakes are and can correct them. Providing scaffolding can help students minimize concept construction errors when solving mathematical problems.

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## 1. INTRODUCTION

Education is an essential factor in the development of human civilization. The main aim of education is to develop students' potential to become human beings who believe and fear God, have noble character, are healthy, knowledgeable, capable, creative, and become democratic and responsible citizens. The curriculum is a reference for teachers to instruct students to achieve goals. The Merdeka Curriculum used in Indonesia uses intracurricular (70-80% of lesson hours) and co-curricular (20-30%) guidelines through the Pancasila Student Encouragement. The independent curriculum was created and implemented to give students enough time to explore concepts and strengthen their competencies and problem-solving abilities [1]. Strengthening competency and problem-solving skills covers all subjects taught at school.

One of the subjects oriented to problem-solving abilities is mathematics. Mathematics is the basic science of all fields of science that underlies the development of modern technology, has a vital role in various scientific disciplines, and advances human thinking [2]. School mathematics are elements or parts of mathematics selected based on or oriented toward educational interests and the interest in mastering and utilizing technology in the future [2]. In mathematics learning, learning objectives include behavior and knowledge that students must achieve [3]. According to Pratiwi [4], teaching mathematics aims to make students understand and understand toys. Therefore, understanding concepts greatly influences students' mathematical problem-solving abilities.

Mastery of concepts is needed to solve various problems in mathematics material. These problems are constructed in mathematics learning by thinking and solving ideas based on mathematical concepts and principles [5]. According to experts, students' conceptual construction errors in solving students' mathematical problems can be traced to four things, including (1) pseudo-construction, (2) construction holes, (3) mis-analogical construction, and (4) mis-logical construction. These four things can be used as a reference to discover errors in students' concept construction in solving problems, especially in mathematics at school.

Various studies show that concept construction errors often occur in mathematics when learning Three Variable Linear Equation Systems (SPLTV). According to Sitepu [5], in general, SPLTV material still has many problems for students and is one of the materials that could be more manageable. The results of observations made by researchers at SMAN 1 Muara Jambi show that students' mathematical problem-solving abilities are still relatively low. Apart from that, many students still need to improve their conceptual construction of the material. Apart from that, in general, many students still need help understanding the concept of SPLTV. The results of in-depth observations showed that students seemed unable to carry out the stages of problem-solving correctly, so the results of the problem-solving they created needed to be corrected.

Several other studies show that some factors cause students' low mathematical problem-solving abilities, including low mathematical resilience (resistance to mathematics). According to Handayani [6], experience, motivation, mathematical resilience (resistance to mathematics), ability to understand problems and thinking skills positively influence students' mathematical problem-solving abilities. The results of other research show that several positive attitudes towards mathematics must be developed in students; the attitudes in question include learning independence, self-confidence, self-ability, and a sense of perseverance and resilience (mathematical resilience) in facing mathematical difficulties or mathematical resilience [7]. This research is strengthened by Chusna [8], who states that students' mathematical problem-solving abilities can be sharpened if they have a positive attitude and are diligent and persistent in facing mathematical difficulties, especially in solving non-routine problems.

Mistakes made by students when solving mathematics problems need to be corrected so that students can avoid repeating the same mistakes and solve problems correctly. One way to do this is by providing scaffolding according to student needs. Providing scaffolding helps students develop the mindset to find the correct result. This aligns with research conducted by Capone [9] and Hayati [10], which states that students make mistakes when solving problems and can support students who experience difficulties or make mistakes in learning mathematics or other material.

Scaffolding can support various learning goals, including absorbing course content and concepts, increasing self-awareness, and providing motivational support [11,12]. Scaffolding understands how to use learning and teaching tools such as computerized learning platforms and learning techniques to adapt to different learning contexts. Li and Taber [13] stated that Vygotsky's theory introduced social constructivism, which consists of two things, namely studying social interaction and the zone of proximal development (ZPD). This scaffolding concept is in line with the opinion about ZPD. In the opinion of Badger [14] and Tabroni [15], students with assistants can do more than they could if learning was carried out in development. However, can the scaffolding concept be applied to mathematics learning to analyze various forms of errors in constructing mathematical concepts? This still needs to be answered with systematic research.

