
THE EFFECT OF PROBLEM BASED LEARNING INTEGRATED WITH ANDROID-BASED MEDIA ON EXCRETION SYSTEM MATERIALS TOWARDS THINKING SKILLS AND MASTERY OF CONCEPT

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Abstract

Today's students are required to have problem solving skills to meet 21st century education competencies. Problem Based Learning is a learning model that requires students to find and solve their problems so that students' interest in learning is significant. The use of media in learning can attract the interest of students, one of which is Android-based media so that research is conducted to analyze the effect of Problem Based Learning integrated with Android-based media on excretory system material on thinking skills and mastery of concepts. This research is a type of quasi-experimental research using matching-only pretest-posttest control group design. Sampling of research classes using purposive sampling technique, so that two classes were obtained as treatment and comparison classes. Student learning outcomes in the form of thinking skills and mastery of concepts were analyzed using SOLO taxonomy and carried out t-test. The results of this study indicate that the level of thinking skills and mastery of students' concepts in the application of Problem Based Learning is integrated with Android-based media higher than students in the application of Problem Based Learning without integration with relational and extended abstract thinking skills and mastery of concepts as much as 80%. It can be concluded that Problem Based Learning integrated with Android-based media on excretory system materials influences thinking skills and mastery of concepts.

Keywords: problem based learning, android media, thinking skills, mastery of concepts

INTRODUCTION

Education has a crucial function to shape the human resources needed in the future. Education is required to develop along with the times. Members of the Asia-Pacific Economic Cooperation (APEC) define four competencies of the 21st century that must be integrated into the education system, namely lifelong learning, problem solving, self-management and teamwork (APEC, 2008). The demands of competencies that students must have at this time are also getting higher.

Education in Indonesia from time to time continues to grow by improving the existing curriculum. Curriculum 2013 is the latest curriculum that has so far been implemented; this curriculum is expected to be able to answer the needs and challenges of the 21st century. In the development of the 2013 Curriculum there is several improvements in mindset namely learning patterns to be student-centered, interactive, networked, active-searching, group learning, based on multimedia tools, strengthening the

development of the unique potential of each student, various sciences (multidiscipline), and critical (Permendikbud RI Number 69, 2013).

Based on observations made when carrying out the Real Teaching Practice program at State Senior High School 1 Gresik, teachers in these high schools have used appropriate learning models to improve the competency of students billed in the 2013 curriculum by using students-centered learning models such as Discovery Learning and some material with the Problem Based Learning model. In the learning model in the implementation, the teacher only uses the lecture method accompanied by powerpoint media, and only a few teachers use the media in the form of flash animation. Learning resources used are only printed books, and some teachers use student worksheets (which only contain material bills in theory).

Problem Based Learning (PBL) has been used in learning in State Senior High School 1 Gresik, but it is still rare, Biology teachers often use the Discovery

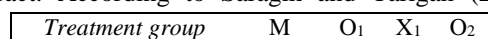
Learning method. Students are often taught to find their knowledge of learning material, but many students have not been trained to hone problem solving skills related to learning material. The ability to solve problems is the highest intellectual ability because in solving problems, students must combine rules or abilities at lower levels (Gagne et al., 1992: 54). PBL trains problem solving skills so that students can sharpen their thinking skills. Marzano (1992) adds that thinking skills are the ability of students to develop their thinking and skills in problem solving.

Problem Based Learning (PBL) will trigger the curiosity of students to be able to solve the problems they have faced. For this reason, student interest is something that must be considered in this learning. If the students do not have an interest or lack of confidence to solve problems because of difficult problems, then they will be reluctant to try to solve them (Sanjaya, 2014: 221). The teacher, as a facilitator, must make students actively involved in learning by attracting their attention.

According to Mulyasa (2008), if most (75%) students are active in learning, in social, physical and mental, by demonstrating the amount of enthusiasm for learning, high self-confidence, and enthusiasm, then the learning process is said to be successful and quality. Teachers need learning tools that can help improve the quality of their learning so that the interest of students is high so that they are active in the course of learning. One learning device that can help teachers to overcome this is to use learning media.

