

The Ability of Problem Solving for Tenth Grade Student on Problem Based Learning About Web-Assisted from Students Independence

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Abstrak

Mathematics learning is very important given in order to the students can have problem solving skills. This study aims to test the effectiveness of PBL assisted by the web on students' problem solving abilities and describe problem solving abilities in terms of student independence. This research is a type of quantitative and qualitative. The study was conducted in Bangsri 1 Public High School SMA Negeri 1 Bangsri in the 2018/2019 academic year. The research subjects were tenth grade students consisting of one experimental class with web-based PBL treatment and one control class. Then two people were selected for the category of high, medium and low independence. Hypothesis testing uses one-party t-test and average difference test. The results of the study showed that PBL was assisted by the web effective against students' problem solving abilities. Students with high independence criteria do not always have good problem solving skills, but they show a significant increase after working on practice questions. Students with moderate independence criteria also showed an increase in problem solving skills after working on practice questions. Whereas in the low independence criteria there are students with good cognitive abilities but the problem solving ability improvement is low.

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INTRODUCTION

Mathematics is one of the fundamental sciences that is very important in this life. The problem solving ability is important for students because in daily life there are a lot of problems related to mathematics (Rajagukguk, 2011: 206). Problem solving ability is the process of solving a problem by using good and correct procedures to get to the desired solution (Anggraeni and Herdiman, 2018: 19; Febriyanti and Irawan, 2017: 32). According to Kotsopoulos and Lee's research (2012: 206) problem solving most often fails at the initial step of understanding. This is in accordance with the conditions that exist on tenth grade students at SMAN 1 Bangsri.

PBL is a learning model that presents contextual problems so that it can encourage students to learn and improve problem solving skills (Wardono et al., 2018: 481; Vendiagryst et al., 2015: 35). PBL provides a good flow for students in problem solving.

Character education is the planting of values in students and renewal of shared life planning that values individual freedom more (Asmani, 2013). Independence is an important character implanted. Independence of children must always be trained so that children can learn independently without waiting for their parents to be told when there is a task or there will be a test.

Web as a place to upload teaching materials, student worksheets, learning videos and places for discussion so that learning can be more efficient. In PBL, the problem given can be directly downloaded from the web and then done in groups. The problem solving process carried out in small groups provides an opportunity to discuss and exchange opinions that can develop students' communication skills (Situmorang, 2016: 14).

Trigonometry is material that is considered difficult for students. According to Cahyaningros et al. (2013: 115) and Alamsyah et al. (2012: 29)

trigonometry is one material where students are considered less successful in achieving its value. For the trigonometry material in tenth grade students, includes trigonometric comparisons of right triangles, trigonometric ratios, and rules of sines and cosines.

In a previous study an attempt was made to develop a learning media website conducted by Afgani et al. (2008). Further research, researchers are interested in developing trigonometric learning material with web-assisted PBL.

PBL assisted by the web is very important to solve problems that exist in learning mathematics in SMAN 1 Bangsri. Mastery of concepts and problem solving skills in order to realize quality learning can be supported by using computer assistance that provides web services (Doyan and Sukmantara, 2014: 118). With the existing wifi facilities in SMAN 1 Bangsri can be accessed from all classes, many students already have laptops and smartphones, PBL implementation can take advantage of web assistance as a support in learning.

The purpose of this study was (1) to test the effectiveness of PBL web-assisted on students 'problem solving abilities and (2) to describe the problem solving abilities in terms of students' independence in web-assisted PBL.

PBL web-assisted is expected to know the stages of mathematical problem solving abilities of high school students in solving various problems. So that the instructors can provide appropriate learning or coaching

METHODS

The type of research used is a type of mix method research (a mixture of quantitative and qualitative) with embedded design. This design can also be characterized as a mixed method strategy that applies one stage of quantitative and qualitative data collection at one time. Quantitative research as

a primary method while qualitative research as a secondary method.

There are two stages of research where research begins with a preliminary study in order to identify problems in the field by conducting studies on data, interviews with teachers, and studies in the literature. In stage two, researchers conduct quantitative and qualitative research in tandem.

Quantitative research to determine the effectiveness of problem-web assisted -based learning on problem-solving abilities while qualitative research to determine problem-solving abilities based on student independence. Quantitative research used is an experimental study design quasi experimental with post-test only control group design.

The population in this study were tenth grade students of SMAN 1 Bangsri. Of the 10 classes of tenth grade students, 1 experimental class was selected which was given web-assisted problem-based learning and 1 control class that was given problem-based learning only. In qualitative research, the research subjects used were only the classes that received web-assisted problem-based learning interventions, namely the experimental class. The research subjects were selected from the experimental class where two independent categories were chosen by two students to analyze their problem solving abilities. Based on the results of interviews and suggestions from class teachers, two were selected students with low categories, namely subjects K1 and subjects K2, students with moderate categories namely subjects K3 and K4, and students with high categories namely subjects K5 and K6.