Azis' [16] research states that the problem-solving abilities of students in the upper group are in the low category, with an achievement percentage of 56.25%. The problem-solving abilities of students in the middle group are included in the deficient category, with an achievement percentage of 37.5%, and the ability of Student problem-solving for the lower group is included in the deficient category, with an achievement percentage of 22.08%. Meanwhile, Muqtada's [17] research stated that students' understanding of concepts in SPLTV material still needs to be fully ingrained in students. Unfortunately, research has yet to systematically describe and analyze the random forms that occur during mathematics learning. Such research has resulted in the absence of systematic efforts to reduce and resolve these forms of error so that they do not continue continuously in the future. Thus, this research aims to determine and analyze what errors students face when solving problems on SPLTV material.

## 2. METHODOLOGY

This research uses a descriptive qualitative approach. Descriptive qualitative research describes the results regarding the studied situation and is presented as a narrative description. This is based on the primary research objective: to analyze scaffolding to overcome students' errors in constructing mathematical concepts and solving problems on SPLTV material. The research was conducted at SMAN 1 Muara Jambi in the even semester of the 2022/2023 academic year, with the subjects being class X students. According to Martin [18], qualitative research is a method for exploring and understanding the meaning that several individuals or groups ascribe to social problems or humanity.

Research subjects were selected using a purposive sampling technique, namely a technique for determining subjects with specific considerations, namely (1) students who have studied SPLTV; (2) students who can express their thoughts verbally and in writing with the aim of revealing errors in concept construction so that they can collaborate with researchers in collecting research data; (3) students were selected with varying abilities from different classes in order to obtain diverse research results. The selection of research subjects was based on the results of students' daily test scores on SPLTV material; each student's mathematical abilities were different, and some students had high, medium, and low levels.

The data in this research describes students' concept construction errors when solving mathematical problems on SPLTV material. The data in this research was collected using technical tests and interviews. The instruments used in the research consisted of two: a sheet of 2 questions arranged in the form of descriptions and an interview guide sheet. Before use, an expert must validate the instrument to ensure data accuracy. This research consists of content validation, which aims to determine the material's suitability, construction, and language used. The interview sheet is carried out in a semi-structured manner; that is, the researcher asks questions freely, the main points of the questions formulated do not need to be asked sequentially, and the choice of words is also not standard. However, it is modified during the interview based on the situation.

In this research, the researcher described the interview results in words [19]. According to Indrawarmi [20], testing the credibility of data or trust in data resulting from qualitative research can be done by extending observations, increasing persistence, triangulation, discussions with colleagues, negative case analysis, and member checks. According to Ayuwanti [19], validating findings means that the researcher determines the accuracy or credibility of the findings through strategies such as member checking or triangulation.

The data analysis technique in this research consists of three data analyses, including: (1) Correcting the results of student work, after which they are ranked to determine which students will be used as research subjects. The results of the student's work, which are the subject of the research, are raw data that must be transformed into notes as material for interviews. (2) After that, the interview results are simplified into an excellent and neat language structure, then transformed into notes. (3) Presentation of the data. This is done by generating an organized collection of data from categories that allow conclusions to be drawn. Next, the data is presented as short descriptions, charts, relationships between categories, flowcharts, and the like [19].

## 3. RESULTS

After students take a written test by solving SPLTV questions, their steps in solving the problem can be seen, and the difficulties they face when solving SPLTV questions can be identified. Interviews are conducted to ensure students understand mathematical concepts when solving SPLTV questions.

The test results or responses from the subjects to the two questions above are presented in Table 1:

