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Scaffolding Learning Strategy on Students' Problem Solving Abilities Material on Lines and Series

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Abstract

Problem solving is an ability that students need to master in learning mathematics. Each student has different problem solving abilities. Student errors in problem solving mean that students do not understand the material well. One of the supports that teachers can provide is through scaffolding (assistance). Scaffolding is provided according to student needs related to students' problem solving abilities. The purpose of this article is to describe scaffolding as an effort to help students in solving mathematical problems regarding sequences and series. This research is a qualitative descriptive study which aims to describe scaffolding as an effort to help students in solving mathematical problems regarding sequences and series. The students involved in this research were class Meanwhile, the research subjects were 2 students taken from the understanding mapping group who needed assistance, namely AD and ZA. Data collection techniques through tests and interviews. The data analysis technique follows the Miles and Huberman model by testing the validity of the triangulation data technique. The research results show that there are errors in the problem solving process. Therefore, the scaffolding provided with the explaining, reviewing, and restructuring stages can help students in solving mathematical problems. Based on research, providing scaffolding can be used as a solution for students to overcome errors in solving problems

Keywords: *Problem solving, scaffolding, explaining, reviewing, restructuring*

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A. Introduction

Mathematics is one of the subjects taught from elementary to upper secondary level. It is not uncommon for mathematics to be considered a problem. The reason why many students feel uninterested in learning mathematics is because they think that mathematics is difficult, challenging, boring and uninteresting because school based learning emphasizes cognitive components and students lack motivation and interest in learning (Buchori & Kholifah 2022, 175). Higher learning education is gradually being recognized as a service industry, where the students are the customer (Abdullah at al, 2019). According to Bautista (2013) The theory posits that human behavior is learned observationally through modeling: from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action. Conceptual scaffolding can be employed to help students mastering key concepts in asynchronous mode. Mathematics is closely related to problem solving. Based on the results of an interview with the class The importance of problem solving abilities is given to students so that they are able to solve mathematical problems logically, systematically, critically and openly. Based on the principles and standards of school mathematics from the National Council of Teacher Mathematics (NCTM 2000, 52) it also states that "Problem solving is an integral part of all mathematics learning". This means that problem solving is an important part of mathematics learning.

Dahar (2011, 121) states that the ability to solve problems is basically the main goal of the educational process. Problem-solving proficient are one of the goals of mathematics learning at school, namely training how to think and reason in drawing conclusions, developing problem-solving abilities, and developing the ability to convey information or communicate ideas through oral, written, pictures, graphs, maps, diagrams, and so on (Depdiknas 2006, 6). The importance of problem solving abilities was also expressed by Branca (1980, in Sumartini 2016) that (a) problem solving is the general goal of teaching mathematics, (b) problem solving which includes methods, procedures and strategies is the core and main process in the mathematics curriculum, and (c) problem solving is a basic ability in learning mathematics. Therefore, teachers have a very important role in developing mathematical problem solving abilities in students both in the form of learning methods or models used, as well as in evaluations in the form of creating supporting questions. An effective learning model in mathematics learning includes values that are relevant to achieving mathematical abilities and provide opportunities for the rise of student creativity (Purwati, 2010).

Based on the diagnostic test given at the beginning of the lesson, group mapping was obtained into three categories, namely proficient, quite proficient, and needing assistance. Based on this explanation, assistance is needed in solving mathematical problems, one thing that can be done is application scaffolding in learning. Learning Scaffolding is defined as a technique for providing learning support, which is carried out at an early stage to encourage students to learn independently (Nurhayati, 2016).

Anghileri categorizes scaffolding into three levels, namely level 1, level 2, and level 3. At level 1, the assistance provided by the teacher is preparing the student's learning environment (classroom organization). Activities carried out by teachers in preparing the learning environment include forming groups (peer collaboration), arrange seating (sequencing and pacing), and providing structured assignments (structured tasks). At level 2, teachers and students are directly involved in an interaction. The forms of interaction in question include : explained(explain), namely conveying the concepts learned, reviewing(reviewing), namely refocusing students' attention, and restructuring (rebuilding understanding), namely simplifying something abstract so that students can understand it. At level 3, there is interaction between teachers and students aimed at developing conceptual thinking by creating opportunities to express understanding for students and teachers (Anghileri 2006, 39). Researchers use scaffolding Level 1 through group activities by providing assistance through process differentiation to groups with criteria for needing assistance, then continued with level 2. At level 2 the provision scaffolding through direct socialization between teachers and students. The form of socialization includes 1) explaining (Explaining), 2) review (reviewing), and 3) restructuring (restructuring). three of the six original scaffolding strategies are motivational (recruitment, direction maintenance, and frustration control) and the other three are cognitive (reduction in degrees of freedom, marking critical features, and demonstration) (Belland at al, 2013)

