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The Effect of The Concept Map Method on The Outcome of Learning Biology of High School Students on Ecosystem Materials

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Abstract: This study aims to determine the effect of using the concept map method on the biology learning outcomes of Al-Hidayah Senior High School students in Medan, Indonesia. This research is a quantitative research with a Quasi Experiment approach (quasi-experiment). The population and sample in this study were students of class X which consisted of 2 classes totaling 50 students. The research instrument used to determine student learning outcomes is using multiple choice tests in the form of pre-test and post-test as many as 20 questions that have been validated by expert lecturers and students. The research findings showed that the average pretest score for the Experimental class was 35.00, while the control pretest had an average score of 30.00 and the posttest result for the Experimental class was 83.00, while the average for Control was 70.00. And in this study, data analysis using the Independent Sample t-test showed that sig < 0.05 with a sig value of 0.00 < 0.05 with a t-count value of 6.189 and a t-table of 2.02 concept maps so that Ho was rejected and Ha received. So it can be concluded that there is an effect of Concept Map on student learning outcomes on ecosystem material in class X SMA Al-Hidayah Medan.

Keywords: biology, concept map, learning outcomes, natural science

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INTRODUCTION

Education is one of the important sectors in the development of every country. Education can be interpreted as a conscious and planned effort to create an atmosphere of learning and the learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by themselves, the community, develop all the potential they need. owned by students through the learning process based on (UU No. 20 Tahun 2003).

Sujana (2011) states that learning can be defined as any systematic and deliberate effort by educators to create conditions for students to carry out learning activities. In this activity there is a deductive interaction between two parties, namely between students who carry out learning activities and teachers who carry out teaching activities. In teaching and learning activities, children are as subjects and as objects and teaching activities. The essence of the teaching process is none other than the learning activities of students in achieving teaching goals. Teaching goals will of course be achieved if students actively try to achieve them. The activeness of students here is not only required from a physical point of view, but also from a psychological perspective. If the child is only physically active, but his mind and mentality are less active, it is likely that the learning objectives will not be achieved (Djamarah, 2010).

Literally the learning model is a strategy used by teachers to increase learning motivation, learning attitudes among students, as well as critical thinking, have social skills and achieve more optimal learning outcomes. In teaching the teacher must adapt to the conditions and atmosphere of the class. The use of one learning model tends to produce boring teaching and learning activities for students and teaching seems rigid. The quality of education is influenced by various factors, one of which is the optimal teaching and learning process. The optimal teaching and learning process not only requires students to understand the concept of learning, but also requires students to think more critically about the learning (Trianto, 2013).

For this reason, it is highly expected that students in today's era will increase their interest and ability in reading as the key to all basic knowledge and practice in all learning matters. Based on the results of the Program for International Student Assessment research, it is known that student interest in learning in Indonesia is still relatively low. When compared to countries in East Asia, Indonesian students are among the lowest. Of the 42 countries surveyed, Indonesian students ranked 39th slightly above Albania and Peru. Besides that, it

was found that the learning outcomes of Indonesian students were still far from the desired expectations.

Learning outcomes can tell us about what students have achieved in the learning process. One of the things to be achieved in formal education is to get learning achievement which is one of the main aspects to gain knowledge, skills and skills in learning. And also the measured learning outcomes can reflect the teaching objectives. Learning outcomes according to Hamsir (2017), indispensable in every teaching and learning process. Because with the learning outcomes, we can find out the level of students' understanding of a material. Students' understanding that can be seen from learning outcomes is understanding in terms of affective, cognitive, and psychomotor. The results of this study can be taken in the long term for example from semester exam results or short term for example from daily tests or tests.

Based on the initial observations made by the author at the Al-Hidayah Private High School Medan, Indonesia, it was found that the problems that are often faced in teaching and learning activities are the low feedback response from students to the teacher's questions and explanations and the lack of concentration of students in learning biology because of the assumption that Biology lessons are rote lessons and students have not been able to apply the concepts of biology in everyday life. This causes students to feel less cared for so that they make their own busyness by playing around during the teaching process. While the learning process involves students and teachers to be active and work together in discussing the subject matter. In addition, students' biology learning outcomes are below the science completeness criteria (KKM) which is 75.0. This can be seen from the average daily test scores of students in class X, which is 65.0. So that teachers need to use alternative learning models that can improve student learning outcomes.

