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Circulatory system learning through student facilitators and explaining in terms of cognitive learning outcomes

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ABSTRACT

The circulatory system knowledge is essential to be mastered by junior high school students. This study aims to determine the effect of the student facilitator and explaining (SFAE) learning model on the learning outcomes of the circulatory system material in grade VIII students of Muhammadiyah 8 Yogyakarta Middle School. This type of research was quasi-experimental research, with the design used a nonequivalent control group design. The population in this study were all students of class VIII SMP Muhammadiyah 8 Yogyakarta in the academic year 2019/2020. The study sample involved 54 students divided into two classes taken by purposive sampling based on the value of daily tests that had been done previously. The research instrument was a test in the form of pretest and posttest questions. The results obtained were the application of the SFAE learning model in class VIIIC of Muhammadiyah 8 Yogyakarta Middle School influencing the learning outcomes of students, as evidenced by the results of the hypothesis test using the Mann Whitney u-test, the significant results obtained was 0.000<0.05. The SFAE learning influences students cognitive learning outcomes on the circulatory system material.

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INTRODUCTION

Knowledge related to the circulatory system is essential to be known by students. Knowledge related to the circulatory system taught at the junior high school level. The contents taught at

junior high school level include various organs with their functions, various types of blood circulation, and diseases related to the circulatory system. Mastery abilities related to the circulatory system can be measured through cognitive learning outcomes, which are a reflection of the achievement of learning objectives. The teacher has an important task to encourage, guide, and provide learning facilities for students to achieve learning goals. Besides, it is responsible for monitoring the progress of each student. The submission of material in learning activities is a dynamic process in all phases and processes of student development (Slameto, 2013).

Learning in science subjects requires encouragement of student activities (such as communication) in each stage of learning that is done so that students easily understand it. The activeness of students in communication can help in building knowledge related to products, science so that it affects the learning outcomes (Yunita & Wijayanti, 2017). One of the materials learned in class VIII is a circulatory system that has abstract characteristics for students, so it needs to be communicated well to be understood by students. Communication is not only between teachers and students but between students is also important to build knowledge. Peer tutors can become students' authentic communication training because communication becomes one of the challenges for students and train their responsibilities for their knowledge. Communication and discussion are important parts of science learning (Chang, Chen, Guo, Cheng, Lin, & Jen, 2011).

Students at the junior high school level are included in the formal operational development stage. Based on observations on subjects aged 13-15 years, the causal mindset has more developed towards the ability to manipulate information (Asih, 2018). Students can indirectly visualize the material taught by the teacher; through this visualization, students can convey ideas or ideas to colleagues so that it can make learning more active. Asmani (2011), the development of a person's character through several phases, namely: (1) foster ethics (age 5-6 years); (2) foster a sense of responsibility (ages 7-8 years); (3) foster caring (ages 9-10 years); (4) foster a sense of independence (ages 11-12 years), and (5) foster the importance of communication (ages 13 years and over). Students in junior high school are generally in the age range 13 and above. Students that age enter the stage of growing communication skills. This information can be an important asset for teachers in implementing learning models that are appropriate to the characteristics of students.

Learning natural science biology material has a variety of characteristics; for the material, the circulatory learning system will take place well when students can convey their knowledge of abstract material to their friends. Courage to argue and convey ideas makes learning more meaningful for students. Learning by activating each student to present ideas or ideas to his colleagues will make the learning atmosphere more comfortable and enjoyable so that it can influence students' learning outcomes or learning outcomes. In other words, the teacher's business goals are measured by student learning outcomes through teaching and learning activities. Teaching success is not only seen from the learning outcomes achieved by students, but also in terms of the process (Hasan, Sundara, & Hafsah, 2017). Learning outcomes are changes in abilities possessed by students after receiving a learning experience (Tanjung & Nababan, 2018). Learning outcomes are achieved by students to know the extent to which students have successfully followed the lessons given by the teacher. The facts show that student learning outcomes are still low.

One of the factors that influence the low learning outcomes is the lack of student activity in learning due to the variety of learning models used in learning. In the learning process takes place, the teacher must be creative in providing learning to students so that there is no saturation. The teacher must be able to design learning how students can participate in ongoing learning (Nurliani, Subarjah, & Sujana, 2016).

