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The Effect of Using Student Excretion System Worksheets Based on Problem-based Learning on Students' Mastery of Concepts

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ABSTRACT

Student worksheets are open material that can assist the learning process in class. The student worksheet is equipped with the syntax of the problem-based learning model. The existence of the PBL model encourages students to think by solving the problems presented in this student worksheet so that it can help students understand the material being studied. This research aims to determine the effect of using problem-based learning-based excretory system student worksheets on students' mastery of concepts. This research method is quasi-experimental. This research was conducted at SMPN 7 Tuban in December 2022. The population of this research was class VIII students, while the sample for this research was class VIII E using Biology student worksheets and VIII D not using Biology student worksheets with each class totaling 30 students. Data collection techniques using test questions. The data obtained was then analyzed using SPSS with the Unpaired t-test. The results showed that the significance value of p (= 0.000) < α (0.05), meaning that there is a significant difference between students who use PBL-based worksheets and students who do not use PBL-based worksheets.

Keywords: Student worksheets, Excretory system, Problem-based learning model, Concept mastery

Introduction

The 21st century is a century of knowledge that has many challenges in the world of education. A skill that is needed in facing challenges in this century such as critical thinking and problem-solving skills, creative thinking and innovation skills, communication skills, and collaborative skills (Buchert, 2014; Fong et al., 2014; Kivunja, 2014). Deep knowledge (cognitive) skills regarding a problem, incident, or event in the context of life are one of the needs in facing existing challenges (Rahayu et al., 2022); Nuri et al. (2021) also stated that in facing intense competition in this knowledge era, higher-level thinking (HOT) skills are needed. In learning activities, students can learn material through examples, applications, and real experiences both inside and outside school, so it is necessary to use information and communication technology that is appropriate, sustainable, and affordable (Marope, 2014). Learning activities also require innovative learning media to help students understand the subject matter. One of the materials that students consider difficult is the excretory system.

The excretory system is a mechanism for ridding the body of nitrogen metabolites and other metabolic waste products that the body no longer needs (Campbell, 2020). This material has a fairly high level of difficulty. This can be seen from the concepts, processes, symptoms, and events related to it. Based on the results of observations, students experienced difficulties because the material being studied was abstract, involved a complicated process, and there was no supporting learning media to help them understand the material. This is following the research of Luzyawati (2019) which states that biological material has many complex, abstract, and difficult concepts to understand. Hence, the opportunity for misconceptions is huge, resulting in low cognitive learning outcomes reaching 40% because the material used is an abstract concept (Mukhoyyaroh et al., 2023) and is memorized (Aprilanti et al., 2016). Abstract means formless and cannot be observed directly by the eye (Ariwibowo & Parmin, 2015). Rahmayani et al. (2013) also stated that students had difficulty understanding the excretory system material because of the terminology and Latin in recognizing the organs that play a role, it was difficult to distinguish the process of excretion in humans, the concepts given were also complicated, and it was difficult to understand because the explanation was not clear. such as the process of urine formation. Misconceptions also occur in people who are experts in their field, not only beginners (Adrianto et al., 2016). Students need the right teaching materials to understand this material.

Teaching materials are all prepared and used in learning activities by describing the competencies students will master. Examples of teaching materials are modules, handouts, worksheets, and other interactive teaching materials (Prastowo, 2015). Learning materials contain learning materials consisting of knowledge, skills, and attitudes that students must learn sequentially to achieve predetermined competency standards (Kristanto, 2011). Teaching materials designed in a structured manner greatly influence the level of learning success (Kurniawan et al., 2018). Teaching materials must be able to encourage and support the development of student independence toward quality learning experiences. Students need teaching materials that can build their knowledge and can be studied independently (Murtini et al., 2019). One of the teaching materials that can be used is worksheets.

Worksheets are tools that complement or support the learning implementation plan (Hamdani, 2011). Prastowo (2015) revealed that worksheets are printed medium containing material information and instructions from teachers to students so they can complete their learning tasks. Worksheets are teaching materials that include material, summaries, and instructions for completing tasks that students must do concerning the core competencies that must be achieved (Ardina & Sa'Dijah, 2016). Worksheets can help students find meaning from lesson material. Apart from that, worksheets emphasize concrete, simple, and relevant phenomena, a concept that wants to be explored. Worksheets also contain things that students must do, including doing, observing, and analyzing. Learning models are really needed to

make it easier for students to use worksheets. The model chosen in developing worksheets is the PBL model. The existence of a learning model can help determine the capacity of thinking abilities and mastery of concepts.