Problem Based Learning (PBL) combined with multimedia and modules has a positive impact on student learning outcomes, the combination of PBL with multimedia is suitable for students who have a high level of abstract thinking ability, and the interaction between multimedia and modules affect students' learning outcomes and verbal abilities (Toto et al., 2012). Nirbita et al. (2018) added that PBL integrated with information and communication technology media can improve students' critical thinking skills in terms of five aspects, namely problem formulation, opinion submission, information collection and compilation, analysis and decision making and conclusions.

Excretion system material is material that discusses physiological processes that are closely related to the patterns of daily life and contains a series of processes that link the relationship between the structure and functions of excretory organs that cannot be seen with the naked eye so that they make them abstract. According to Saragih and Tarigan (2016),



students find it difficult to understand the material and concepts of excretion learning systems because they are abstract and the methods used by most teachers are still oriented towards achieving the material alone. The learning process in this material should be carried out with innovative learning methods and also raise the problems experienced daily, to help students understand the material.

Based on the description that has been described, the researcher wants to conduct a study of "The Effect of Problem Based Learning Integrated with Android-Based Media on Excretion System Materials Towards Thinking Skills and Mastery of Concepts".

METHODS

This type of research is an experimental study with a quasi-experimental design using the matching-only pretest-posttest control group design. The study was conducted by matching the experimental class and comparison class. The experimental class and the control class are homogeneous or the same class with certain characteristics in common but do not have the assurance that each subject is equal due to the subject in the complete class without random assignments. The characteristics used are the similarity of the average student learning outcomes in the last test and the gender ratio of students used in the research in each class. Determination of this research class using purposive sampling technique. The use of this technique is due to the presence of superior classes, so researchers take classes that are at an equivalent level. Determination of the class used was carried out by researchers with the help of curriculum teachers, so it was obtained in class XI MIPA 4 and class XI MIPA 3.

Learning activities in both classes were carried out using validated tools, including lesson plan, student worksheets and the questions about the pretest and posttest. The learning device is adjusted to the treatment of each class. Before the treatment the two classes were given the initial test (pretest) as the initial measurement, then the Experimental Class was treated using PBL model with the integration of Android-based media, and the Comparative Class was treated using PBL models without the integration of Android-based media. After the treatment, the two classes were given the final test (posttest) as the final measurement. The results of the pretest and posttest were used to assess the differences between the two classes.

The following figure is an overview of experimental research designs with The Matching-Only Pretest-Posttest Control Group Design.

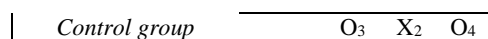


Figure 1. Diagram of the matching-only pretest-posttest control group design (Adapted from Fraenkel dan Wallen 2009:267)

Annotation:

M : Matching
O : Pretest and Posttest
X₁: Treatment (PBL integrated with android-based media)
X₂: Comparison (PBL only)

The results of the pretest and posttest of each class will be analyzed based on thinking skills and mastery of the concepts of students. Data on students' thinking skills are obtained from the results of the pretest and posttest. The analysis was carried out on each item worked by students. Thinking skills based on the answers of students will be interpreted based on the taxonomy of SOLO into five levels, namely structural, nonstructural, multi-structural, relational, and extended abstract. Based on the analysis, changes in students' thinking skills can be known based on color changes from the results of the pretest and posttest on excretory system material learning using the PBL and PBL models integrated with Android-based media. Data mastery of students' concepts is obtained from the answers of students at the pretest and posttest that are done; students are said to have mastered the material when obtaining a value above SKM (>75). The pretest and posttest data of the students were then analyzed using the t-test using SPSS 22.0 to determine whether or not there were differences in learning outcomes from PBL and PBL integrated Android-based media.

RESULT AND DISCUSSION

The research about the effect of Problem Based Learning integrated with Android learning media toward thinking skill and concept mastery of students in excretion system had been conducted in class XI MIPA 4 and XI MIPA 3 SMA NEGERI 1 Gresik with 25 students in each class. The effect of learning was analyzed based on thinking skills and mastery of students' concepts.