**Table 1. Examples of student answers to test questions**

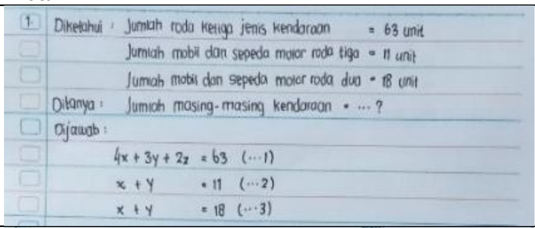
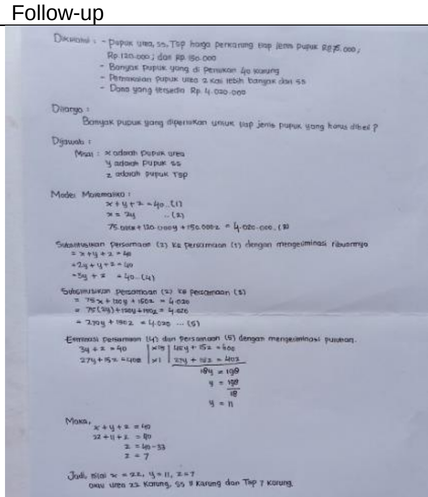
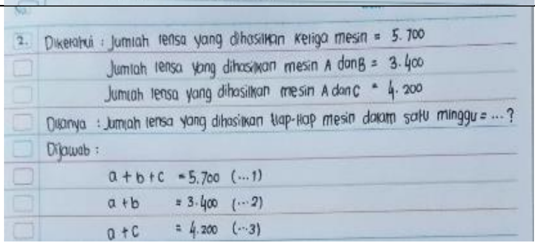
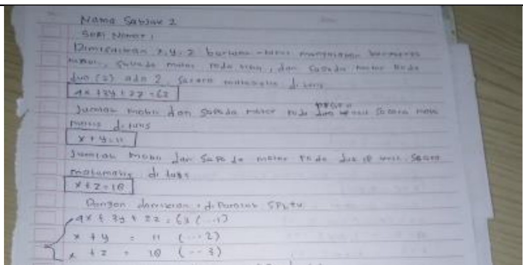
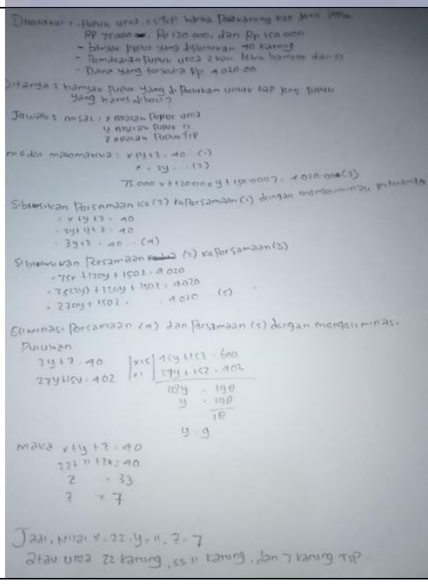
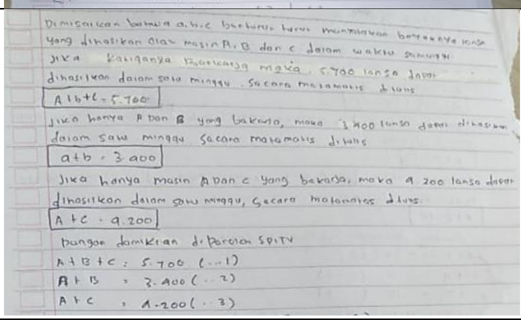
| Subject code | Student answers | |
|---|---|---|
| | Initial | Follow-up |
| S1 (1) |  1. Diketahui : Jumlah roda ketiga jenis kendaraan = 63 unit<br>Jumlah mobil dan sepeda motor roda tiga = 11 unit<br>Jumlah mobil dan sepeda motor roda dua = 18 unit<br>Ditanya : Jumlah masing-masing kendaraan = ... ?<br>Dijawab :<br>$4x + 3y + 2z = 63$ (...1)<br>$x + y = 11$ (...2)<br>$x + y = 18$ (...3) |  |
| (2) |  2. Diketahui : Jumlah lensa yang dihasilkan ketiga mesin = 5.700<br>Jumlah lensa yang dihasilkan mesin A dan B = 3.400<br>Jumlah lensa yang dihasilkan mesin A dan C = 4.200<br>Ditanya : Jumlah lensa yang dihasilkan tiap-tiap mesin dalam satu minggu = ... ?<br>Dijawab :<br>$a + b + c = 5.700$ (...1)<br>$a + b = 3.400$ (...2)<br>$a + c = 4.200$ (...3) | |
| S2 (1) |  |  |
| (2) |  | |

