

The Influence of the Assisted Problem-based Learning Model Scaffolding Method against Problems Solving and Communication Ability of High School Students

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Abstract

This study aims to examine the influence of the assisted problem-based learning model scaffolding method against ability-solution problem participants studied at SMAN 9 Palu, and the influence of the assisted problem-based learning model scaffolding method against ability communication participants studied at SMAN 9 Palu. Study This has been held in the odd semesters of 2023-2024 teaching in class X MIA SMAN 9 Palu. The type of research used is a quantitative study that employs a quasi-experimental method with a non-equivalent control group design. Population under study This is all over participants educate class X at SMAN 9 Palu year 2023/2024 teachings consisting of 5 groups. A study with a large number of participants educates up to 157 people. The sample study consists of class X MIA 2 as the class experiment and class X MIA 1 as the respective class controls, totaling 25 participants with specified education, based on the technique of purposive sampling. Data collection techniques use instrument test ability to solve issues and sheets observation ability to communicate. The effect size of the use-assisted problem-based learning method of scaffolding amounted to 5.83, while the conventional model (lecture) was 4.77 with a difference of 1.06 (category high). Average percentage yield ability communication participant students who use the assisted problem-based learning model entrance scaffolding method in category moderate (score 40–59%) to high (score 60–79%), whereas class control using a conventional model (lecture) entry in category less (20–39%) up to moderate (score 40–59%) for percentage score each aspect. Based on the results of the study, it was concluded that: (1) the assisted problem-based learning model is an influential scaffolding method for ability-solution problem participants studied at SMAN 9 Palu, and (2) the assisted problem-based learning model is an influential scaffolding method for ability-communication participants studied at SMAN 9 Palu.

Keywords: Problem-based learning model, scaffolding method, ability solution problems, capabilities communication.

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Introduction

The ability to solve problems and communicate demands necessary abilities that are noticed and developed. That thing has been emphasized in a way explicit in the revised 2013 curriculum as competence basic must be developed and integrated into some material and field-appropriate studies, one of which is field studies science.

Biology is one of the subjects covered in field studies science. Biology is regarded as one of the eye-capable lessons that improve problem-solving abilities. This thing caused an eye-opening biology lesson about phenomena natural and problems with creatures living. A phenomenon or problem can be a stimulus for increasing the ability to solve problems and improve communication among participants. Therefore, the ability to solve problems and communicate needs to be developed through eye lessons in biology.

The ability to solve problems entails the ability to analyze problems until a solution is found. Ability This becomes the focus you want to achieve the teacher because, through ability solutions, students' problems can actualize what they get from learning, which is then applied in their lives (Putri et al. 2019). In line with this, Rahmawati (2018) points out that the skills solution problem is not optimal for students because of a lack of ability to identify and analyze given problems.

The ability to communicate is very capable and important. For mastered participant education, participants can process information received and convey information that with

appropriate so that meaningful learning can occur. Urwani, et al. (2018) revealed that to get something conceptual, participants need communication as a means of sharing knowledge, ideas, notions, or opinions between two people or more. Ability to communicate with participants with low education, seen from participants educating those who don't want to be involved in the presentation and questions answered (Budiaty, 2013). Ability low communication can result in participants education experiences multiple perception or misconceptions so that objective learning is delivered with good (Aeni et al. 2017).

Based on results, observations, and interviews with an eye teacher about lesson biology at SMAN 9 Palu, which was carried out on October 27, 2022, it was found that implementation of learning biology still cannot meet various demands by the revised 2013 curriculum, including the ability to solve problems and communicate with participants. This thing is caused by the fact that the learning process is not yet fully student-centered, and is less variable in using models and methods. The learning that can be done will increase communication as well as hone the ability of the participant to think and solve problems.

The low ability solution problem participant educated, looked from method student in do and finished the question given to the participant educate. Moment participants educated on the given question found that not all participants educated could understand problems and plan solutions to problems that fit the question. Students are more dominant in solving

questions straight away and not checking again, what are the results obtained, already by the provision for the problem in question, or vice versa. This thing shows that participants are not yet capable of finishing problems by stages of ability to solve problems according to [Polya \(1973\)](#), namely: understanding problems; planning settlement; finishing problems by plans; and checking and returning all steps taken and done.