Problem-based learning (PBL) is learning based on problems that do not merely transfer knowledge from educators to students but involve collaborative thinking between teachers and students, as well as between students and other students to obtain the core solution to the problem being discussed (Suyadi, 2013). The steps in the PBL model are orienting students to the problem, organizing students to learn, guiding individual/group experiences, developing and presenting work results, and analyzing and evaluating the problem-solving process (Hosnan, 2014). In the PBL model, the focus of learning is on the chosen problem so that students not only learn concepts related to the problem but also scientific methods for solving the problem. Therefore, students not only understand concepts that are relevant to the problem that is the center of attention but also gain learning experiences related to skills in applying scientific methods in solving problems and cultivating thinking patterns (Resianto, 2010). Problem-based learning can facilitate students' involvement in learning and joining in solving fundamental problems. Cognitive learning outcomes can be improved through the problem-based learning model (Mardiana & Irawati, 2016a).

This research aims to determine the effect of problem-based learning-based excretion system worksheets on students' mastery of concepts.

Methods

This type of research is quasi-experimental involving two groups, namely the control group and the experimental group. The research design uses a form of non-equivalent control group design. The population in this study were all students in class VIII at SMPN 7 Tuban and the sample research subjects were students in class VIII D and VIII E, each class numbering 30 students. Sampling used the purposive sampling technique. The number of samples for each class is 30 students. The research was conducted in December 2022.

The research instruments used consisted of learning plans (RPP), worksheets, and essay questions. The first stage provides test questions to all class VIII to test class equality. The second stage is selecting classes that will be used as experimental classes and control classes. The third stage is the application of PBL-based worksheets in the experimental class and learning in the control class using teaching materials available at school. The fourth or final stage is giving a posttest to the experimental class and control class.

The data obtained will then be analyzed using prerequisite tests and hypothesis testing. To test the hypothesis using unpaired T analysis. Before carrying out the t-test, a prerequisite test is first carried out, namely, the normality test using the One-Sample Kolmogorov-Smirnov test and the variance homogeneity test using Levene's Test of Equality of Error Variances (Sugiyono, 2018). Data significance is based on: 1. If the probability is > 0.05 then the null hypothesis is accepted. 2. If the probability <0.05 then the null hypothesis is not accepted. The entire data analysis process was assisted and utilized the SPSS 25.0 for Windows computer program application.

Results and Discussion

Concept mastery is measured using 10 questions. The data obtained regarding the achievement of mastery of the material from two different classes is presented in Figure 1.

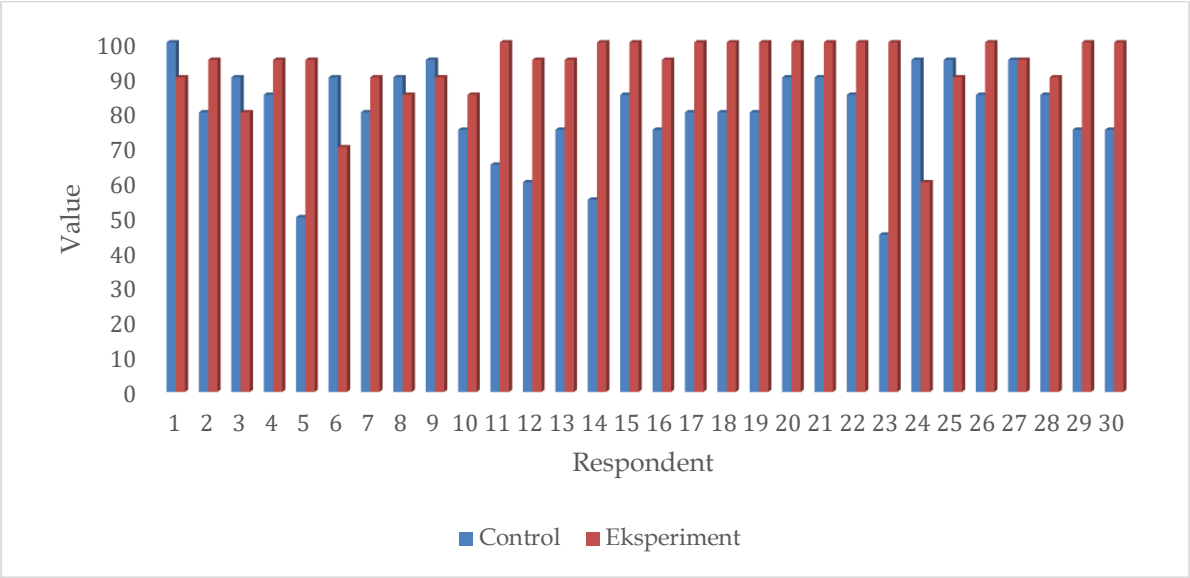

Figure 1. Student Concepts Mastery Scores

Based on the results of mastering the concepts above, it can be seen that the values are different for the two groups. The data obtained was then analyzed descriptively to determine the average results of the two groups, which are shown in Table 1.