**Table 2. Analysis of student test results on mathematical problem-solving test questions**

| Subject Code | NQ | Subject Behavior | Type of Construction Error | Scaffolding Concept given | Code |
|---|---|---|---|---|---|
| S1 | 1. | Directly write a mathematical model without writing down the example. | *Pseudo Construction* Wrong | *Reviewing* level 2 | PCS |
| | | It seems like they do not understand and cannot make connections between mathematical concepts that are appropriate to the problem given | *Mis-Analogical Construction* | *explaining* level 2 | MAC |
| | 2. | Directly write a mathematical model without writing down the example. | *Pseudo Construction* Wrong | *Reviewing* level 2 | PCS |
| | | Not sure and unable to carry out truth tests when interviewed | Construction Hole | *conceptual development* level 3 | LK |
| S2 | 1. | Work on questions using commonly used procedures using X and Y equations. | Construction Hole | *Explaining* level 2 | LK |
| | | Does not understand the concept of elimination, even though the subject works on questions using mixed methods (elimination-substitution) | *Pseudo Construction Correct* | *restructuring* level 2 | PCB |
| | 2. | Do not write a conclusion in your answer | *Pseudo Construction* Wrong | *conceptual development* level 3 | PCS |
| S3 | 1. | I worked to completion with the correct procedure, but the answer was wrong. | *Pseudo Construction* Correct | *Explaining* level 2 | PCB |
| | | Not writing down examples and need for understanding of concepts. | *Mis-Logical Construction* | *Restructuring* level 2 | MLC |
| | 2. | Able to work on problem-solving problems but not write variable examples | *Pseudo Construction* Correct | *reviewing* level 2 | PCS |
| | | I followed the procedure correctly, but the answer needed to be corrected. | *Pseudo Construction* Correct | *Explaining* level 2 | PCS |
| S4 | 1. | We need to solve problems correctly, write what is known, and ask correctly. | *Pseudo Construction* Correct | *Explaining* level 2 | PCB |
| | | I am not writing examples and lack of understanding of concepts. | *Mis-Logical Construction* | *Restructuring* level 2 | MLC |
| | 2. | Able to work on problem-solving problems but not write variable examples | *Pseudo Construction* Wrong | *Reviewing* level 2 | PCS |
| S5 | 1. | Do it until it is finished and the procedure is correct, but do not write the conclusion of the problem. | Construction Hole | *Explaining* level 2 | PCB |
| | 2. | Able to work on problem-solving problems but not write variable examples | *Pseudo Construction* Wrong | *Reviewing* level 2 | PCS |
| | | Able to work until completion and the procedure is correct, but the answer needs to be corrected and hesitant. | *Mis-logical Construction* | *Reviewing* level 2 | PCS |
| S6 | 1. | Able to work on problem-solving problems but not write variable examples | *Pseudo Construction* Wrong | *conceptual development* level 3 | MAC |
| | 2. | Able to work on problem-solving problems but not write variable examples | *Pseudo Construction Wrong* | *conceptual development* level 3 | MAC |

Table 1 shows examples of answers from the subjects, in this case, subjects 1 and 2, and shows that the first subjects' answers to questions (1) and (2) were partially correct. The first subject still experienced some errors. However, after the first subject was assisted in the form of scaffolding and tested again with similar questions, the test results improved, as seen in the follow-up column. Like the first subject, the second subject also experienced several errors and improved after being assisted in scaffolding. The other subjects, namely the third, fourth, fifth, and sixth, have the same pattern with different error levels and positions. Providing scaffolding assistance has encouraged them to be able to correct errors in the follow-up process.

The subject's behavior, types of errors, and types of scaffolding assistance provided are systematically shown in Table 2:

Referring to the data in Table 2, it can be understood that each subject has different types of behavior and types of concept construction errors. This situation also requires that different scaffolding treatments be given. Providing scaffolding assistance, in general, has encouraged them to be able to correct errors in the follow-up process. This proves that providing scaffolding assistance positively impacts correcting types of conceptual construction errors by subjects or students.

## 4. DISCUSSION

Referring to the research data above, it can be understood that the process of occurrence and types of concept construction errors are different for each student.

### 4.1 Problem Understanding Stage in Mathematical Problem Solving

In the first stage of problem-solving, namely understanding the problem, there are two aspects that students must master based on the information provided. These two aspects are that the subject can express the meaning of the problem and the information contained in the problem. From the results of the analysis obtained, subject S1 experienced pseudo as seen from question number 1, writing the information given completely, but in question number 2, the subject only wrote known, but the information asked was not written down. It was also experienced by subject S4 on question number 2, subject S5 on question number2, and S6 on question numbers is in line with what Rahayuningsih [21] stated that errors at the stage of understanding the problem occur if the subject does not know or does not write down the information in the question and what the subject will do to solve the story problem related to SPLTV.

The subject thinks spontaneously so that the information obtained is immediately used to solve the problem without thinking more deeply about whether the information can solve the problem or whether other information is needed to help solve the problem. This is in line with the results of research conducted by Hidayanto [22], who said that process skills errors were caused by students needing more background knowledge and reasoning and errors in basic operational calculations. After looking again at the problem asked in the question, S3 realized that what was being asked was the maximum income from the sale of the two-party clothes. This is in line with research [23], which states that students are asked to review the problem-solving they have worked on at the reviewing stage. Therefore, reviewing is very useful for overcoming incorrect pseudo-construction errors.

