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The Effect Of Problem Solving Model Towards Students' Academic Ability–Based Argumentation Ability In Additive And Addictive Substance Materials At Smpn 18 Padang

Mutia Sari[1], Heffi Alberida[2*], Abdul Razak[3*] and Syamsurizal[4*]

[1] Master's Degree Program of Biology Education, Faculty of Mathematics and Sciences, Universitas Negeri Padang

Jl. Prof. Dr. Hamka Air Tawar Barat Padang - 25131, Indonesia

[2]Lecturer of Biology Department, Faculty of Mathematics and Sciences,

Universitas Negeri Padang

Jl. Prof. Dr. Hamka Air Tawar Barat Padang – 25131, Indonesia

Abstract – The learning process that occurs was still teacher-centered. The students' argumentation ability was still low, and their academic ability was less of a concern in the learning process, so that learning has not been carried out in accordance with the 21st century. One of the ways to solve these problems is by applying Problem Solving learning by paying attention to the students' academic ability. This study aims to determine the effect of Problem Solving learning model by paying attention to the students' academic ability towards their argumentation ability on additive and addictive substance materials. This research was a quasi-experimental research design with a 2x2 factorial design. The population of this research was the students grade VIII of SMPN 18 Padang. The samples of this research were the students grade VIII.7 experimental group and class VIII.8 control group chosen by using a purposive sampling technique The instrument used was a description of the argument. The data analysis was by testing the two-way ANOVA hypothesis using SPSS software. The results showed that: (1) There is an effect of Problem Solving learning model towards the students' argumentative ability. (2) There is an effect of Problem Solving learning model towards the students' argumentative ability with high academic ability. (3) There is an effect of Problem Solving learning model towards the students' argumentative ability with low academic ability. (4) There is an interaction of Problem Solving learning model with academic ability towards the students' argumentative ability.

Keywords – Problem Solving, argumentation ability, academic ability.

I. INTRODUCTION

The learning process in the 21st century is needed in increasing national competitiveness as well as a determining factor for the success of the development and progress of a nation. Therefore, students are required to be able to think critically, argue, solve problems, collaborate, and communicate. Farida (2018) & Haris (2012) explain that, in the learning process of the 21st century, students are required to think systematically and be able to argue effectively so as to form quality students. Things that must be considered in the learning process are how to learn to be involved in various important aspects, namely being able to formulate questions, develop ideas, and build arguments to students. Therefore, in advancing the quality of education in the 21st century, there

Corresponding Author: Heffi Alberida

needs to be a change in the learning process from teacher-centered learning to learning that emphasizes the scientific skills of students.

The results of the preliminary observation on the students of SMPN 18 Padang using argumentation description questions showed that the argumentation ability of the students grade VIII was still low, namely 90% in the poor category and 10% in the sufficient category. This suggests that the lessons needed in the 21st century are not fully understood. Farida (2018) & Saadah (2015) explain that argumentation ability is needed for the quality of human resources in increasing national competitiveness as well as being a determining factor for the success of a nation's development and progress in meeting the demands of 21st century learning. Faize, Husain & Nisar (2018) revealed that, empowerment of arguments in science learning can develop critical thinking skills, increase motivation in conducting investigations, and increase conceptual understanding and student learning outcomes. Furthermore, students can also apply the knowledge they have learned in their daily lives (Nuangchalerm & Kwuanthong, 2010).

The results of the observation also showed that the learning process is still less varied and teacher-centered. It makes students less active in the learning process so that they are less able to develop the argumentation ability during the learning process. According to Fatmawati (2019); Rudd and Baker (2000) stated that teacher-centered learning results in low thinking ability of students. In addition, in science learning, the academic ability of students is not paid attention by the teacher in implementing learning. The differences in academic ability should be of concern to teachers in implementing learning because there can be gaps in the learning process between students who have high academic ability and students who have low academic ability. Dipalaya (2016) explained that thinking ability is influenced by the academic ability of students. Therefore, a learning strategy or model is needed that can accommodate students with various levels of academic ability.

One learning model that has a learner-centered syntax and can train the argumentation ability in solving problems and based on students' academic differences is Problem Solving model. Wijayanti (2016) explains that Problem Solving model can improve the ability to argue, think critically, ask, identify, or solve existing problems. The studies conducted by Fatmawati (2019) and Sulistyaningkarti (2016) showed that Problem Solving model can improve students' thinking skills such as the ability to ask and answer, as well as the ability of students to argue in providing solutions, solving, and analyzing a given problem. Yunisa (2015) stated that the application of Problem Solving model is effective in improving the students' argumentation ability.