The data sources in this study were students where they were obtained from the results of the student's problem solving ability test, the results of the independence scale, the interview results sheet for students 'problem solving abilities and students' independence. The research instrument consisted of test and non-test research instruments. The

instrument of the test is the problem solving ability test. Non-test research instruments include the scale of independence, interview guidelines for students' problem solving skills and guidelines for interviewing student learning independence. Each instrument was carried out a feasibility analysis where the test instruments were carried out construct validity, content validity and trial. The interview guideline instrument is only construct validation and content validation. Data analysis in quantitative research includes normality test, homogeneity test, completeness test. Qualitative data analysis follows the concept given by Milles & Huberman (2007), namely data reduction (data reduction), data display (data presentation), and conclusions: drawing / verification.

RESULTS AND DISCUSSION

The results of the web design can be accessed through the address www.waroengsinau.com. The start page of the web is a menu of teaching materials, materials, video tutorials and discussions.

Based on the results of the independence questionnaire in the experimental class students obtained results as in Table 1.

Table 1. Based Student Grouping Independence

Students Category	Students Total	Percentage
High	5	13.9
Modarate	25	69.4
Low	6	16.7
Total	36	100

Each category of independence was chosen by 2 students to analyze their problem solving abilities in depth. The selection of high category students was obtained from 2 students with the lowest independence score and the highest in the high category. The selection of medium category

students was obtained from 2 students with the lowest and highest independence scores in the medium category. While the selection of low students was obtained from 2 students with the lowest independence score and the highest in the low category.

Based on the results of the calculation of mastery learning experimental class using the proportion test of one party obtained the average value of students in the class with PBL web-assisted was 75.07 with 28 students who achieved individual completeness. This means that the percentage of students who complete individually on problem-based learning is more than 75%. So the problem solving abilities of students who get problem-based learning achieve learning completeness. Based on the different test average of the experimental class with the control class obtained the average value of students in the class with PBL web assisted is 75.07 and the average value of students in the control class is 67.64. The conclusion is that the average reliability of problem solving for students in the class with PBL assisted by the web is more than the problem solving ability of students in the control class

The different test average of two independent samples was used to determine whether the ability of the problem between the experimental classes was better than the control class students. Based on the calculation results obtained t value of 4.645 while the t table is 1.65. This means $t_{\text{count}} > t_{\text{table}}$, then the problem solving abilities of the experimental class students taught with PBL web help is higher than the control class.

The results of multiple regression tests with SPSS calculations show the value of R square = 0.942, meaning that it is 94.2% students' problem solving abilities are influenced by independence and the web as learning media, while 6.8% are influenced by other factors. The stepwise method is also used to determine the independence variable in influencing problem solving abilities. The stepwise

test results show that the influence of the independence variable on problem solving ability is 0.923 or 92.3%. The influence of the independence variable after adding web variables as a supporting media for problem solving ability is 0.942 or 94.2%. These results indicate that in this study the independence variable was more dominant in influencing problem solving abilities.

Students' problem solving abilities are assessed based on Polya's problem solving steps. In Figure 1 a diagram shows the acquisition of scores obtained by each experimental subject for four observations.

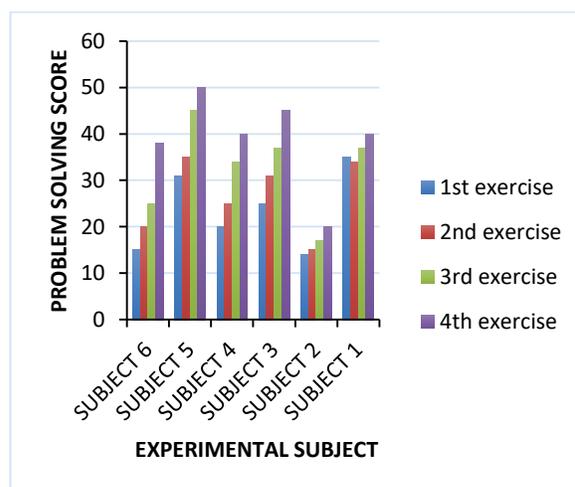


Figure 1. Problem Solving Ability Score

Increased observation score of problem solving ability of each subject from the beginning of observation to the end for K6 gain value of 0.51; K5 is 0.65; K4 is 0.5; K3 is 0.57; K2 is 0.13 and K1 is 0.20.

Web-based problem-based learning provides a learning experience for students to learn through problems given by the teacher through problem solving activities. Students build new knowledge by linking the knowledge they have before. This is in line with Sastrawati et al. (2011) who say that problem-based learning is a learning model that is implemented by giving meaningful problems to

students where the problem will be used as material for investigation so students can arrange own knowledge, develop higher skills, improve students and increase student confidence.