A few studies on problem-based learning with scaffolding, most notably those by Jatisunda and Nahdi (2020), indicate that students' ability to solve problems more effectively when they are involved in problem-based learning with scaffolding is higher than when they are involved in problem-based learning without scaffolding. Then, Khatimah et al. (2017) state that when an algebra problem is presented, thought barriers occurs in students with higher (S1) and lower (S2) learning disabilities. The scaffolding that is provided is tailored to the challenges that students face during the phases of comprehending the problem, formulating a strategy, executing the plan, and reflecting on the process or outcome. In addition, research (Yuntawati, 2017) indicates that the results of the study, which were obtained by hypothesis testing using t testing,

indicate that the use of scaffolding is effective in increasing the ability to solve mathematical problems.

The study that has already been completed focuses on the impact of scaffolding strategy in addressing the problem of matematics among students. This research's results are consistent with those of previous studies, which found that scaffolding use negatively affected students' learning process in maths class, leading to the conclusion that most research projects were unsuccessful. Based on the description above, the teacher acts as a facilitator in the learning process by providing assistance (scaffolding) tailored to the needs of each student. This assistance aims to help students overcome barriers to thinking in solving problems while studying. With scaffolding, students are encouraged to achieve independence in solving their learning problems. Teachers can also adjust the type and level of assistance based on the individual characteristics of each student.

B. Methods

This research is a qualitative descriptive study. As a preliminary study aimed at providing elaborations on the aspects, types, and strategies of scaffolding, the present study adopted George's model of library research (2008). The students involved in this research were 36 students of class X PM 2 at SMK N 2 Semarang. However, only 2 students were selected as research subjects who came from the group category that needed guidance, namely AD subjects and SKA subjects, based on the location of errors that had the same characteristics and could be provided. Scaffolding continued level 2, because level 1 was given during group activities. This research uses data collection techniques, namely through tests and interviews. The test in question is a test of problem solving proficient on sequence and series material. The test is given so that researchers know the form of administration scaffolding appropriate to help students in solving the problems given. Apart from that, interviews were carried out after students completed questions and activities which were only carried out with 2 people who were research subjects.

The data analysis technique used in this research consists of three streams of activities that occur simultaneously, namely data reduction, data presentation, and data verification and drawing conclusions (Miles & Huberman, 1992). Meanwhile, the implementation stage of this research consists of several stages, namely; (1) Preliminary Stage, (2) Preparation Stage, (3) Implementation Stage, and (4) Data Analysis Stage (Safira et al., 2023:1486). The data validity test used in this research is technical triangulation. Technical triangulation can be done by checking data from the same source, but with different techniques (Mekarisce 2020, 150). This technique is an interview technique which is then compared with the student's test results. After comparing, researchers can find out whether there is a match between the interview results and the

test answers of the research subjects (Safira et al., 2023, 1486). Data analysis in qualitative research is the process of simplifying data into a form that is easy to read and interpret (Purwati, 2010).

C. Result and Discussion

The research aims to help students solve mathematical problems with strategies scaffolding. The results of the research are in the form of a description of the given of scaffolding as a solution to overcome the thinking errors of class X PM 2 SMK N 2 Semarang students. Research is carried out by providing assistance scaffolding level 1 in the initial activities is organizing the learning environment through group activities. Group mapping is based on three categories, namely proficient, quite proficient, and needs assistance. Each category consists of two groups with the intensity of assistance and assistance varying between groups. Scaffolding more intensively in two groups with the group category that needs assistance. Mentoring is carried out occasionally and then released when students understand the problem solving process on the LKPD provided. After level 1 activities are carried out, the teacher carries out a problem solving test. Based on the results of the problem solving test, then continue scaffolding level 2 is based on the characteristics of students' errors.