A lack of understanding of the problem impacts errors in sorting and linking information to solve the problem. From this activity, it can be seen that the three subjects used problem-solving procedures spontaneously without thinking about whether the procedures were correct or not. This aligns with research by Vinner [24], which states that students who give spontaneous responses without realizing what they are doing experience pseudo-thinking. From this spontaneous thinking, they produce wrong answers and must reflect on their actions.

### 4.2 Solution Planning Stage in Mathematical Problem Solving

Subject S1 questions 1 and 2 experienced pseudo errors because the written answers on the test did not include examples, miswrote equations with the information given, and did not write mathematical equations. Students who show pseudo-construction errors can be caused by being used to working on questions of almost the same type and then using the steps they have learned to work on new problems, but they need to recheck the concept. It is in line with [25] which states that students who think pseudo-thinking is because students are used to working on questions of the same type. Hence, students return to thinking about using previously used procedures, and they only care about completing answers quickly and do not carry out the steps. Recheck the answers so that students do not realize that the answers that students have given are not correct. Students' errors in pseudo-construction are also in line with the results of Salsabila's [26] research, which stated that students could solve questions well and that the answers they produced were correct, but there were errors.

Then, subject S3 questions number 1 and 2 experienced a pseudo-wrong thinking process, which can be seen from the aspect of the loss of the control stage where the subject ignored one of the components, namely not writing the example and lack of understanding of the concept because when writing the mathematical equation the subject did not understand it. Subject S4 experienced a loss of control, a lack of cognitive commitment, and a lack of conceptual understanding. It can be seen from the subject's answer that he did not write the examples in questions number 1 and 2, the equations written did not match the information given for question number 1, and he did not write the symbols for equations one and two for questions number 1 and 2.

The types of errors that arise in understanding the problem are students who are incomplete in writing down the steps used, do not write down the methods and steps used, and make mistakes in creating mathematical models. Another mistake is that students need to write down the equations. As Yusuf [27] said, students can make equations but need to explain the meaning of the variables.

At the stage of solving the problem, subject S1 questions number 1 and 2 experienced pseudo errors, namely the loss of control over the answers to the steps in the process, because the answers they worked on needed to match what was taught. Then, subject S2 on questions 1 and 2 experienced a loss of control (ignoring one of the components obtained). For example, during the interview, the subject said that the method used was substitution, even though the subject worked on question number one using a mixed method (elimination-substitution), which could be seen From these two errors, subject S2 experienced a pseudo-correct thinking process because when working on problem-solving questions, the subjects all did it correctly at this stage. However, during the interview, it turned out that the subject's answers needed to match the answers they should have.

Furthermore, subject S3 on question number 1 answered correctly the concept of elimination work. However, the subject was still rushing to work on the question. The subject did not write the conclusion at the stage of completing the problem-solving plan, did not write down the examples at the planning stage for solving the problem, and lacked cognitive commitment, namely, carrying out other activities unrelated to learning. In line with the results of research conducted by Satoto [28], Wahab [29], and Rahmawati [30] stated that students made errors in their final answers because they needed to write down the final results according to the procedures or steps used.

According to Dewi & Kartini [31], to be able to minimize student errors in solving SPLTV questions, students need to receive reinforcement regarding knowledge of mathematical symbols or terms, students need to be given explanations using concrete or tangible teaching aids, students need to be trained to understand problems in questions as a whole, students need to get used to solving story problems mathematically and clearly, and teachers should remind students to recheck their worksheets before collecting them.

### 4.3 Calculation Implementation Stage in Mathematical Problem Solving

At the stage of carrying out calculations and problem-solving, especially subject S4 questions number 1 and 2, I experienced a loss of control, a lack of cognitive commitment, and a lack of conceptual understanding. Mis-logical construction errors made by students align with the results obtained from research by Wulandari [32], which indicates that students made concept construction errors due to illogical assumptions. Based on the previous explanation, the vital thing to educate students is to understand that to study mathematics, students must first understand the concept because by understanding this concept, students can construct the intended meaning.

At the stage of completing the solution plan, the subject was good at calculating, but the results were wrong because the subject needed to correct the math equation. Subject S5 for questions 1 and 2 was pseudo-correct because the answer was correct, but during the interview, the student was not careful with his answer, so he stated the result incorrectly. Subjects S1, S3, and S4 at this stage were subjects who still needed to complete the mathematical model they had made, made a mistake in the calculations, and did not solve problems according to what was asked.