Low learning outcomes are also often caused by a lack of variation in learning, teacher-centered learning is limited to providing information related to the material without much building on student activities (Supiandi & Ege, 2017). The results of observations and interviews that have

been carried out at Muhammadiyah 8 Yogyakarta Junior High School obtained information that in previous science learning, it was rarely student-centered. The learning process is still centered on the teacher, and this is because the teacher uses the lecture method more often. Also, the school has been carrying out activities to read books related to the topic to be studied. In the learning process, most student activities in the classroom are dominated by taking notes and listening to the teacher's explanation. This condition is because teachers still dominate learning. During the learning process takes place the phenomenon of students who still do not pay attention to the explanation of the teacher, among others: some students talk outside the topic of material with classmates and fall asleep in class.

Problems that occur need to be resolved, one of them is by implementing learning with learning models that can foster the activeness of students to convey ideas or ideas that are owned to colleagues and teachers so that it can affect the learning outcomes of students. One such learning model is SFAE. Suprijono (2009), SFAE, is a learning model that encourages students to present ideas or opinions to other students. The SFAE learning model is useful for training students to speak in conveying their ideas or opinions. The SFAE learning model can make students active in learning (Mawarsih, Syamsu, & Kamaluddin, 2016). The model can increase insight and development of students' thinking skills because, in the learning process, there is an interaction between the teacher and students. Also, fellow students in terms of exchanging opinions and ideas, and the material learned is related to daily life. Ruhulessin, Ratumanan, & Tamalene (2019), the SFAE learning model is presented with cooperative learning settings that can encourage students to be more open and want to ask their friends who better understand the material. Interaction between students also develops very well. Students can more freely ask questions and discuss with group friends.

Based on research conducted by Ningrum & Setiawan (2016), the application of the SFAE model through the concept map media can improve students' cognitive learning outcomes. This result shows that there are differences in the application of learning strategies in improving cognitive learning outcomes of students with conventional learning models. This difference can occur primarily in the cognitive domain using the SFAE model due to several factors. One of the factors is the students themselves. The difference with this research is that this research uses concept map media while this study uses teaching aids media.

Circulatory system material is one of the subjects in VIII grade junior high school students, and the discussion requires learning methods that can be easily digested both by students. The broad topics in this material must be explained and taught to students creatively and innovatively so that students do not feel bored, and their desire to learn is better than before (Aisyah, Widiyanto, & Fatkhurrohman, 2018). This study aims to determine the effect of the SFAE learning model on learning outcomes of the circulatory system material in grade VIII students of SMP Muhammadiyah 8 Yogyakarta.

RESEARCH METHODS

Research Design

This research was in the form of quasi-experimental research with the nonequivalent control group design model (Table 1). This selection is based on the sampling technique used by purposive sampling.

Table 1. *Nonequivalent control group design*

Grup	Pretest	Treatment	Posttest
Experiment	T1	SFAE learning	T2
Control	T1	Conventional learning	T2

Note:
T1 : Pretest of experiment and control classes
T2 : Posttest of experiment and control classes

Population and Samples

The population in this study were all students of class VIII semester I of SMP Muhammadiyah 8 Yogyakarta in the academic year 2019/2020. Samples were taken by purposive sampling in some two classes, namely the control class and treatment class, based on daily test scores that had been done previously. The treatment class used was class VIIIC, with a total of 28 students, and the control class used was class VIIIB, with a total of 26 students.

Instruments

Data collection techniques using the test instrument in the form of pretest questions consisting of 5 questions in the form of short fields, and posttest questions in the form of essays as many as five questions that include KD 3.7 with indicator indicators from C1-C3. The learning tools and instruments used were validated through expert judgment consisting of one teacher and one lecturer. The results of the instrument validation were stated to be quite good and could be used by making improvements, including 1) the variation of the questions given did not yet represent all the existing sub-materials, 2) the editorial language was not easy to understand, 3) there were no questions that were appropriate for the C3 level.