Problem Solving learning model is a learning model that can stimulate students in the ability to argue to gain knowledge and concepts of a given problem. In this study, additive and addictive substance materials were used. These materials are important to be understood by students because it can stimulate students' argumentation ability in the learning process, these materials are related to the daily life of students, are informative, and require understanding for students. Rahmadhani (2020) explains that concepts in science learning should be relevant to everyday life, train attitudes, including how to communicate and build science concepts. One of the goals of science learning is to equip students to learn about scientific concepts so that students can argue scientifically. The application of Problem Solving model which is based on the students' high and low academic ability is expected to help overcome the learning conditions that were originally in the form of transferring information from teachers to students into a learning process that emphasizes constructing knowledge based on understanding and experience gained both individually and in groups. Hence, in the learning activities, students actively think, argue, seek and process data, and conclude. Based on these problems, the purpose of this study was to determine the effect of Problem Solving learning model towards the students' academic ability-based argumentation ability on additive and addictive substance materials at SMPN 18 Padang.

II. RESEARCH METHODS

This type of research was a quasi-experimental research design with a 2x2 factorial design. In this research, the students were divided into two classes: the experimental class and the control class. The population in this study was all VIII classes at SMP Negeri 18 Padang in the 2019/2020 academic year totaling eleven classes. The sample was taken by using a purposive sampling technique so that class VIII.7 was obtained as the experimental class applying Problem Solving model and class VIII.8 was the control class applying the Direct Instruction model. The stages of the Problem Solving learning model by Alberida (2018) consists of seven syntaxs namely, (1) introduction, (2) observation, (3) initial problems, (4) collecting data or information (5) organizing data, (6) analyzing data and (7) communicate. The instrument of this research was by using a description of the arguments with indicators developed by McNeill & Krajcik (2007) namely, claim, evidence, and reasoning. Moreover, the assessment rubric and argumentation descriptor can be seen in Table 1.

Table 1. Assessment Rubric and Description of Critical Thinking

Scoring Guidelines	Score
Not answering, or making wrong claims	0
Making simple or imprecise claims	1
Making a correct claim	2
Making a true claim, with data or facts (evidence)	3
Making a true claim, with data or facts (evidence) and providing evidence (reasoning)	4

Furthermore, the value of students' argumentation ability is calculated by the following formula.

$$\text{Value} = \frac{\text{Score obtained}}{\text{Maximun score}} \times 100$$

The instrument about the argumentation ability was carried out by content validation and question testing to determine the empirical validity, reliability, difficulty level and distinguishing power of the questions. The result of the calculation of the reliability of the test obtained was 0.62 with high criteria. Furthermore, the data analysis technique was carried out by using normality test, homogeneity test, and hypothesis testing using 2-way ANOVA, and continued with Bonferroni further test with SPSS program.

III. RESULTS AND DISCUSSION

The results of the research regarding the effect of Problem Solving model towards the argumentation ability based on the academic ability of the students on additive and addictive substance materials at SMPN 18 Padang can be seen in Table 2.

Table 2. Results of Problem Solving Research towards Argumentation Ability based on Students' Academic Ability

Average Argumentation Ability Based on Academic Ability				
Class	Mean	Academic Ability	Mean	SD
Experiment	79,33	High	84,00	4,70
		Low	74,67	3,99
Control	75,47	High	82,50	4,47
		Low	68,44	5,07

Results of Normality and Homogeneity of Argumentation Ability			
Parameter	Class		Information
	Experiment	Control	
Normality	0,053	0,117	Normal
Homogeniy	0,61		Homogenous

Results of Two-Way Anova Test for Argumentation Ability and Academic Ability				
Parameter	Mean square	F	Significancy	Information
Class (Model)	231,252	11,001	0,00	Significant
Academic Ability	2118,832	100,792	0,00	Significant
Class* Academic Ability	86,574	4,118	0,047	There is interaction

The ability of argumentation is the ability of students to provide or put forward reasons to strengthen or reject an opinion by submitting evidence using logical principles so that other people believe in that opinion or reason. The application of Problem Solving learning model towards the ability of argumentation in KD 3.6 material for additives and addictive substances makes

students able to practice thinking scientifically, communicating, acting, and solving problems, especially in additive and addictive substance materials which discuss a lot of problems, especially in the context of everyday life. Problem Solving learning model has a positive effect towards the students' argumentation ability in KD 3.6 on additives and addictive substance materials. This is supported by studies conducted by Rahmadhani (2020), Wijayanti (2016), and Fatmawati (2019) showed that Problem Solving model affects the students' argumentatiion ability, especially on additive and addictive materials which include many problems in everyday life. Therefore, it is important to familiarize students to be able to argue scientifically. Faize, Husain, & Nisar (2018) and Nuangchalerm & Kwuanthong (2010) reveal the advantages of empowering arguments in science learning, namely developing critical thinking skills, increasing motivation in carrying out investigations, increasing conceptual understanding and learning outcomes of students and being able to apply the knowledge that has been studied in their daily life.

The students' argumentation ability in KD 3.6 in the experimental class using Problem Solving learning model is better than the control class. This can be seen from the average value of the students' critical thinking ability of the experimental class which was higher than the average value of the argumentation ability of the control class. The difference in the average value of the argumentation ability obtained by the experimental class and the control class can be a reference that Problem Solving learning model affects the students' argumentation ability in KD 3.6 on additives and addictive substance materials. This is supported by Majid (2007); Hou, Chang, & Sung (2008); Collins (2014) stated that Problem Solving can hone skills that allow a person to find solutions to problems that cannot be solved if only by memorizing a concept or memory. The problems that occur do not always have one solution, but also have many solutions that may not be known by students. Problem Solving can train students' critical thinking and argumentation ability because in their learning activities it requires the application of knowledge and relating it to real life. Therefore, Problem Solving model has an effect on the argumentation skills of students.