The ability solution problems participants educated, classified as low, caused because, during the ongoing learning process, teachers are lacking in bringing up related phenomena with material for searching for the solution. Besides, that's why there are not enough teachers to train and get used to participant education with activity solution problems. Participant education is also rare given questions that lead to ability solution problems because the teacher feels difficulty in making related questions about the problem. On the other hand, participants were seen as passive in accepting information from the teacher, had difficulties controlling concepts, and only memorized material provided by the teacher.

Ability communication participant education is still classified as low. This thing can be seen in the learning process. We still found passive and reluctant learners involved in presentations and questions answered. There are only two to four participating students who ask or respond to the teacher. Besides, it was found that participants were educated on difficult answers to given questions, even used language that was not yet following the rules, and spoke good and correct language. The low ability of communication participant education is also visible from not enough belief in self-participant education. For teachers and students to ask about things they haven't understood, as well as participants to educate still embarrassed stare/see against talk during the discussion process taking place. The teacher also stated that the ability to communicate with participants has not yet once measured, because of the limitations in time for internal teachers to make instrument evaluations, communication causes teachers to ignore assessments of abilities, communicate with participants, and emphasize cognitive as well as affective abilities.

Several previous studies that have been carried out, among others, by [Armana, et al. \(2020\)](#) show that group students studying with problem-based learning own skills think critically and think more creatively compared to group students studying with a conventional learning model. [Iftitahrahimah, et al. \(2020\)](#), in their research, show that the problem-based learning model influences the ability of communication between written and oral students on the principal solution electrolytes and non-electrolytes. Research conducted by [Aprilia and Fajar \(2022\)](#) shows that ability, communication, mathematics, and independence study students who follow a problem-based learning model in a significant way are better than students who follow the conventional learning model. [Irnaningsih, et al. \(2022\)](#) show that the problem-based learning model is influential and significant to students' ability to think critically and solve problems. [Irawan, et al. \(2022\)](#) also show that problem-based learning STEM-based using influential mobile learning is significant to skills solution problems and independent study students. Research conducted by [Widyawati, et al. \(2023\)](#) shows that problem-based learning and scaffolding have a significant effect on the ability to think critically. Likewise, research conducted by [Alipvia, et al. \(2022\)](#) shows that scaffolding has a great influence on motivation and results in study students.

Possible efforts are made to overcome problems by using models and methods of appropriate learning to increase the ability to solve problems and educate participants in

communication. This is an assisted problem-based learning (PBL) method. Scaffolding can be made as one possible alternative used in the learning process to increase the ability to solve problems and educate participants in communication.

Problem-based learning is a learning model that presents an appropriate problem, reality, and meaning to the participant. It is investigated in a way that is open and finds a solution. Problems studied are contextual problems found by students in life every day ([Pramistyasari, 2022](#)). In principle, PBL emphasizes improvement and repair methods. Study to strengthen draft in real-life situations, develop high-level thinking skills, problem problem-solving abilities, and improve liveliness. Study students, develop skills, make decisions, dig up information, improve, believe in yourself, bear responsibility, cooperate, and communicate ([Supiandi & Julung, 2016](#)). [Angga \(2022\)](#) put forward that the PBL model is capable of increasing 4C abilities (thinking critically, communication, collaboration, and creativity) in participants.

Scaffolding is an effort to assist students in the form of motivation, warnings, instructions, or pictures, outlining the steps, top solution problems, expressed examples, or other activities that direct students to understand and learn in an independent way ([Mustofa et al. 2023](#)). Application scaffolding in learning places the participant educated as someone who has the freedom to learn and explore his abilities through help or teacher guidance. As a result, scaffolding can stimulate activity and educate participants. Build freedom Study participant education can be done gradually by the teacher, who gives help to the participant and also gradually reduces help for the participants to be capable and independent in finishing problems.