The next stage was to test the homogeneity of the data using the Levene test which can be seen in Table 2.

Table 2. Average Student Mastery of Concepts

Average Student Mastery of Concepts					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Value	Control	30	80.1667	13.67627	2.49693
	Experiment	30	93.1667	9.51254	1.73675

The control class got an average score of 80 and the average score for the experimental class was 93. Based on the data above, it can be seen that there are differences between the two classes. This is because the worksheets used can help students understand the material. The Worksheet is equipped with a PBL learning model, real-life problems related to the material, material descriptions, clear pictures, practice questions, and a glossary. Worksheets also help students apply and integrate various concepts provided. Worksheets also function as reinforcement for previously studied material delivered by the teacher, so that learning can be concentrated on students and by the objectives of the 2013 curriculum (Suryani et al., 2016). Worksheets also have an attractive appearance and contextual content that can motivate students' interest in learning, so that they can help the learning process (Yuliza et al., 2013). The values obtained were then tested using the unpaired t-test to see the significance of the two groups and obtained the results shown in Table 2.

Table 2. Unpaired T-Test Result of Students' Concept Mastery

Unpaired T-Test Result of Students' Concept Mastery			
	t	**Df**	**Sig. (2-tailed)**
Mastery of students' concept	4.274	58	.000
	4.274	51.738	.000

Based on this table, it can be seen that the significance value is 0.000 < 0.05 so H_1 is accepted, which means that there is a significant difference between students who use PBL-based worksheets and those who use books from school. This means that problem-based worksheets can improve students' mastery of concepts. This is because there is a PBL model in the worksheets. Problem-based learning can facilitate students' involvement in learning and joining in solving fundamental problems. Cognitive learning outcomes can be improved through the problem-based learning model (Mardiana & Irawati, 2016b). This is because there is a real problem that is often present in everyday life in teaching students about the problem-solving process (Akınoğlu & Tandoğan, 2007). Real problems occurring around students and being open in the process of solving them, it will stimulate the development of students' critical thinking skills in problem-solving and students' understanding of deeper knowledge concepts. Students will have the ability to solve problems if the basic concepts they have are more competent (Keleş & Özsoy, 2009). Komalasari (2010) states that problem-based learning using problems faced in everyday life is a way to make students think critically, develop skills in solving problems, and gain knowledge and concepts that are essential to the subject.

The PBL model is student-centered so that it makes students more active, innovative, and creative in learning by the objectives of current curriculum implementation (Sari et al., 2017). The problem-based learning model can improve student learning outcomes (Dirgatama et al., 2016; Noviar & Hastuti, 2015). The research results found that problem-based learning had a significant effect on critical thinking abilities and understanding of concepts. Students who master concepts can convey ideas and then connect these ideas to more meaningful learning (Zewdie, 2014). Phungsuk et al. (2017) state that problem-based learning (PBL) is student-centered learning where students learn about a subject by trying to find solutions to existing problems. Uzunboylu & Birinci (2014), in research prepared on a significant topic, found that problem-based learning was developed to eliminate the shortcomings and weaknesses of traditional teaching. Elkhamoshi (2011) in research found that the PBL group had higher scores in academic achievement, and also found that there was an increase in student learning achievement when using the PBL model. Yew & Goh (2016) in his research stated that PBL is a learning approach that allows students to learn while actively engaging with mental models for learning, and forming independent learning habits through practice and reflection. This model can improve students' problem-solving skills and concept mastery (Kumullah et al., 2018), where students in learning are more problem-oriented through experiments and evaluations (Sarmatheo et al., 2020). This is supported by the advantages of the problem-based learning model, namely that it helps students gain knowledge and improves problem-solving skills, increasing independent learning abilities.

Conclusion

Based on the research results, it can be concluded that the significance value is 0.000 < 0.05 which means that there is a significant difference between students who use PBL-based worksheets and those who use books from school. This research can be used as a reference for researchers in other fields.

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