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The Effectiveness of Reasoning and Problem Solving Learning Model and Problem-Based Learning Model to Improve Problem Solving Skills

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Abstract. This research strived to determine the effectiveness of reasoning and problem solving learning model and problem-based learning model on problem solving skills in immune system material by the students in grade XI in SMA N 5 Semarang. It was in form of quasi-experimental research. For the variables, this research had reasoning and problem-solving learning model and problem-based learning model as the independent variables, and problem solving skills as the dependent variable. In terms of sample, this research used probability sampling technique so that all students deserved to be the research objects. The samples came from the students of Natural Science (IPA) 10 in grade XI as the control class, while as the experimental class, there were students of IPA 8 in grade XI, and students of IPA 9 in grade XI. Their data were collected using portfolio, observation, and documentation. Further, the researchers performed data analysis using normality test through chi square formula, homogeneity test with Bartlett test, and average difference test with t-test. The findings of the research showed significant differences, namely the experimental class 1 gained 85, the experimental class 2 gained 85 and the control class gained 82. These indicate that the reasoning and problem-solving learning model and problem-based learning model have some effects on the problem solving skills in immune system material by the students in grade XI in SMA N 5 Semarang.

INTRODUCTION

Technology, information, and communication development influences factors in the world of education since education is demanded to have higher quality and standard. Surely, it aims to enable Indonesia to catch up with international education world. To do so, there is a need for a model, medium, strategy, and learning model that can improve students' learning outcomes and enable them to face various challenges of changing times. Besides, teachers and educators must be empowered to be professional, creative, innovative, and critical to guide students in solving various daily life problems [1].

According to [2] problem solving skill belongs to one of the highest skills or called as higher order thinking since its outcome consists of thinking skill, collaboration skill, communication skills, and others [3]. These skills are in line with what the ministry of education and culture formulated in the learning paradigm of the 21st century [2], namely emphasizing students' skills in exploring knowledge from many sources, formulating problems to enable analytical thinking, doing cooperation and collaboration to solving problems [1].

In Quran, Surah Al Hashr (59): 18 and Al Mujadila (58): 11 explain that learning is a way to acquire knowledge to elevate life degree and attain instructions to solve problem in everyday life as well as become a better person. Someone will get good in his life if he attends Islamic forums or studies. It is because Allah loves people who have faith, obedience, and study [4].

Curriculum 2013 emphasizes a student-centered learning model that requires real experience learning activities which expect students to learn authentically [5]. This authentic learning can happen when teachers give meaningful and appropriate chances so that students can think scientifically, critically, solve problems, and reflect problems they face in everyday life. Here, problem solving needs thinking skills, including observing, reporting, describing, predicting, interpreting, criticizing, drawing conclusion, and generalizing the collected and processed information [6][7].

Unfortunately, facts explain that the problem-solving skills ability owned by Senior High School students are low, especially in Biology subject in immunology system [8]- [16]. They tend to memorize the concepts given by teachers without applying it to problems they encounter either in school or environment. Hence, in learning process students are not able to develop skills they must solve problems coming from the environment.

RESEARCH METHODOLOGY

This research used quantitative method with the type of experimental research. Experimental research can be defined as a research method which is used to find out the effectiveness of a particular treatment on other variables in a controlled condition. Since the researchers attempted to look for the effectiveness of a particular treatment, this method was used. In depth, the experimental research was in form of quasi-experimental. It has posttest control design pattern, namely determining hypotheses based on the score of posttests [5],[14].

With regard of sample, there involved the students of IPA 8 in grade XI totaling 35 students, students of IPA 9 in grade XI totaling 32 students, and students of IPA 10 in grade XI totaling 33 students. In total, 100 students were invited to be the samples. For the variable, this study set reasoning and problem-solving learning model (X1) and problem-based learning model (X2) as the independent variables, and problem solving skill as the dependent variable.

Within the research process, the researchers performed several procedures such as preparation, implementation, and data analysis. Prior to the data analysis, students' data were collected through observation, post portfolio of problem-solving skills, and documentation. All these instruments were analyzed in terms of validity test, reliability test, item discrimination test, and item difficulty test [12][13]. For more, in implementation process, the data of learning process were calculated using normality and homogeneity tests, while the hypothesis testing was carried out with help of t-test to examine significant differences in problem solving skills between control class and experimental class.