The use of scaffolding can increase interaction between teachers and participants and educate them more intensively, so the ability to communicate with participants educates them more and makes them capable of solving problems in an independent manner. The results of research conducted by [Amaliya et al. \(2023\)](#) show that scaffolding can contribute to the syntactic process of learning in PBL, so second, optimizing independence can help learners learn and improve other 21st century skills like creativity, collaboration, communication, and critical thinking. Hence, scaffolding is one of the methods of proper learning that is applied inside the class ([Lestari, 2016](#)). The Objectives of this research are as follows: (1) to know the influence of the problem-based learning model and help method scaffolding on ability solution problem participants studied at SMAN 9 Palu; (2) to know the influence of the problem-based learning model and help method scaffolding on ability communication participants studied at SMAN 9 Palu.

Methods

The type of research used is a quantitative study that employs a quasi-experimental method with a non-equivalent control group design. The population under study is all over participant education class X at SMAN 9 Palu year 2023/2024 teachings consisting of 5 groups. A study with a large number of participants educates up to 157 people. Sample in research uses two classes: class X MIA 2 as a class experiment consisting of 25 participants consisting of students of 9 men and 16 women, as well as class X MIA 1 as a class control totaling 25 participants consisting of students of 11 men and 14 women. A sample study was determined based on the technique of *purposive sampling*. The type of data obtained from the study is quantitative data, namely the data obtained from the results of tests and non-tests.

For determining ability, solving problems, and communication, the Instrument test used: measure ability solution problem consists of 10 essay questions, meanwhile sheet observations used: measure ability communication consists of 12 items indicators that have been covered in 6 aspects of ability communication, namely: 1) discuss; 2) understanding fill material; 3) file questions; 4) draw conclusions; 5) smoothly communicate; and 6) language in class. Deep data collection techniques: study This is a test in the form of 10 essay questions given through the *pretest* and *posttest*. For measuring ability solution problems, sheet observation is used. For knowing ability communication, participants are educated based on six aspects of ability communication that are observed and measured during the learning process taking place. Data analysis techniques used for measuring ability solution problems consist of prerequisite tests in the form of normality and homogeneity tests, hypothesis testing in the form of a t-test, and an effect size test using SPSS version 25. To measure ability communication, we used a formula to count the percentage of each aspect of ability communication.

Results and Discussion

Based on normality test results, ability solution problem participants teach in class experiments show that results from the pretest and posttest have a sig value > 0.05 . This is proven by the results of the pretest, where a sig value was obtained, namely, $0.200 > 0.05$, and the posttest, namely, $0.169 > 0.05$, which means both data are normally distributed, so for hypothesis testing using parametric tests, whereas the normality test results in ability to solve a problem, participants taught in class control show that the results of the pretest and posttest have a sig value > 0.05 . This is demonstrated by the pretest results, where the obtained sig value was $0.200 > 0.05$, and the posttest results, where the obtained sig value was $0.200 > 0.05$, indicating that both data were normally distributed. To test the hypothesis, we also use parametric tests.

Homogeneity test results pretest in-class experiments and class control show that sig value > 0.05 . This thing is proven by the pretest data results' ability solution problem participants teach in class experiments and class control with sig value, namely $0.584 > 0.05$, which means the data is homogeneous and can continue to test the hypothesis. Whereas homogeneity test results posttest in-class experiments and class control show that sig value > 0.05 . This thing is proven by posttest data results' ability solution problems participants teach in class experiments and class control with sig value, namely $0.395 > 0.05$, which means the data is homogeneous and can continue to test the hypothesis.

Testing hypothesis can done if precondition testing hypothesis already fulfilled. Hypothesis testing for normally distributed and homogeneous data is parametric in the form of a t-test, but if the data is not normally distributed and not homogeneous, it is nonparametric in the form of the Mann-Whitney U test. Based on the results of the prerequisite test, the data obtained is data that is normally distributed and homogeneous, so the test was carried out. As for hypothesis test results in the study, this is as follows:

Pretest and posttest results in the class experiment show that the sig value is < 0.05 . This is proven by the sig value obtained, namely $0.000 < 0.05$, which means paired test results. For ability solution problems, participants in the class experiment show that before and after learning, there is a difference in average pretest and post-test scores in the class

experiment. Whereas results from the pretest and posttest in class control show a sig value < 0.05 . This is proven by the sig value obtained, namely $0.000 < 0.05$, which means paired test results. For ability solution problems, participants teach in class control and show that before and after learning, there is a difference in average pretest and posttest scores in the class control.