The intervention focused on establishing key components of knowledge-building learning (Scardamalia, 2002): (1) improvable ideas: Learning activities and teacher-student interactions established that all ideas regarding literary theories were improvable and that no knowledge—even that from authoritative sources—was finite. (2) Rise above thinking : Learning activities focused on scaffolding students' abilities to develop merging understandings and encouraging them to build on and extend their own and other students' ideas. (3) Progressive discourse: Students practiced adding to, justifying, and challenging literary interpretations in classroom and Knowledge Forum discussions in which the progression of ideas, idea diversity, and building on others'ideas became visible and extended beyond one class or one learning activity

The flow of explaining the description by showing the results of the work before it is given scaffolding and after being given scaffolding. Below we will show the results of the work each subject. Based on problem solving problem p the work of the AD subject is shown in figure 1.

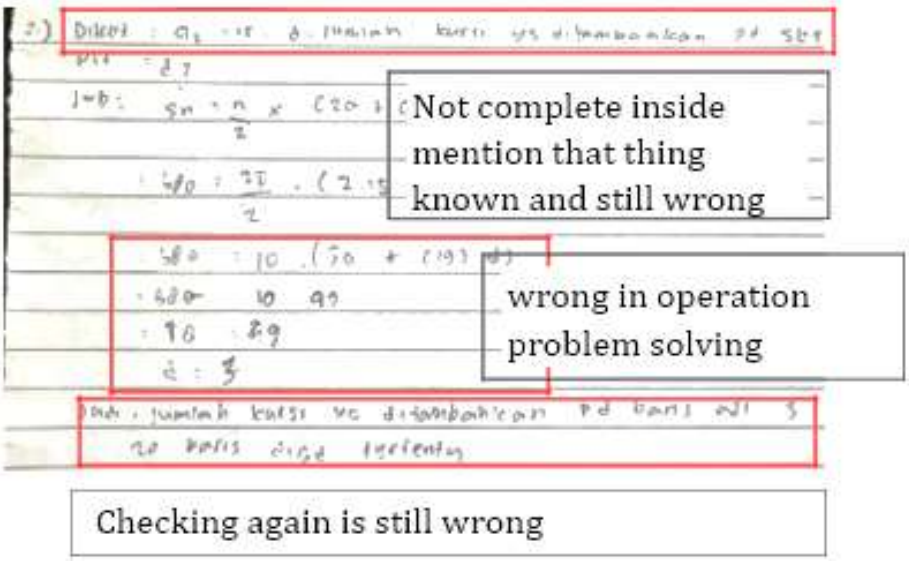

Figure 1. AD errors before providing scaffolding

Based on Figure 1, the results of subject AD's work on rows and series problems still show errors in the problem solving indicators. In the indicator of understanding the problem, AD subjects still wrote down what they knew incorrectly and were incomplete. In the problem planning indicator, the AD subject makes a solution plan that leads to the correct answer but is still wrong in using the problem solving strategy, so that in the rechecking indicator, the AD subject still makes mistakes in solving the problem given. Interview excerpts from subject AD are shown in Figure 2.

Researche	: "Try to pay attention to the problem given, do you understand the problem well?".
Subject AD	: "I don't understand yet, ma'am.".
Researche	: "Why can you write like that?".
Subject AD	: "Because there is the word amount, just keep looking at the writing on the blackboard."

Figure 2 Interview Results of AD Subjects Regarding Question Work

Based on Figure 2, the researcher provides scaffolding by asking the AD subject to mention things that are known to first understand the problem and state the formula that will be used to solve the problem (Explaining). The next stage the researcher directed AD subjects to carry out distribution operations in addition and subtraction, then division operations (reviewing). After the process is complete, the next stage is that AD subjects

are given the opportunity to think and solve problems according to the directions given (restructuring). Job results of AD subjects after administration scaffolding in figure 3.