Procedures

Research steps or procedures are as follows: formulate the title and research problem, then determine the population to be sampled for research. The determination of the sample is done using a purposive sampling technique by making daily test scores a consideration of class selection. The class used has a balanced average of daily test results. In the next stage, observations were made to determine the state of students, teachers, and the school environment. Determination of core competencies (KI) and basic competencies (KD) are carried out for the preparation of RPP. The teacher is involved in determining the feasibility of lesson plans, questions about pretest, and posttest. Pretest questions are used to find out the basic knowledge of students about KD to be taught. The items compiled consist of 5 field short entry items, while the posttest questions consist of 5 essay items. The learning process begins with a pretest. Learning is carried out four times following the lesson plans that have been prepared for each class and ends with a posttest. Data on the results of pretest and posttest results that have been collected are analyzed using the normality test and the Mann Whitney U-Test to obtain a conclusion.

Data Analysis

The data analysis technique used is descriptive statistics and inferential statistics. Descriptive statistics are used to determine the average value of student learning outcomes before and after the SFAE learning model is applied. Inferential statistics are used to determine whether there is an influence on the use of SFAE learning models in science subjects. Data analysis using the normality test, while the hypothesis test using the Mann Whitney U-test based on the results of the normality test, some data are not normally distributed

RESULTS

After taking the data in the control and treatment class, the results of the posttest biology study were obtained on the circulatory system material. Then the learning outcome data is processed using SPSS software. Descriptive analysis results as presented in Table 2.

Table 2. Result of descriptive analysis

Statistic	Treatment	Control
Mean	81.21	60.11
Median	88.00	59.00
Variance	239.43	337.86
Standard Deviation	15.47	18.38
Maximum score	98.00	87.00
Minimum score	42.00	18.00

The underlying assumption test is performed using posttest data, and the results are presented in Table 3. Hypothesis testing is done using a non-parametric Mann Whitney U-test because there are data that are not normally distributed. Hypothesis test results are shown in Table 4.

Table 3. Normality test

Model	Shapiro-Wilk		
	Statistic	df	Sig.
Control	0.958	26	0.347
Treatment	0.874	28	0.003

Table 4. Result of *mann whitney u-test*

Hypothesis Test Summary			
Null hypothesis	Test	Sig.	Decision
1 The distribution of learning outcome (posttest) is the same across categories of model	*Mann-Whitney U-test*	0.000	Reject the null hypothesis.

DISCUSSION

This study was conducted four times, with details of one pretest (initial ability test), and one posttest (final ability test). Based on Table 2, there are differences in the average value of the two classes. The treatment class has a higher average than the control class. Next, before ascertaining whether there was an effect of treatment on learning outcomes, data were tested with the Normality test (Table 3). According to Santoso (2012), if the normality test results obtained a sig value >0.05, reported data normally distributed; otherwise, the sig value < 0.05 indicates abnormal data. Based on the analysis results of the posttest normality test in the class with treatment using the SFAE learning model obtained significance value 0.003<0.05. The normality test for the treatment class was declared not normally distributed, while the control class received a significance value of 0.347>0.05, then it was reported normally distributed. Based on these results, then the hypothesis test was performed using the Man Whitney U-test (Table 4), the test results obtained a significance value of 0.000<0.05, indicating that the use of the SFAE model has a significant influence on the learning outcomes of treatment class students.

Based on the results of data analysis, it is known that the SFAE learning model applied to the treatment class has a better influence than the control class. These results reinforce similar research with different materials and media; the SFAE learning model with PowerPoint media influences learning outcomes (Sari, Kurniawan, & Rahayu, 2015). The learning process becomes more attractive to students because the material presented is more concrete and clear. This learning

process can help students to understand and strengthen students' memory of the material of the circulatory system. According to Shoimin (2014), the strengths of the SFAE model, among others: the material delivered more clearly and concretely, can increase the absorption of students because learning is done by demonstration, train students to become teachers because students are allowed to repeat the teacher's explanation that has been he heard, spurred students' motivation to be the best in explaining teaching material and knowing the ability of students to convey ideas or ideas.

The SFAE learning model applied in the treatment class has more influence on learning outcomes than the control class. Judging from the average value, students in the treatment class (81.21) are higher than the control class (60.11). This result is because in the control class applying the conventional learning model (question and answer) so that the involvement of students in learning is less optimal. In the treatment class, the SFAE learning model is applied to require students to be actively involved in the learning process because students act as facilitators. Students during learning by using SFAE appear to be very active; this is following the observations of Ningrum & Setiawan (2016), who noted that learning with SFAE encourages students to be active in the learning process. The activeness of these students makes them able to develop their cognitive through information exchange when the discussion takes place. Learning using the SFAE model gives teachers full opportunities for students to be active and creative when delivering material that has been delivered by the teacher before. This research is following the opinion of Huda (2014), which states the SFAE model can improve student learning outcomes, especially in the cognitive domain, because students have the opportunity to become facilitators of other students. Students who are active in the learning process can make students find more new information in learning. According to Suarjo (2016), the application of learning models by conventional teachers causes students to become passive. Learners are only a tool for the transfer of knowledge possessed by the teacher without involving students in the learning process.