Based on independent test results, pretests for ability solution problems in class experiments and class control show that the mark sig. (2-tailed) is 0.808. The test results for the ability solution problem show that the sig value is > 0.05 . This is proven by the sig value obtained, namely $0.808 > 0.05$, which means independent test results, test ability, solution problem, and participant education before the use of problem-based learning models help method scaffolding does not there is the difference in average values pretest class experiments and class control. Independent test results (posttest) for ability solution problems in class experiments and class control show that the mark sig. (2-tailed) is 0.037. The posttest results for the ability solution problem show that the sig value is < 0.05 . This is proven by the sig value obtained, namely $0.037 < 0.05$, which means independent test results, test ability, solution problem, participant education after use of problem-based learning models, help method scaffolding is available, and difference in average values posttest, class experiments, and class control.

Test the effect size to know if there is influence after using the problem-based learning model assisted by the scaffolding method in the classroom experiment and conventional models (lectures) in class control. Testing done with compare results before and after learning done with the use of analysis effect size.

Effect size test results show that the assisted problem-based learning method of scaffolding gives a more distant influence with a value of 5.83 than the conventional model (lecture) with a value of 4.77. The effect size value obtained between class experiments and class control's difference of 1.06 Based on interpretation effect size, [Cohen & Morrison \(2011\)](#) stated that value 1.06 entered in category high, which means the use of assisted problem-based learning model method scaffolding has a greater impact on results, ability to solve problems, and participant education than the use of conventional models (lectures).

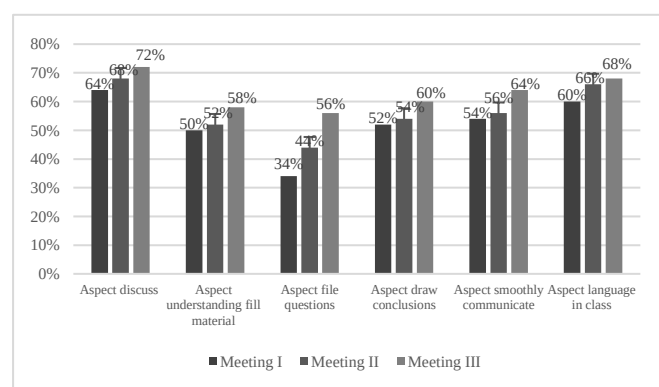


Figure 1. Percentage of aspect communication ability for experimental class.

The ability to communicate participant education can be measured using sheet observation. Sheet observations are used to form several filled statements with a method of giving a score. For each activity, communication participants are educated in the learning process.

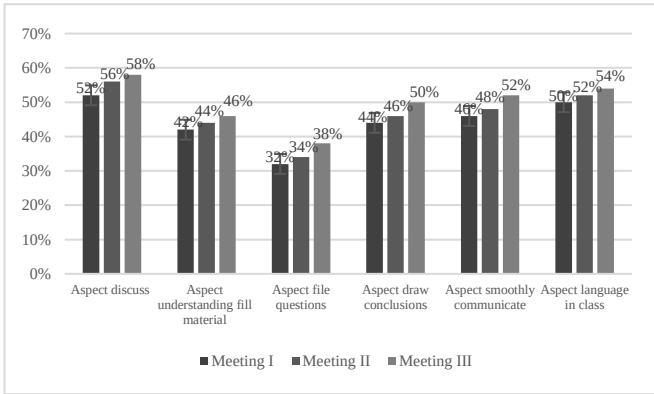


Figure 2. Percentage aspect communication ability for control classroom.

Ability communication participant students who are measured refers to six aspects, namely: 1) discuss; 2) understand fill material; 3) file questions; 4) draw conclusions; 5) smoothly communicate; and 6) use language in class. Analysis results in the ability to communicate with participants learned in the class experiment and control can be seen in Figure 1.