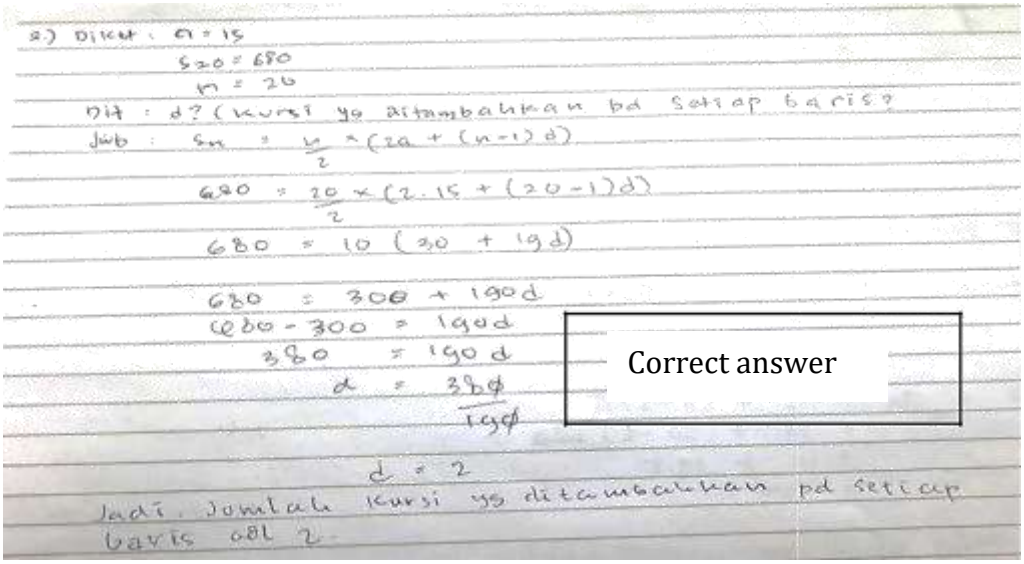

Figure 3. Results of work on AD Subject after given of *scaffolding*

Based on figure 3 after administration scaffolding, AD subjects are able to correct errors and comply with problem solving indicators. Therefore, it can be said that it is a given of scaffolding can be used as a solution for AD subjects to overcome their problems in solving mathematical problems. Problem solving in problem solving for subject ZA is not much different from subject AD. The results of subject ZA's work are shown in Figure 4.

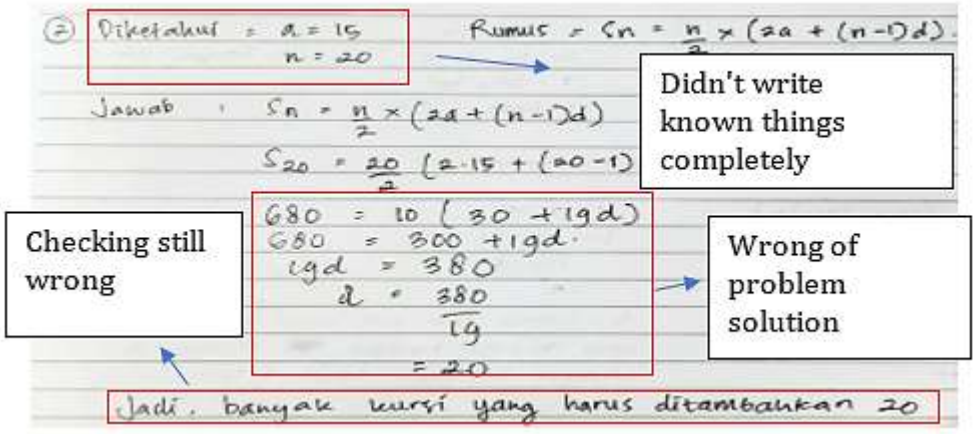

Figure 4. ZA errors before providing *scaffolding*

Based on Figure 4, the results of subject ZA's work, there are several errors in the indicators of problem solving ability for sequence and series material. In the indicator of understanding the problem, subject ZA does not seem to understand the problem because he is incomplete in writing down the things he knows. Subject ZA also did not write down what was asked in the question so it did not meet the problem planning indicators. Subject ZA has developed a problem solving strategy by writing down the formula used to solve the problem but is still hampered by errors in the distribution calculation procedure addition and subtraction. This has the impact that the conclusions drawn by subject ZA are still wrong.

The results of subject ZA's work in Figure 4 show errors in solving mathematical problems and getting final results that are still wrong. Excerpts from subject ZA's interview are shown in Figure 5.