Fajriani (2019) argues that only by using conventional learning methods students are less enthusiastic in learning, tend to be passive, have KKM which can be said to be lacking. So with this research I want to prove whether by changing the learning method or using a learning model that simultaneously uses learning media can improve learning outcomes and student responses more than using conventional learning methods. Some of the obstacles to the success of student learning outcomes are learning methods that are less relevant, teaching techniques that do not attract students' attention, learning media that are less supportive, or perhaps because of the student's readiness to accept subject matter that is less, so that there is often a low level of completeness in learning biology.

The problems that are often faced in teaching and learning activities are the low feedback response from students to the teacher's questions and explanations (Nuraini, 2017),

and the lack of concentration of students in learning biology because of the assumption that biology lessons are rote lessons and students have not been able to apply them. Biological concepts in everyday life. In general, students think that biology is a lesson that is only limited to memorizing without understanding existing concepts and students tend to be passive by only listening to the teacher's explanation in class without any activity from students so that students are less enthusiastic and get bored quickly to take biology lessons. This is because the delivery of the material presented by the teacher is less attractive without being accompanied by learning strategies and less varied teaching methods. To overcome this, a solution is sought, namely teaching with a concept map strategy, which is a schematic picture to present a series of concepts and the relationship between these concepts. This concept map reveals meaningful relationships and emphasizes the main ideas (Hikmawati, 2013). By using a concept map, students are expected to express all their knowledge about a biological problem to be used to solve the problem.

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In general conveys that strategy has the meaning of an outline of the direction to act in an effort to achieve predetermined targets (Apriyanto, 2012). Associated with teaching and learning, strategies can be interpreted as general patterns of teacher and student activities in the realization of teaching and learning activities to achieve the goals that have been outlined. Learning strategy is a learning activity that must be done by teachers and students so that learning objectives can be achieved effectively and efficiently and learning strategies are special actions taken by someone to make it easier, faster, enjoy more, understand more directly and be more easily transferred into situations. new ones (Ahmad, 2017).

To overcome this, a solution is sought, namely teaching with a concept map strategy, which is a schematic picture to present a series of concepts and the relationship between these concepts. The concept is an abstraction of a series of experiences defined as a group of objects or events. Abstraction means a process of focusing one's attention on a particular situation and taking certain elements and ignoring other elements. For example, if someone wants to make an abstraction about leaves, he focuses on leaf color and ignores leaves as a caterpillar's

habitat. From the description above, it can be concluded that to be able to master the concept, one must be able to distinguish between one object and another, one event and another.

By mastering the concept students will be able to classify the world around them. According to the concept, for example, according to color, shape, size, number and so on. Example: concepts in biology are biotic, abiotic, individual, population and community. Thus, these concepts are very important for humans in thinking and in learning. By mastering the concepts, it is possible to acquire unlimited knowledge.

Safitri (2016) revealed that what is meant by a concept map is a concrete graphic illustration that identifies how a single concept is linked to other concepts in the same category. In order to have a clear understanding of the characteristics of a concept map, namely: (1) A concept map or concept mapping is a way to maintain the concepts and proportions of a field of study; (2) A concept map is a two-dimensional image of the field of study; (3) How to express the relationship between concepts; and (4) hierarchical characteristics, namely two or more concepts are described under a more inclusive concept, forming a hierarchy on the concept map.

This concept map reveals meaningful relationships and emphasizes main ideas. By using a concept map, students are expected to express all their knowledge about a biological problem to be used to solve the problem. Making a concept map is done by making a visual presentation or a diagram of how important ideas or a particular topic are related to each other. To create a concept map, students are trained to identify key ideas related to a topic and arrange these ideas in a logical pattern. Sometimes the concept map focuses on cause-and-effect relationships.

The advantages of using the concept map method for teachers according to Trianto (2013), include: (1) Helping what has been done what has been known in a simpler form, planning and starting a learning topic, and changing the keywords that will be used in learning; (2) Help to revise the learning concept, create a pattern of excellent work and study notes for achievement purposes; (3) Helping to diagnose what students already know in the form of structures they build in the form of words; (4) Helping to find out the students' misconceptions, for example in the exam there will be a picture of students processing their ideas in graphic form; (5) Help to check students' understanding of the concepts being studied where the concept map made by students is right or wrong; and (6) Help to correct conceptual errors that students accept as a basis for learning.