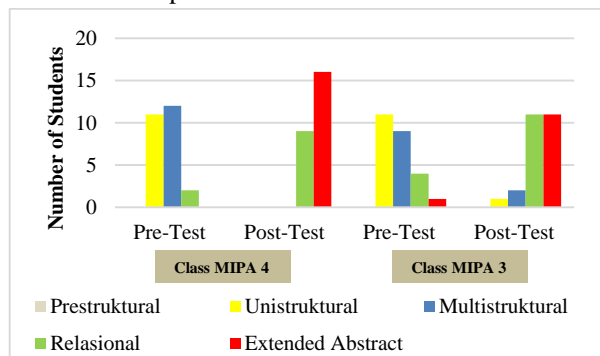


Figure 2. Level chart of student thinking skill

Students' thinking skills were measured by the results of the pretest and posttest answers. The

students' answers at the pretest and posttest were analyzed according to the SOLO taxonomic scoring rubric developed by Purnamasari (2012). Thus, the thinking skills of students in class XI MIPA 4 and class XI MIPA 3 could be categorized into 5 levels of thinking skills such as pre-structural, unstructural, multi-structural, relational and extended abstract. The level of students' thinking skills based on the pretest and posttest can be seen based in Figure 2.

Based on the tendency of students answering 5 question consisting four indicators, it was showed graph of the level of thinking of students in class XI MIPA 4 and class XI MIPA 3 based on the results of the pretest and posttest in Figure 2. Therefore, it can be seen that 25 students on the results of the XI MIPA pretest 4 students' thinking skills consisted of 11 structural 12 Multistruktural, and 2 Relasional, while in class XI MIPA 3 consists of 11 structural, 9 multistruktural, 4 relational and 1 extended abstract. In the results of the posttest class XI MIPA 4 the level of thinking skills of students, there were 9 Relasional and 16 Extended Abstract, while in class XI MIPA 3 there are 1 Unistruktural, 2 Multistruktural, 11 Relasional and 11 Extended Abstract.

Based on the percentage value of pretest class XI MIPA 4 obtained 0%, which meant that all students at the beginning of learning had not mastered the concept, while in class XI MIPA 3 the percentage was 4%, which meant that only 1 student has mastered the excretion system material concepts. The percentage of posttest value in class XI MIPA 4 was 80% while in class XI MIPA 3 was 52%. There were 5 students in class XI MIPA 4 who had not mastered the concept while in class XI MIPA 3, there were 12 students. The level of mastery of concepts in class XI MIPA 4 from 0% rose to 80% and in class XI MIPA 3 from 4% rose to 56%. Thus, it can be seen that the level of mastery of students' concepts in class XI MIPA 4 with the application of integrated Android-based PBL was better than the XI MIPA 3 class with the application of PBL without integration. The pretest and posttest scores obtained that the t-test was examined using the SPSS 22.0 program to test for differences in learning outcomes in students using different PBL models so that it can be seen the influence of the application of integrated Android-based media PBL.

Table 1. consisted statistical result data for both classes, the data tested were data changes from the pretest and posttest of the two classes. This test aimed to find out the differences in student learning outcomes based on treatment. Mastery of the concepts of both classes is normal and homogeneous, so an unpaired t test is carried out. Based on these test, it was known

that there are differences in learning outcomes in both treatments. They were indicated by the sig value. (2-tailed) of 0.029 which was smaller than 0.05, the value indicates that the two data differ significantly. The treatment of integrated PBL on android-based media has a better effect on student learning outcomes than PBL without being integrated.

Table 1. The results of the statistical test mastery of the concepts of treatment and control class students

No.	Parameter	Explanation
1.	Normality (mastery of concepts treatment and comparison classes)	Normal, based on shapiro-wilk test amounting to 0.285 and 0.123 with a significance level of 95%
2.	Homogeneity (mastery of concepts treatment and comparison classes)	Homogen, based on homogeneity variances test about 0.785 with a significance level of 95%
3.	Differences in mastery of concepts treatment and comparison classes	Significant difference, based on independent sample t test by the sig value. (2-tailed) of 0.029 with a significance level 95%

Based on the results of the research, the shift in students' thinking skills with SOLO taxonomy analysis was significant in class XI MIPA 4. there were 11 structural, 12 structural, and 2 relational with 0% completeness to 9 relational and 16 extended abstract with 80% completeness, while in class XI MIPA 3 of 11 structural, 9 multi-structural, 4 relational and 1 extended abstract with 4% completeness to 1 unstructural, 2 structural, 11 relational and 11 extended abstract with 52% completeness. This was because the results of the pretest are the initial understanding of students who have not gained knowledge about excretory system material. Therefore, the initial knowledge was still low. After being given learning in both classes, there was an increase in the level of thinking skills of students.