Researcher	: " Pay attention to the known part, is it complete or not?".
Subject ZA	: " Not yet, Mom ".
Researcher	: " Then, where do you understand the problem?".
Subject ZA	: " I see my friend's work, Mom ".
Researcher	: " For the calculation part, are there any procedures that you are still confused about? Why is the front one 300, the rear still 19d?".
Subject ZA	: "Uh, forgot to multiply the last one, Mom".
Researche	: "That means checking the return is still wrong, right?".
Subject ZA	: "Yes, Mom"

Figure 5. Interview results of ZA subjects regarding problem solving

Based on Figure 5, the researcher provides Scaffolding by conveying things that are known so that you can then understand the problem in the problem given (explain). Then proceed with reviewing the results of work on the ZA subject with the formula used and the calculation process (reviewing). The next stage directs subject ZA to continue the work until the end (reconstruct the process is complete, the next stage is that subject ZA is given the opportunity to solve the questions according to the directions given. Results of sub-gifting work scaffolding in Figure 6

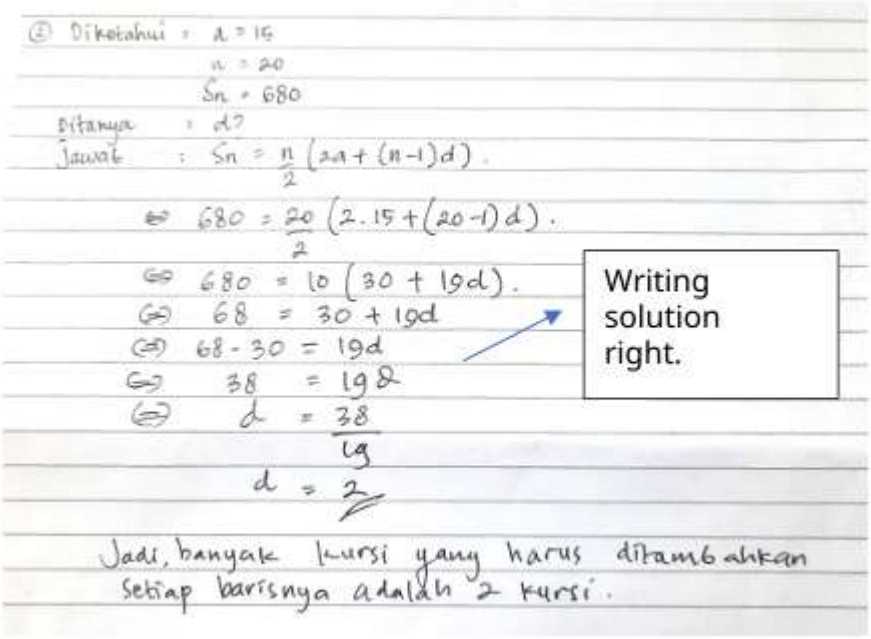

Figure 6. Results of work on subject ZA after given of *scaffolding*

Based on figure 6 after administration scaffolding ZA subjects were able to correct errors in problem solving by using appropriate operations. Therefore, it can be said that it is a given of scaffolding can be used as a solution for ZA subjects to overcome errors in problem solving. Checking the validity of gift data scaffolding AD subjects and ZA subjects in table 1.

Table 1. Checking the validity of data on scaffolding provision

No.	Indicator giving scaffolding	Subject AD	Subject ZA	Triangulation Source
1	*Explaining*	Given the opportunity to think and solve the problem others according to concept direction has been given	convey known things and asked for then you can understand the problem in that matter given	Convey back concept which has taught to learners

2	*Reviewing*	direct to doing operation internal distribution addition and subtraction, then surgery division	review results work on the subject ZA with that formula use and process calculation	Focus return attention learners
3	*Restructuring*	given the opportunity to think and finish problems as directed that has been given	direct to continue work arrives end up to review.	Simplify Something that abstract so you can participants understand educate

Based on the above explanation, scaffolding serves as a substitute to optimise the learning process, particularly problem-based learning, by providing assistance that is tailored to the needs of the student. The research findings are based on an analysis conducted in a non-destructive manner on the subjects AD and ZA using a scaffolding strategy with non-significantly different characteristics. Integration of scaffolding strategies to help students build up autonomy in learning online (Suwastini at al, 2021).

D. Conclusion

Based on the discussion above, it may be concluded that students are not very good at solving mathematical problems. It is important for students to provide assistance in the form of scaffolding that is tailored to students' needs. The scaffolding that researchers apply to study participants in order to assist them in resolving their own problems has been defined by phases that include explanation, review, and restructuring. After putting up the scaffolding, the student can improve the problem-solving process by following the guidance of the instructor. Therefore, it can be said that scaffolding installation can be considered a solution for disabled people to overcome obstacles in problem solving.

A useful strategy for further research would be to provide scaffolding support during the teacher-student learning process through ongoing evaluations. This would

enable the learning process to proceed in an efficient manner and meet the intended learning objectives, with maths lessons being particularly beneficial for the students.

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