While the advantages of the concept map method for students include: (1) Helping students to identify key learning concepts, interpreting/estimating understanding relationships

and assisting in further learning; (2) Help make the concept of the lesson better so that it is easy for exam purposes; (3) Helps to provide a thought for linking lesson concepts; (4) Helping to think more deeply with students' ideas and making students understand correctly the knowledge they have acquired; (5) Clarifying the ideas obtained by students about something in the form of words; (6) Creating an understanding structure of all the facts associated with subsequent knowledge; (7) Learn how to organize something starting from information, facts and concepts into a context of understanding, so that it is formed; and (8) good understanding and writing correctly.

METHOD

This type of research includes quasi-experimental research (quasi-experimental) by using a two-class research sample (Sugiyono, 2008). The samples taken in this study were divided into two groups, namely the experimental group I as the class that was taught using the concept map method for class X1 and the experimental group II as the class that was taught without using the concept map method for class X2. There are two kinds of variables in this study, namely independent variables (which affect) using the concept map method and without using the concept map method. While the dependent variable (influenced) in this study is student learning outcomes on ecosystem material in class X IPA at SMA Swasta Al-Hidayah Medan, Indonesia. The instrument of this research is a test. The test instrument is used to determine student learning outcomes (Sanjaya, 2006). The form of the design used in the study is presented in **Table 1**.

Table 1. Research design

Sample	Pretest	Treatment	Posttest
Experimental Class (X1)	T1	X1	T2
Control Class (X2)	T1	X2	T2

Provision:
X_1 = Learning using concept maps
X_2 = Learning without using concept maps
T_1 = Pretest
T_2 = Posttest

FINDING AND DISCUSSION

Finding

This research was conducted to determine the effect of the concept map learning method on student learning outcomes on ecosystem material. To collect data on learning

outcomes, researchers used pretest and posttest. The results of the tests carried out can be seen in **Table 2**.

Table 2. Pretest and posttest scores

Class	N	Min	Max	Mean
Control class pretest	25	15	45	30.00
Control class posttest	25	60	85	70.00
Experimental class pretest	25	15	45	35.00
Experimental class posttest	25	75	95	83.00

Notes:
N : number of samples
Max : maximum lowest scores
Min : Minimum lowest scores
Mean : Average scores

Based on **Table 2**, it can be seen that the learning scores of the control class before applying the concept map learning method obtained a pre-test score with a minimum score of 15, a maximum of 45 and an average of 30. After applying the concept map learning method, a post-test was obtained with a minimum score of 60, a maximum of 85. and an average of 70. Whereas in the experimental class before the concept map learning method was applied, the minimum pre-test scores were 15, the maximum was 45 and the average was 35. After the concept map learning method was applied, the post-test scores were a minimum of 60, a maximum of 85 and an average 70.

The data obtained from this study is the result of student learning on the material Ecosystem in class X SMA Swasta Al - Hidayah Medan. Before conducting the research, the instrument was first validated in class XI IPA to determine the reliability, discriminatory power, and level of difficulty of the test.

Validation Test

After the test was tested and looked for test validation, it was obtained from 50 questions tested there were 20 valid questions and 30 invalid questions showed in **Table 3**.

Table 3. Validation test

No	Test Validity Category	Question Number
1	Invalid	1, 3, 4, 6, 8, 9, 12, 13, 15, 17, 18, 19, 20, 21, 22, 24, 26, 27, 29, 30, 31, 32, 35, 38,41,42,43,47,48,49,50.
2	Valid	2, 5, 7, 10, 11, 14, 16, 23, 25, 28, 33, 34, 36, 37, 39, 40,44,45,46.

Reliability Test

From the test results, the reliability of the test was 0.857 so that r_{11} = (0.857) > r_{table} = (0.334). So, it can be concluded that the overall learning outcomes test is reliable and can be used as a research instrument.

Difficulty Level Test

From the test results, it can be seen that of the 50 items tested, there are 27 easy questions, 22 medium questions and 1 difficult item.

Power of Different Questions

Based on the results of the calculation of the discriminatory power test, it shows that from 50 items the following results are obtained: 36 questions are classified as having distinguishing power that meets the requirements (not difficult) and 14 questions are classified as having distinguishing power that does not meet the requirements (difficult). The categories of distinguishing power of the items are shown in **Table 4**.

Table 4. Power of different question

No	Distinguishing Power	Question Number
1	Not Difficult	1, 3, 4, 6, 8, 9, 12, 13, 15, 16, 17, 18, 19, 29, 21, 22, 23, 24, 26, 27, 29, 30, 31, 32, 35, 38,41,42,43,44,45,46
2	Difficult	2, 5, 7, 10, 11, 14, 25, 28, 33, 34, 36, 37, 39, 40,47,48,49,50

The next data analysis begins with the normality test, homogeneity test, and hypothesis test.