Students in class XI MIPA 4 after conducting Android integrated PBL had thinking skills at the two highest levels (relational and extended abstract) while in class XI MIPA 3 after PBL without integration, students' thinking skills still exist that occupied a level of unstructural and multistructural. This is shown in Figure 4.1. The data shows that the two PBL models can improve students' thinking skills because the students are encouraged to think critically and apply knowledge in problem-solving (Sinprakob and

Songkram, 2015; Nurdyansyah and Fahyuni, 2016: 83).

The shift that can be seen based on SOLO taxonomy analysis is a shift in the level of thinking skills, complexity in connecting several concepts and understanding of students' concepts (Ang et al., 2016). The shift of the students' level of thinking skills in grade XI of Mathematics and Natural sciences class (MIPA) 4 better shows that the learning process can be well received by the students. In grade XI of Mathematics and Natural sciences class (MIPA) 4 there was a perfect shift in the level of thinking skills from unstructural and multi-structural into a relational and extended abstract, meanwhile in grade XI of Natural sciences class (MIPA) 3 there were still students who had unstructural and multi-structural thinking skills. This is in line with a research conducted by Martin (2011) about the use of technology in classroom learning to be well connected with the SOLO taxonomy approach because students can be motivated and exchange opinions between students and teachers.

In accordance with the students' level of thinking skills, students' mastery concepts has increased. Based on Table 4.10. grade XI of Natural sciences class (MIPA) 4 has increased 80%, while grade XI of Natural sciences class (MIPA) 3 has only increased by 48%, from 4% to 52%. Students in grade XI of Natural sciences class (MIPA) 4 have the highest mastery of concepts on the indicators identifying the structure and function of excretory organ systems by 86%, whereas in grade XI of Natural sciences class (MIPA) 3 only 82%. The lowest level of mastery of concept in grade XI of Natural sciences class (MIPA) 4 is in the indicator analyzing the mechanism of excretory system organ work with a percentage of 65%, whereas in grade XI of Natural sciences class (MIPA) 3 in the indicator identifies abnormalities/disorders of excretory systems with a percentage of 60.5%. This is in line with the research carried out by Amini et al (2018) that the students experience difficulties in excretory system material at the level of cognitive analysis and in the indicators identifying abnormalities/disorders of excretory systems with high difficulty categories and identifying excretory system organs with highest difficulty categories.

Based on the t-test of changes in student learning outcomes in Table 1. both classes have significant differences with the sig values. (2-tailed) of 0.029. These results show that differences in the learning treatment in both classes affect student learning outcomes. In accordance with the study carried out by Muryaroah and Fajartia (2017) mentioned

that biology learning uses media based on android learning is more effective, because learning can be done anytime and anywhere, so the interests and learning outcomes of students increase. Diwaluthfi (2017) also explained that in solving a problem, the students will work optimally when learning is effective. This shows that PBL which is integrated with android-based media has been well implemented and proven to have a positive impact on the students' thinking skills and mastery concepts.

Nazarlou (2013) in his research explained that learning by using learning media which includes sound, animation, and video will create a multi-channel information that is easily captured so it increases the efficiency and quality of information distribution which has an effect on learning. The study is in line with the statement of Edgar Dale which said that someone will remember 10% of what was read, remember 20% of what was heard, remember 30% of what was seen and remember 50% of what was heard and seen (Tohir, 2016). According to Alshomrani et al. (2015) technology in learning serves to help educators with simulation tools which are useful and improve the quality of learning.

CONCLUSIONS

Based on the results of this study indicate there are differences in problem based learning integrated with android-based media and problem based learning without integrating excretory system material into thinking skills and concept mastery, problem based learning treatment integrated with android-based media to get better results with relational level thinking skills and extended abstract as well as mastery of concepts as much as 80%, so it can be concluded that problem based learning learning is integrated with android-based media on excretory system material influencing thinking skills and mastery of concepts.

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