The stages of the learning process begin with the teacher explaining the activities to be carried out by students. After that, the teacher groups students into groups of 3-4 people. The teacher explains the material of the circulatory system briefly by demonstrating it using teaching aids. Learning media can encourage students to be actively involved in learning interactions (Sadiman, 2009). Learning by utilizing teaching aids can provide real experiences for students by utilizing their senses, and learning outcomes will be optimal when, in learning, many students use as many senses as possible to interact (Anidityas, Utami, & Widiyaningrum, 2012; Manzilatusifa, 2007). The teacher appoints one student from each group to become a facilitator. At this stage, students who are appointed as facilitators by the teacher will better understand the material. Learners can experience learning directly by demonstrating in front of other students. According to Arfianti, Lufri, & Farida (2014), in improving learning outcomes, there must be a facilitator who can apply the teaching style to the maximum, interacting, and communicating, which results in the creation of learning conditions. That includes the activeness of students, which affects the improvement in their learning outcomes.

Zaini (2009) Argues that a student will easily remember independently acquired knowledge for longer, compared with information obtained by students from listening to others. Active learning can teach students to participate in all learning processes, not only mentally but also physically involving students (Zaini, Munthe, & Aryani, 2008). According to Arfianto (2015), three-dimensional teaching aids of the human circulatory system have the advantage that students can see the blood directly will flow from the heart to the pulmonary veins and flow throughout the human body. Before returning to the heart, the blood will pass through the lungs to take oxygen, which will be flowed throughout the body. Blood circulation from the heart to the lungs and back to the heart is called small blood circulation. Props can be made as simple as in Figure 1.

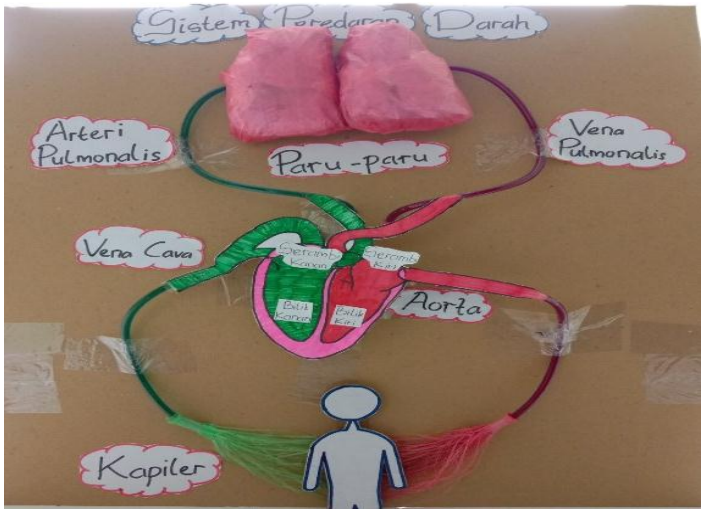

Figure 1. Simple teaching aids circulatory system material

The application of the SFAE learning model in the treatment class and the application of the inquiry learning model in the control class makes students active in learning. However, the treatment class that uses a circulatory system aids makes students more enthusiastic and active during the learning process, so that it affects the achievement of student learning outcomes. Research conducted by Yanto & Juwita (2018), found that the SFAE emphasizes students to participate more actively in the learning process by allowing students designated as peer tutors to explain the subject matter that has been explained by the teacher to other students.

CONCLUSION

The SFAE learning model in class VIIIC Muhammadiyah 8 Yogyakarta Middle School influences the learning outcomes of students, as evidenced by the results of the Mann Whitney U-test, obtained a sig value was 0.000<0.05 and the average value was 81.21 while the control class was 60.11. In the treatment class that uses a circulatory system teaching aids make students more enthusiastic and active during learning, so that it affects the achievement of student learning outcomes.

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