Based on Figure 1, shows the enhancement percentage for every aspect of communication at meetings first, second, and third, with a category mark range currently until high. Enhancement percentage: each aspect can be seen from the mark of the difference obtained in the score mark from first to third. Difference mark percentage aspect ability communication on aspects discuss (8%), aspect understanding fill material (8%), aspect submits questions (4%), aspects take conclusion (8%), aspect smoothness communicating (10%), and aspects language in class (8%). Meanwhile, in Figure 2, it also experiences an increase, but enters the category mark range not enough until medium, with a difference mark percentage of aspect ability communication on aspects discussed (6%), aspect understanding fill material (4%), aspect file questions (6%), aspect conclude (6%), aspect smoothly communicate (6%), and aspect language in class (4%).

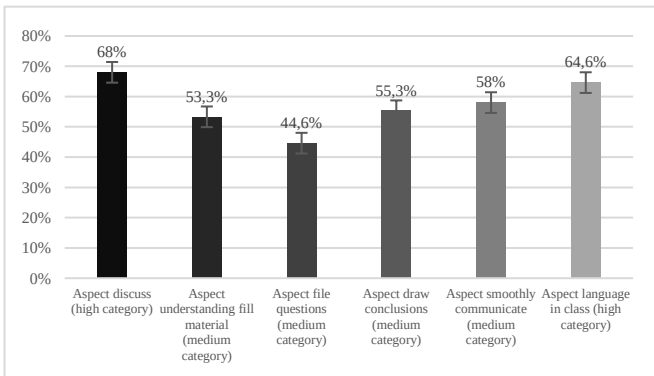


Figure 3. Average percentage communication ability (experiment)

Based on Figure 3, it can be concluded that the use of different learning models can have an impact and influence on results, communication, and participant education. This can be seen from the average percentage results of ability communication participant education, where class experiments using the assisted problem-based learning method of average scaffolding comes into in category currently until tall for percentage score each aspect.

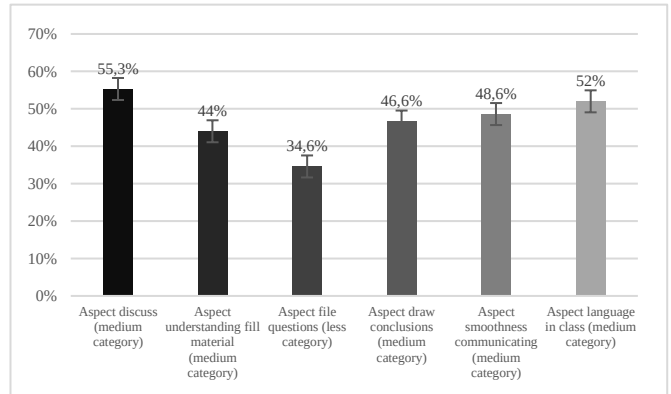


Figure 4. Average percentage communication ability (control).

Based on the results of the research in the class experiment and control (whereas class control using a conventional model (lecture) entry in the category is not enough until currently for percentage score each aspect), after a paired t-test was carried out, results showed that the average score obtained in the class experiment showed a significant improvement that was bigger with the average pretest score is 54.58 and the posttest score is 73.38, with a difference of 18.80 whereas the class control obtained the average pretest score is 53.86 and the average posttest score is 66.55, with a difference of 12.69. This thing shows that the ability of communication participants to teach in class experiments increases more than class control.

Independent pretest t-tests on class experiment and control show that the ability solution problem participants before the use of problem-based learning models help method scaffolding and conventional models (lectures) are not there difference in average values pretest class experiments and class control. This can be seen from the average value of pretest class experiments and controls that have a difference of 0.72. The difference in values demonstrates that No There is a difference in the ability solution problems between class experiments and class control (meaning they have the same start). Meanwhile, the independent post-test t-test on class experiments and control shows that the ability solution problems participants are educated after the use of problem-based learning models, method scaffolding, and conventional models (lectures). There is a difference in average values between posttest class experiments and class control. This can be seen from the average posttest score of class experiments and class control, which has a difference of 6.83. The difference in value shows that the use of problem-based planning models helps method scaffolding provide more influence on the ability to solve problems and educate participants compared to the use of conventional models (lectures).