Argumentation ability has indicators, claims, evidence, and reasoning. Each of these indicators has a positive effect on each of the syntax of Problem Solving model, such as when students are given an observation or observation contained in Problem Solving syntax regarding the dangers of additives and addictive substance materials. Students are able to develop claim argumentation ability, where students are able to provide an answer to a problem regarding the dangers of additives and addictive substances by identifying, criticizing, and investigating a problem. Furthermore, the evidence indicator here students are able to provide supporting data or information to support claims from a given which is contained in each Problem Solving model syntax. Then, in the reasoning indicators students are able to invite or convince others by providing supporting evidence or providing justification that connects claims and evidence covering the principles corresponding to the problem given. This is supported by Sani (2014) showed that Problem Solving has the potential to train students to face various problems, both individual problems and group problems. Students will be required to identify the causes of problems and find solutions to overcome the problems faced so that students understand better the content of the lessons given by the teacher. Austhink (2016) states that instrument ability can make students build common reasons and critical thinking skills, help organize and make strong arguments, help evaluate the reasons that have been obtained, help make the right decisions, and help solve reasons that become conflicted.

The results of the normality test for the experimental class, the students' argumentation ability in the experimental class and control class, were normally distributed. Furthermore, the results of the homogeneity test of the students' argumentation ability in both classes of the study sample had homogeneous variances. Two-way ANOVA test results on the parameters of the learning model showed the Sig. equal to $0.00 < 0.05$. It can be concluded that "there is a significant difference in the argumentation ability of students between the experimental class and the control class". Furthermore, the academic ability parameter showed the Sig value. amounting to $0.000 < 0.05$, it can be concluded that "there is a significant difference in the students' argumentation ability between the students with high academic ability and the students with low academic ability". Based on the results of the the students' argumentation ability with high academic ability, they get higher results than students with low academic ability. This learning model affects the students' argumentation ability. The group of students with high academic ability obtained a higher average than the group of students with low academic ability. Based on the results of the two-way Annova test, it can also be seen that the interaction between learning models by paying attention to academic ability to the students' argumentative ability. The results of the two-way Annova test stated that there is an interaction between learning models by paying attention to academic abilities to the argumentation skills of students. The two-way Annova test curve results in intersection if it is continued. From this curve it can be seen that there is an influence between the learning model and the academic ability of students (Figure 1).

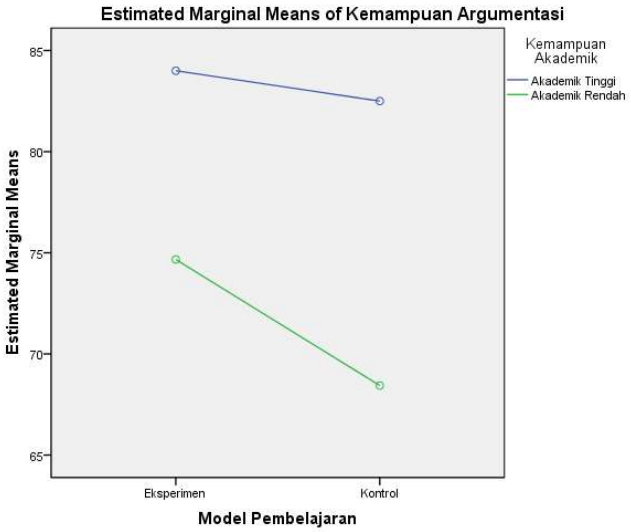

Figure 1. Interaction between classes with attention to academic ability towards argumentation ability

The interaction parameter between the learning model and academic ability showed the Sig. amounting to 0.047 <α 0.05. It can be concluded that "that, there is an interaction between the learning model and the academic ability of the students' argumentation ability ". If the curves intersect, there is an interaction, if the curves are parallel and do not intersect, there is no interaction (Sugiyono, 2012). Furthermore, because the results of the two-way ANOVA test on class parameters and academic ability showed significant results, a further test was conducted to determine which groups were significantly different. The results of the Bonferroni follow-up test showed a significant difference between the academic ability groups of the two sample classes, which was smaller than α 0.05, except in the Bonferroni advanced test the argumentation ability of the high academic control class and the high academic experimental class. Thus, it can be concluded that there is a significant difference.

IV. CONCLUSION

The application of Problem Solving model to the ability to argue based on the academic ability of the students was obtained: (1) There is an effect of Problem Solving learning model towards the students' argumentation ability. (2) There is an effect of Problem Solving learning model towards the students' argumentation ability with high academic ability. (3) There is an effect of Problem Solving learning model towards the argumentation ability of the students with low academic ability. (4) There is an interaction of Problem Solving learning model with academic ability on the students' argumentation ability on additive and addictive substance materials at SMPN 18 Padang.

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