RESEARCH FINDINGS

This research was carried out for 6 learning hours in both control class and experimental class. Based on the observation results, prior to the treatment of reasoning and problem-solving model and problem-based learning model, the students were passive so that their high order thinking skills, including problem solving skill were not yet sharpened. As a results, the students found it difficult to join problem-based learning via online platform. Further, the hypothesis testing results revealed that the comparison between the treatment class 1 (reasoning and problem-solving model) and the control class gained 2.05, the treatment class 2 (problem-based learning) and the control group obtained 2.60. Through these results, the obtained value of t-table was 1,167. It indicated that of two learning models, H_0 was rejected and H_a was accepted. In other words, the reasoning and problem-solving model and problem-based learning model could improve the problem-solving skills in immune system materials by the students of SMA N 5 Semarang in grade XI. Additionally, there found differences in the problem-solving skills of students in the experimental group and the control group. The mean of the treatment class 1 and class 2 were 85 and 85.62 respectively, while the mean of the control class was 82.66. So that there are differences in the effect of reasoning and problem solving and problem based learning models on problem solving skills in the class immune system material. Based on the results of the calculation of problem skills tests that have been carried out, problem-based learning is more able to improve problem solving skills on the material of the immune system of class XI students than learning by using reasoning and problem-solving models.

DISCUSSION

One of the differences in learning outcomes shown by each sample is influenced by differences in treatment during the learning process. In the reasoning and problem solving learning model, students are trained to develop problem solving skills conveyed by the teacher, so that student activities become the main concern. Due to virtual learning, all

student activities are not monitored optimally, but with today's technology, students' online or offline conditions can be detected from Google Classroom. In this learning, the teacher can play a role in inviting students to find the right solution for the problems they are facing. By using the reasoning and problem solving learning model in learning, students will focus their attention on giving an opinion on the problems given by the teacher, so that students are trained to develop thinking skills, problem solving skills, creativity, and the courage to express an opinion or solution to a problem. In the learning process, teachers provide opportunities and freedom for students to find sources of information and interact online with anyone to help solve problems. Students are given the opportunity to collect data related to problems online, either from reference books, articles, journals, or by interviewing parties who are experts in the field of immunization and the immune system.

Learning like this will be more fun for students because students are given the freedom to express their opinions through problem solving. Even with the Covid-19 outbreak, problem solving was delivered online and in writing, but it did not dampen the enthusiasm of students to play an active role during the learning process.

In contrast to students who are given learning in the control class using the discovery learning model, they are only given material with the lecture method, question and answer activities and then provide evaluation. Learning activities like this cause students to tend to be passive because they pay attention and listening to the teacher who delivered the material orally and students were not given the opportunity to express their opinions. Learning like this will make students get bored and bored quickly, especially with a lot of biology material.

Meanwhile, the class given the problem-based learning model is centered on students to conduct research, integrate theory and apply knowledge and abilities to develop the most appropriate solutions to problems.

Learning problem based learning trains students to learn through problem solving that puts complex problems in it so that it allows more than problem solving solutions [15]. The problem-based learning model is student-centered, where students explain problems related to real life with research principles and concepts. In this model, students will be trained to solve problems, communicate, collaborate, and enable various problem solving from different perspectives. This problem-based learning model requires an authentic investigation to be able to provide a solution to a problem that occurs in everyday life.

CONCLUSION

According to the findings, the reasoning and problem solving learning model influences the improvement of problem solving skills in immune system material of grade XI. It was evidenced by the result of t-test for the significance level of $\alpha = 5\%$ was $t\text{-count} = 2.0508$. This concludes that H_0 is rejected and H_a is accepted. Meanwhile, the problem solving skills in the experimental class are better than the control class. By referring to the results of problem-based learning model, the researchers conclude that this learning model influences the improvement of problem solving skills in immune system material of grade XI. It was evidenced by the results of t-test for the significance level $\alpha = 5\%$, namely $t\text{-count} = 2.605$. It makes H_0 rejected and H_a accepted. Then, the problem solving skills of the experimental group are better than the control group.

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