

The Effect of the Conceptual Understanding Procedures Learning Model and the Initial Ability towards the Biology Cognitive Competence of Students Grade X MIPA at SMAN 2 Padang

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Abstract – This study aims to determine the effect of the conceptual understanding procedures learning model towards students' Biology cognitive competence. This study was a quasi-experimental research design with Randomized Control Posted Only Design. The population of this study was the students Grade X MIPA SMAN 2 Padang registered in the 2019/2020 academic year. The samples of this study were students Grade X MIPA 3 as the experimental class and Grade X MIPA 1 as the control class chosen by using a Purposive Sampling technique. The instrument used was in the form of posttest. The data of this study were analyzed by using the two-way ANOVA test. The results revealed that there are significant differences between the experimental class and the control class which the results of the students' cognitive competence from the experimental class were higher than the control class. The mean score of the students' cognitive competence from the experimental class was 76, 92 and the control class was 72, 47. Thus, it can be concluded that the conceptual understanding procedures learning model can improve the students' Biology cognitive competence.

Keywords – Conceptual Understanding Procedures (CUPs), initial ability, cognitive competence.

I. INTRODUCTION

Education is a very important thing in human development including in cognitive, affective, and psychomotor. Education is a process of training and teaching students in order to provide knowledge and develop skills (Saidah, 2016). Education must be adaptive to the changing times. Education is now expected to follow the developments

in the field of science and technology that are increasingly developing in the 21st century.

Education in the 21st century is marked by the rapid development of science and technology in the field of life in society, especially in the development of technology and information. Natural Sciences or science is one of the subjects that occupy an important role in dealing with the times

(Yuliati, 2010). Science learning (science) is not just understanding about concepts, facts or principles, but a process that requires students to learn to find something new and can be applied in everyday life. One of the natural sciences (IPA) learned at school is Biology.

Biology is a science that has an important role in improving the quality of education and advancing the thinking power of students to think critically, logically and systematically. Biology has an important role in improving the quality of education, especially in producing quality students namely people who are able to think critically, creatively, logically and take initiatives in responding to issues in society (Sajidan, 2012).

Biology learning has an important role, so the process of learning biology in class should be interesting, fun and student-centered. Biology learning has basic principles in developing the potential of students, namely cognitive, affective, and psychomotor (Lufri. 2007). The mastery of competencies by students is inseparable from their teacher's role. The teacher is a guide and facilitator in learning activities. The teacher must be able to arrange an interesting

strategy or learning model in order to be able to improve the students' competences. The success of a student's competence refers to the teacher who is creative in designing learning (Agustiya. 2017).

The results of a questionnaire analysis conducted by the researcher from 70 students Grade X MIPA SMAN 2 Padang on September 13th, 2019 revealed that 76.64% of the teachers used the lecturing, discussion, and question and answer methods. 52, 44% of the students were less active in asking questions. 50, 33% of them lacked of interest in reading references before participating in the learning. Lack of the students' interest in reading references will have an impact on the lack of understanding of students' concepts regarding the material to be studied.

The researcher also looked at the achievement of students' learning competencies in Biology. The percentage of the completeness of daily test results (UH) of the students Grade X MIPA SMAN 2 Padang in the 2019/2020 academic year showed that the students' learning outcomes were still below the KKM which was 75. The mean of the completeness of the students' learning outcomes can be seen in Table 1.

Table 1. The Mean of the Biology Daily Test Results (UH) on the Virus Material of the Students Grade X MIPA SMAN 2 Padang in 2019/2020 Academic Year.

No	Class	UH Mean Results	Percentage of completeness	
			Complete (%)	Incomplete (%)
1	X MIPA 1	72,22	29,59	70,41
2	X MIPA 2	71,25	29,42	70,58
3	X MIPA 3	72,36	30,33	69,67
4	X MIPA 4	78,80	36,00	64,00
5	X MIPA 5	71,67	28,38	71,62
6	X MIPA 6	70,69	33,65	66,35
7	X MIPA 7	63,61	40,00	60,00
Mean			32,48	67,52

The students' low learning competence was caused by several factors, namely the students' lack of conceptual understanding of learning material, the learning models that have not emphasized the understanding of concepts, and the students' initial abilities. One of the causes of the low learning outcomes is related to the learning model (Rahman. 2016). The use of varied learning models can improve learning outcomes (Annisa, 2019). The initial ability of students is a determining factor in the success of mathematics learning (Lestari, 2017).

The results of interviews conducted by the researcher to the teacher on Biology Subject at Grade X MIPA SMAN 2 Padang on September 12th, 2019 showed that the teacher has used the *Inquiry Learning Model* and *Scientific Approach*. The use of learning models has not been implemented optimally. This was supported by the observations conducted by the researcher directly at SMAN 2 Padang in which the teacher still used the lecturing and discussion methods. The application of the learning model has not emphasized the students' conceptual understanding.

Obviously, the problems above require the application of an appropriate learning model in improving students' learning competencies. One of the learning models that can be used is the *Conceptual Understanding Procedures* (CUPs) learning model. The *Conceptual Understanding Procedures* (CUPs) learning model helps students improve conceptual understanding. Understanding the concept will help students longer in remembering the material being studied so that it will have an impact on student learning outcomes (Suriyani, 2018)

Based on this background the researcher proposed the title "The Effect of the *Conceptual Understanding Procedures* (CUPs) Learning Model and the Initial Ability towards the Cognitive Competency of Students Grade X Class in Mathematics and Natural Sciences SMAN 2 Padang.