Students in the experimental class can solve the problems better than students in the control class. This is in accordance with the results of a study from Maretasani et al. (2015) which states that problem-based learning is effective against problem solving abilities. Students can understand the problem well, plan problem solving, carry out problem solving and check again. The process of self monitoring and self regulating helps students to find the right problem solving solutions because of their awareness to regulate and control the process of thinking whether the problem solving steps that he uses are in accordance with the objectives set. One of the failures of students in problem solving is due to the absence of self-monitoring and self regulation in students during the problem solving process (Schoenfeld, et al., 2002; Lee et al., 2014).

In this study, subjects for problem solving abilities of low category students were K1 and K2. Based on the results of the analysis it was concluded that K1 and K2 were students who rarely practiced trigonometric problems based on Polya's problem solving steps. Students with low categories tend to be confident with the knowledge they already have. They are less motivated to be better at solving problems.

Based on the results of data analysis, the results show that there are two kinds of low category students. First is students with a fairly good level of understanding if given a question and the second is students who are somewhat less able to understand a problem. Both of them did not experience significant changes in working based on problem solving steps. They lack practice in working according to the steps and are also not careful in doing it.

Subjects for problem solving ability of students in the medium category are K3 and K4.

Based on the results of the analysis it was concluded that K3 and K4 were able to solve problems by understanding problems, planning solutions, and implementing plans. But less able to check back.

This medium category student is able to simplify the problem with do a simulation by making a picture to help him make a strategy to solve the problem. Make data selection according to what is known so that it can determine the appropriate formula to solve the problem.

The stage of implementing the plan is carried out by students in the medium category well and correctly Moderate category students are able to substitute data into a predetermined formula and carry out coherent and correct solutions. Seen in the written results of students in the medium category who are able to solve the problem correctly.

Students in the medium category are not able to carry out the re-examination phase properly. Because the category student is only able to re-examine the results of his work by recalculating the solution, so just checking the results without the process. Performing recalculation cannot detect errors in the completion process so students in the medium category cannot ensure that the answer is correct.

Subjects for problem solving abilities of high category students are K5 and K6. Based on the results of the analysis it was concluded that K5 and K6 from day to day have increase in understanding problem solving well. After interviews, this high category always repeats the results of the learning itself at school and at school. Even so there are still incorrect answers because students' ability to absorb learning is classified as lacking.

High category types are able to follow step by step problem solving well. Although there are students who are still confused in simplifying the problem to help him make a strategy to solve the problem. High category students make the data

selection sometimes not in accordance with the known and asked clearly so that the formula used is often less precise.

Even so, high category students always try to check the answers back. Based on the results of the interview, high category students re-examine the results of their work using another method, namely substituting the results that have been obtained to check the known data. This means that high-category students are able to re-examine the results

and workmanship process so that high-category students are sure of the answers and are confirmed by concluding the answers.

From the description above, high category students have an effort to be able to master good problem solving skills even though the end result is not as expected. All indicators of Polya problem solving have also been achieved by high category students. For more details, analysis of problem solving capabilities can be seen in Table.

Table 2. Problem Solving Skill

No	Indicator	Subject	Problem Solving Skill
1.	Understanding the Problem	K1, K3, K4, K5, K6	Students can write down what is known and asked from the problem in full.
		K2	Students can write down what is known and asked of the problem even though it is not yet completed.
2.	Planning for Problem Solving	K1, K3, K4, K6, K5	Students begin to be able to represent problems in images even though they are still in a simple form.
		K2	Students can write systematic problem solving plans.
3.	Implement Problem Solving	K1, K5	Students begin to need planning that is still not appropriate on plans that have been made even though sometimes it is still difficult to model
		K2, K3, K4, K6	Students begin to get used to trying to solve problems based on plans that have been made even though sometimes it is still difficult to model
4.	Re-examining and Making Conclusions	K1	Students can carry out problem solving based on problem solving plans
		K2, K3, K4	Re-examine the results of his work and can draw conclusions even if only a few words
		K5	Re-examine the results of his work even though sometimes it is not thorough and can make conclusions, although rarely advise other answers.
		K6	Not used to checking answers and making conclusions. Start getting used to checking the results of their work and making conclusions

At the end of the meeting a student response questionnaire was given in trigonometric learning from the experimental class to respond with an average of 76% (good category). This is due to various varied and innovative learning activities such as internet access, and group discussions that make students not bored and happy to receive learning. Besides that, it is reinforced by web-assisted learning which causes discussion in learning to become more meaningful for students.

Students' response to learning is one of the supporters of student motivation in following the learning process. Especially in mathematics subjects whose learning context is difficult to understand students, without any student response, learning will be difficult to achieve goals.

CONCLUSION

Based on the results of the research and discussion, the authors can conclude that PBL is web-assisted effective on students' problem solving abilities. Students with high independence criteria do not always have good problem solving skills, but they are showed a significant increase after working on practice questions. Students with moderate independence criteria also showed an increase in problem solving skills after working on practice questions. Whereas in the low independence criteria there are students with good cognitive abilities but the problem solving ability improvement is low.

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