Based on effect size tests, results show that using the assisted problem-based learning method of scaffolding gives a greater distance influence with a value of 5.83 than the conventional model (lecture) with a value of 4.77. The effect size value obtained between class experiments and classes controls its difference of 1.06 (category high), which means the use of assisted problem-based learning method scaffolding has a greater impact on the results' ability to solve problems and educate participants than the use of conventional models (lectures).

Ability communication participants teach in class experiments own more average value for every aspect of ability, communication is more important than class control. This thing can be seen in Aspect 1 (discussion), where the class experiment obtained a value of 68% (category high), while the class control obtained a value of 55.3% (category medium) with a difference

of 12.7%. In Aspect 2 (understanding fill material), the class experiment obtained a value of 55.3% (category medium), while the class control obtained a value of 44% (category medium) with a difference of 11.3%. In Aspect 3 (the filed question), the class experiment obtained a value of 44.6% (category medium) while the class control obtained a value of 34.6% (category less) with a difference of 10%. In Aspect 4 (conclude), the class experiment obtained a value of 55.3% (category medium), while the class control obtained a value of 46.6% (category medium) with a difference of 8.7%. In Aspect 5 (smoothly communicate), the class experiment obtained a value of 58% (category medium), while the class control obtained a value of 48.6% (category medium), with a difference of 9.4%. In Aspect 6 (language in class), the class experiment obtained a value of 64.6% (category high), while the class control obtained a value of 52% (category medium) with a difference of 12.6%.

The average percentage aspect ability communication participant educates well in class experiments nor class control shows that from six aspects that is the lowest percentage is the aspect of understanding fill material (aspect 2) with range category medium and aspect of submitting a question (aspect 3) with range category not enough until medium. The low mark in the percentage in aspect 2 is caused because participants are still not enough involved in explaining something appropriate with material learning, and participants still have difficult answering correctly following the draft material when asked, likewise, in aspect 3, participants are still doubtful and reluctant to ask about material that is not understood and about related things that are observed during the learning process. So the average participant students involved in learning process activities, especially ability communication on aspects 2 and 3, are only done by some participants educated in each group.

Based on this data, it can be concluded that the use of different learning models can have an impact and influence on results, communication, and participant education. This can be seen from the average percentage results of ability communication participant education, where class experiments using the assisted problem-based learning method average scaffolding comes in category medium (percentage score between 40 and 59 %) to high (percentage score between 60 and 79 %) for percentage score each aspect, whereas class control using a conventional model (lecture) entry comes in category less (percentage score between 20 and 39 %) to medium (percentage score between 40 and 59 %) for percentage score each aspect.

Conclusions

The results of the effect size test show that using the assisted problem-based learning model method scaffolding has a greater distant influence with a rating of 5.83 than using conventional models (lectures) with a rating of 4.77. The effect size value obtained between class experiments and classes control own difference of 1.06 (category high) This thing shows that using the assisted problem-based learning model method of scaffolding has more impact and influence on results, ability to solve problems, and participant education than using conventional models (lectures).

The average percentage ability communication participant students in aspect 1 (discussion) for the class experiment was 68% (category high) whereas class control was 55.3% (category medium); in aspect 2 (understanding fill material) class experiment 55.3% (category medium) while class control 44% (category medium); aspect 3 (file question) class experiment 44.6% (category medium) while class control 34.6% (category

less), aspect 4 (conclude) class experiment 55.3% (category medium) while class control 46.6% (category medium); Aspect 5 (smoothly communicate) class experiment 58% (category medium) while class control 48.6% (category medium), Aspect 6 (language in class) class experiment 64.6% (category high) while in class control 52% (category medium). This shows that using the assisted problem-based learning method of scaffolding has more influence on results, communication, and participant education than using conventional models (lectures).

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Conflicts of Interest

All authors declare that they have no conflicts of interest.

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