II. RESEARCH METHODOLOGY

This type of study was a quasi-experimental research with a research design *The Static Group Comparison Design* that has been modified. The population of this study was the students Grade X MIPA SMAN 2 Padang registered in 2019/2020 academic year. The samples of this study were the students Grade X MIPA 3 as the experimental class and the students Grade X MIPA 1 as the control class chosen by using a *Purposive Sampling* technique. The instrument used was the posttest. The data of this study were analyzed by using the two-way ANNOVA test using *SPSS* application.

III. RESULTS AND DISCUSSION

A. RESULTS

The analysis of the research data in the cognitive domain was done by normality test, homogeneity test, and hypothesis testing. The normality and homogeneity test data can be seen in Table 2 below.

Table 2. The Data of Normality and Homogeneity Tests for the Sample Classes

Parameter	Class		Information
	<i>Experiment</i>	<i>Control</i>	
Mean	76,92	72,47	$\bar{x}_1 > \bar{x}_2$
Normality test	0,51	0,47	Normal
Homogeneity Test	0,15		Homogenous

Based on table 2, the mean scores of the cognitive domain of the students from the **experimental** class was 76, 92 higher than the results from the control class which was 72, 47. The results of the normality and homogeneity tests of the two sample classes were $\text{Sig} > \alpha$. It means the data are

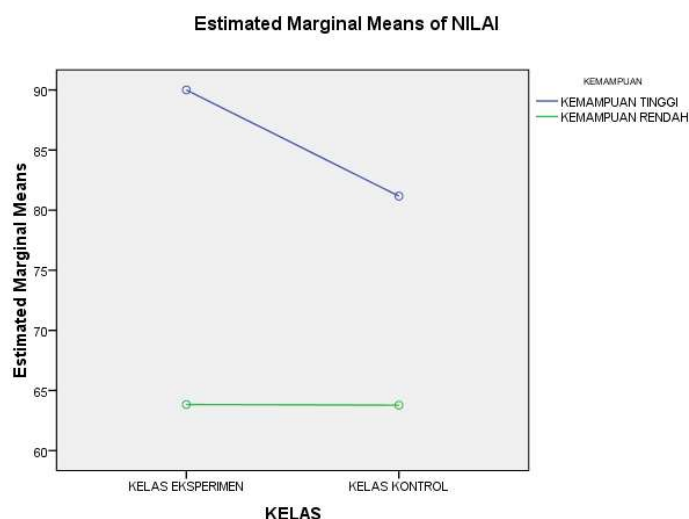
normally distributed and have a variance that is homogeneous then proceed with hypothesis testing. Hypothesis testing was done by using the two-way ANNOVA test using the *SPSS* application. The data of the two-way ANNOVA test results can be seen in Table 3.

Table 3. The Data of the Two-way ANNOVA Test Results on the Cognitive Competence and the Initial Ability of the Students in the Sample Classes.

Parameter	Mean Square	F	Sig.	Information
Class (Model)	355,556	6,017	0,017	Significant
Initial Ability	8536,889	144,473	0,00	Significant
Class * Initial ability	346,722	5,868	0,018	No interaction

Based on Table 3 above, it can be concluded that there is no interaction between the learning model and the initial ability to increase the results of the students' cognitive competence.

The learning model in this study was a *Conceptual Understanding Procedures* (Cups) learning model for the experimental class and a scientific approach for the control class. Both of the models did not have any interaction with the students' initial abilities. This can be seen in Curve 1 below.



Curve 1. Interaction between Class and Initial Ability in Sample Classes

B. DISCUSSION

Cognitive competence is an ability to solve problems that require students to connect and combine ideas, methods or procedures that were previously learned to solve problems (Yamin, 2012). Cognitive competence is the ability possessed by students including aspects of thinking, obtaining, recognizing, and understanding knowledge (Wita, 2019). One of the efforts made to improve students' learning competence is by applying the learning model in the 2013 curriculum and using the help of Student Worksheets (Sintia, 2018).

Cognitive competence assessment can be done by using tests (Sudjana, 2008). The type of test used in this study was posttest. The results obtained from this posttest that the mean scores of the experimental class were higher than the control class.

This is because the *Conceptual Understanding Procedures* is a learning model that requires students to play an active role in improving understanding of concepts through individual work, groups and presentations. The ability to understand concepts possessed by students greatly

affect the results of learning to be able to solve problems from the questions received by the teacher (Sari, 2017).

The learning process in the experimental class and the control class together classify students based on initial abilities. In this study the experimental class consisted of a group of high initial ability students and a group of low initial ability students. The results of the hypothesis test found that the conceptual understanding of the learning procedures and initial ability models can improve students' cognitive competence in the *Kingdom Plantae* and *Kingdom Animalia* materials on Grade X MIPA SMAN 2 Padang.

The mean of the students' learning outcomes on the cognitive competence with high initial ability obtained higher results compared to the students with low initial ability. This study was also in accordance with previous studies conducted by Razali (2017) that showed that students with high initial ability get higher results on their learning outcomes compared to the students who have low initial development after being given the same treatment.

The two-way ANNOVA test results showed that there is no interaction between the learning model and the initial ability of the students' learning outcomes. If the curves

intersect then there is an interaction. On the contrary, if the curves are parallel and they do not intersect then there is no interaction. Then, if the curves are horizontal and parallel then there is no interaction (Sugiyono, 2012).

IV. CONCLUSION

Based on the results of the study, it can be concluded that the application of the *Conceptual Understanding Procedures* learning model and initial ability significantly improve the students' cognitive competence.

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