Another error is that students need to write the conclusion correctly and write the conclusion, which aligns with what Yusuf [27] said: that students understand the SPLTV material well enough to know the procedures for solving questions. However, there are still errors, namely, the conclusion must be written according to what was written and requested in the question. Researchers provide scaffolding in the form of explaining, namely by explaining the correct concept in determining decision variables through the problem asked in the question. It aims to ensure that S1 and S3 can accept new concepts, which can be constructed for the next concept [33]. In addition, students still need to conclude the answers obtained. Based on research results, Tunu [34] stated that difficulties in concluding answers occurred because students were not used to making conclusions from the answers they obtained.

4. Re-examination Stage of Problem Solving Procedures and Results in Mathematical Problem Solving.

Errors at this stage include errors in the reasonably high category. It can be seen from the interview results that the teacher explains truth testing or checking again, but when giving practice questions, no aspect asks students to recheck answers or test the truth. The type of error that appears at this stage is that students need to recheck the answers they get, which is in line with research conducted by Fatmala [35], which found that, on average, students do not recheck their answers. Another error is that students do need to complete their checks when they check again.

The research showed several subjects (S1 and S3) experienced mis-analogical construction errors. When S1 and S3 were asked why they did this during the interview process with researchers. During the interview, the researcher provided scaffolding in the form of reviewing, namely by asking S1 and S3 to review the questions given to understand the meaning of the sentences. Reviewing is provided so that students reflect on what they have done.

After getting the answer, the subject felt satisfied and did not recheck the answer he produced. Subjects are allowed to reflect. When given the opportunity to reflect for the first time, the subject did not make maximum use of the reflection time, giving the impression that he was reflecting without actually using his mind to solve the problem. Thus, this fact is in accordance with research by Ni'mah [36], which shows that the errors in concept construction often found in students are pseudo construction, construction holes, mineralogical construction, and mislogical construction.

When students carry out mathematical problem-solving activities and make concept construction errors, the errors made by students in learning mathematics need to be of grave concern because these errors will impact students' understanding if they are not immediately addressed. To correct errors in conceptual construction, assistance or reinforcement is needed from the teacher or supervisor in the form of reinforcement or scaffolding appropriate to the student's circumstances and needs.

The results of the problem-solving test analysis show that the application of scaffolding in solving mathematics problems on the subject of linear equations with three variables is relatively good. The results of this research align with Tan [37] research that using scaffolding strategies can improve mathematical problem-solving skills. Scaffolding is applied at two levels, namely explaining, reviewing, and restructuring, and the third level, namely developing conceptual thinking [38].

Based on the results of this research, providing scaffolding can significantly help students understand the concept of SPLTV so that they can solve mathematical problems. Students begin to understand where their difficulties and mistakes lie and can begin to overcome them. Scaffolding is an effort to assist students with questions, instructions, reminders, directions, or encouragement when they experience errors in solving problems. According to Kumalasari [39], scaffolding helps/supports a person during the initial stages of learning and then slowly removes the support towards learning independence [1].

According to Vygotsky (Santrock, 2019), scaffolding is a change in guidance during a learning session, where more skilled people change the guidance according to the student's ability level. As for providing scaffolding to help students solve difficulties in learning, according to Anghileri (2006), there are three levels of scaffolding, as a series of effective learning strategies that may or may not be seen in the classroom, namely: (a) Level 1, environmental provisions, namely environmental management—learning that allows learning to take place without direct intervention from the teacher. A common thread can be drawn from previous research. Based on theoretical studies and researchers' findings in this research, it is clear that students' mistakes can be overcome with intense guidance by teachers through the provision of scaffolding.

The factors that cause problem-solving errors in solving SPLTV mathematics questions are divided into cognitive and non-cognitive factors. Cognitive factors include remembering, understanding, applying, analyzing, evaluating, and creating. Non-cognitive factors include attitude and personality, learning, physical health, emotional state, teacher's way of teaching, learning facilities, and home atmosphere.

## 5. CONCLUSION

Based on the results of the research and analysis that has been carried out, it can be concluded that solving complete mathematical problems means that students can carry out the problem understanding stage (making it known and asked), the solution planning stage (making mathematical examples and models), the calculation implementation stage (solving problems using substitution, elimination, or combination methods), as well as the examination stage returning procedures and results of problem-solving (making calculation results and conclusions). However, there are several errors experienced by students in solving mathematical problems in the System of Three Variable Linear Equations (SPLTV) material, namely: (a). Pseudo Construction, where students write mathematical models without writing examples of the questions given, incorrect explanations of the methods used, and students do not write conclusions about the questions; (b) construction Hole, where students learn with habitual factors (doing questions using commonly used procedures). For example, the subject only knows that the variables that can be taken, for example, are only x and y; (c) mis-Analogical Construction, where students need help understanding and making connections between mathematical concepts that are appropriate to the problem given; (d) Mis-logical construction, where students work on solving the problem until it is finished and the procedure is correct. However, the answer was wrong because the initial stage of solving the number calculation was wrong, and they were doubtful about their answer. The scaffolding given to students is Level 1 (explaining, reviewing, and restructuring) to help students understand the problem and Level 2 (developing conceptual thinking) to develop concepts that students have mastered. Based on the results of research that has been carried out, researchers hope that teachers can provide scaffolding to students whose answers are wrong. That way, all students will master the material, and the teacher should provide reflection time or encourage students to reflect to minimize incorrect concept construction. Based on the constraints and limitations of this research, the researcher provides recommendations for similar research to perfect this research. Future researchers should be able to collect data quantitatively and expand the scope of conceptual construction errors in solving mathematical problems based on the provision of scaffolding. Future researchers can further refine and deepen the scaffolding stages related to pseudo-thinking, such as pseudo-analytical and conceptual.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Aisyah PN, Nurani N, Akbar P, Yuliani, A. Analysis of the relationship between mathematical problem solving abilities and self-confidence of junior high school students. Journal on Education. 2018; 1(1):58-65.
2. Kolgatin, Kurniasari C, Hidajat D, Handayani YA. Analysis of the difficulty of solving story problems on arithmetic sequences and series using polya indicators for class x students. Numeracy. 2022;9(2):122–137.
3. Syam S et al. Learning and learning. Medan: Kita Write Foundation; 2022
4. Pratiwi B, Hardiansyah MA, Ramadhan I, Suriyanisa S, Kusumayanti N, Yeni Y. Analysis of changes in the online to offline learning implementation system during the COVID-19 pandemic in junior high schools. Basicedu Journal. 2021;5(6):5840-5852.
5. Sitepu, Fatmasari HR, Waluya SB, Sugianto S. Mathematical problem solving ability in view from 7th grade students.' Self-Efficacy. 2022;11(2).

6. Handayani K. Analysis of factors that influence the ability to solve mathematical story problems; 2017.
7. Alexandra G, Queen N. Profile of mathematical critical thinking abilities of junior high school students using graded response models. Mosharafa: Journal of Mathematics Education. 2018;7(1):103–112.
8. Chusna CA, Rochmad, Prasetyo APB. Students' mathematical resilience in team assisted individualization learning in an effort to improve mathematical reasoning ability. National Postgraduate Seminar. 2019;157–162.
9. Capone R. Blended learning and student-centered active learning environment: A case study with STEM undergraduate students. Canadian Journal of Science, Mathematics and Technology Education. 2022;22(1):210–236.
10. Hayati TR, Thursday. Analysis of mathematical literacy processes in high school students. International Journal of Trends in Mathematics Education Research. 2019;2(3):116-119.
11. Gilbertson K, Ewert A, Siklander P, Bates T. Outdoor education: Methods and strategies. Human Kinetics. Handayani; 2017.
12. Syaiful S, Kamid K., Muslim M, Huda N, Mukminin A, Habibi A. Emotional quotient and creative thinking skills in mathematics. Universal Journal of Educational Research, USA. 2020;8(2):499–507.
13. Li X, Taber KS. The future of interaction: Augmented reality, holography, and artificial intelligence in early childhood science education. In STEM, Robotics, Mobile Apps in Early Childhood and Primary Education: Technology to Promote Teaching and Learning. Springer. Maharani and Bernard. 2018;415–442.
14. Badger K, Morrice R, Buckeldee O, Cotton N, Hunukumbure D, Mitchell O, Mustafa A, Oluwole E, Pahuja J, Davies D. More than just a medical student: A mixed methods exploration of a structured volunteering program for undergraduate medical students. BMC Medical Education. 2022; 22(1):1–12.
15. Tabroni I, Irpani A, Ahmadiah D, Agusta AR, Girivirya S. Implementing and strengthening the literacy movement in elementary schools during the COVID-19 pandemic. Multicultural Education. 2022; 8(01):15–31.
16. Aziz R. Implementation of curriculum development. Implementation of Curriculum Development. 2018;VII(1):44–50.
17. Muqtada MR, Paskalia Pradanti, Subaidah. Student perspectives on the implementation of project based learning in mathematics learning planning courses. ASYMMETRIC: Journal of Mathematics and Science Education. 2023;4(2):66-75.
18. Martin G, Chang B. Intersectionality: Scaling intersectional praxis. In A. Maisuria (Ed.), The Encyclopedia of Marxism & education Brill. 2022;341-354. Available:https://doi.org/10.1163/9789004505612_021
19. Ayuwanti I, Siswoyo D. Teacher-student interaction in mathematics learning. International Journal of Evaluation and Research in Education. 2021;10(2):660-667.
20. Indrawarmi Ulfa YL, Roza Y, Maimunah, M. High school students' mathematical problem solving ability on distance material in space shapes. Mosharafa: Journal of Mathematics Education. 2022;11(3):415–424.
21. Rahayuningsih P, Qohar A. Error analysis solving story problems on systems of linear equations in two variables (SPLDV) and their scaffolding based on newman's error analysis in class viii students of smp negeri 2 poor. Journal of Mathematics and Science Education. 2014;II(2):109-116.
22. Hidayanto T, Subanji, Erry Hidayanto. Description of middle school students' thinking structure errors in solving geometry problems and defragmenting them: A case study. JKPM: Journal of Mathematics Learning Studies. 2017;1(1): 72-81.
23. Tyaningsih RY, Padian BHL, Subarinah S, Soepriyanto H. Analysis of problem solving ability material on systems of linear equations with three variables in view of students' cognitive style. Journal of Classroom Action Research. 2023;5(2):73-80.
24. Vinner S. The pseudo-conceptual and the pseudo-analytical thought processes in mathematics learning. Educational Studies in Mathematics. 1997;34(1):97–129.
25. Wahyudi W, Anugraheni I. Mathematical problem solving strategies. Salatiga: Satya Wacana University Press Satya Wacana Christian University Jl. Diponegoro. 2017; 52-60.

26. Salsabila, Azhar E. Analysis of pseudo-thinking errors in solving mathematical problems viewed from self-confidence. UNION: Scientific Journal of Mathematics Education. 2022;10(2):239~252.
27. Yusuf A, Fitriani N. Analysis of junior high school students' errors in solving two-variable linear equation problems at SMPN 1 Campaka Mulya-Cianjur. JPMI (Journal of Innovative Mathematics Learning). 2020;3(1):59-68.
28. Satoto S, Sutarto H, Pujiastuti E. Analysis of errors in student learning results in solving questions using the newman procedure. Unnes Journal of Mathematics Education. 2013;1(2).
29. Wahab A et al. Strengthening character education through digital literacy as a strategy towards immersive learning in the 4.0 era. Journal of Education and Counseling. 2022;4(5):4644-4653.
30. Rahmawati C, Zhanty LS. Analysis of secondary students' communication abilities towards mathematical resilience. 2019;X(X):147–154.
31. Dewi SP, Kartini K. Analysis of student errors in solving problems on systems of linear equations with three variables based on the newman error procedure. Scholar's Journal: Journal of Mathematics Education. 2019;5(1):632–642.
32. Wulandari. Analysis of mathematics problem-solving ability and self-efficacy of state middle school students in ciamis regency. An Analysis of Mathematics Problem-solving Ability and Self-Efficacy of Junior High School Students in Ciamis Regency. 2017;4(2): 166–175.
33. Wahyudi W, Anugraheni I. Mathematical problem solving strategies. Salatiga: Satya Wacana University Press Satya Wacana Christian University Jl. Diponegoro. 2017;52-60.
34. Tunu DJI, Daniel F, Gella NJM. Analysis of students' ability to solve mathematics story problems in terms of gender. Scholar's Journal: Journal of Mathematics Education. 2022;6(2):1499-1510.
35. Fatmala RR, Sariningsih R, Zhanty LS. Analysis of the mathematical problem solving ability of class vii middle school students on social arithmetic material. Scholar's Journal: Journal of Mathematics Education. 2020;4(1):227-236.
36. Ni'mah R, Sunismi, Fathani AH. Misconstruction of mathematical concepts and their scaffolding. Edudikara: Journal of Education and Learning. 2018;3(2):162–171.
37. Tan H. Description of mathematical problem solving ability. University of Medan; 2019.
38. Anghileri J. Scaffolding practices that enhance mathematical learning. Journal of Mathematics Teacher Education. 2006; 9(1):33-52. Available:http://doi.org/10.1007/S30857-006-9005-9
39. Kumalasari E. Differences in mathematics learning outcomes for students taught using drill and expository methods. Journal of Research in Mathematics Education and Teaching. 2016;2(1):21–28.

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