Normality Test

In this study, the normality test was carried out by the Shapiro-Wilk test using the help of the Statistical Product and Service Solution (SPSS) software version 22. In the normality test there are criteria for significance, if the significance is less than 0.05 then the data obtained is not normally distributed, and if the significance is more than 0.05 then the data obtained is normally distributed. The results of the normality of student learning outcomes can be seen in **Table 5**.

Table 5. Normality test

		Kolmogorov-Smirnov[a]					
	Class	**Statistic**	**df**	**Sig.**	**Statistic.**	**df**	**Sig.**
Students Outcome	Control Class	0.149	25	0.160	0.941	25	0.154
	Experiment Class	0.198	25	0.013	0.915	25	0.069

Based on the test of normality output table above, it is known that the df (degree of freedom) value for the control class and the experimental class is 25. So the number of samples and each class is less than 50, so the Shapiro-Wilk value is used to see if the data is normally distributed or not. From the output above, it can be seen that the significance value of the learning model is 0.069, which is greater than 0.05, so it can be concluded that the control and experimental classes are normally distributed.

Homogeneity Test

This homogeneity test is used to test whether the two groups of data from different samples are homogeneous. Homogeneity testing is carried out using the Levene's Test approach with the provision that if the Sig value is > 0.05, the research data is declared to have a homogeneous variance or comes from a homogeneous population. Based on the results of the calculation of the homogeneity test of the control class and the experimental class, the data summary is obtained in **Table 6**.

Table 6. Homogeneity test

Test of Homogeneity of Variance					
	Levene	**Statistic**	**df1**	**df2**	**Sig.**
Students Outcome	Based on Mean	0.626	1	48	0.433
	Based on Median	0.457	1	48	0.502
	Based on Media and with adjusted df	0.457	1	45.617	0.502

Based on the output of the test of homogeneity of variance, it is known that the significance value based on the mean is 0.433, which is greater than 0.05, so it can be concluded that the post-test variance of the control and experimental groups is the same or homogeneous. Thus, one of the requirements of the Independent Sample t-test has been fulfilled.

Hypothesis Test

After knowing that the data is normally distributed and homogeneous, then a hypothesis test is carried out to determine whether the alternative hypothesis (Ha) in this study is accepted or rejected. In testing this hypothesis using the Independent Sample t-test at the value of Sig = 0.05 where if the value of Sig> 0.05 then Ho is accepted, meanwhile if the value of Sig <0.05 then Ha is accepted.

Based on the output of the Independent Sample t-test, it is known that the significance value of Levene's test for equality of variance is 0.433, greater than 0.5, it can be interpreted that the data varience between the control class and the experimental class is homogeneous or

the same (Sanjaya Wina, 2006). Based on the independent sample t-test output in the t-test for equality of means, it is known that the sig(2-tailed) value of 0.00 is smaller than 0.05, so as the basis for decision making in the independent sample t-test test, it can be concluded that Ho is rejected and Ha is accepted. Thus it can be concluded that there is a significant effect on student learning outcomes in the control class and the experimental class.

Based on the results of the experimental class and control class t-test calculations. it is found that tcount is 6.189 and t_{table} is 2.02, so that the value shows tcount > t_{table}. So it can be concluded that there is a significant effect of the concept map method on student learning outcomes on ecosystem material in class X SMA Al-Hidayah Medan.

Discussion

This study begins with giving a pre-test origin test to the two predetermined class samples (Arsyad, 2019). Then in each class taught with a different model. The experimental class is taught using a concept map and the control class is taught using the conventional. At the end of the study, a post-test was given to determine student learning outcomes. When learning takes place, students are taught by the concept map method, are more active in seeking information from various information and are more enthusiastic in expressing their opinions through questions during discussion. While the control class students tend to be passive and less participate in the learning process.

During the learning process, the researcher encountered several obstacles. The obstacles faced by researchers were in the experimental class, namely, during group discussions students could not maintain conduciveness in class and learning resources were only textbooks (enrichment), because they were not conducive, some of the students were not active in discussions and silent in answering the questions given. The solution to this problem is to give rewards for each lesson so that students are more motivated to work together in groups. In the control class, the obstacles faced by the researchers were learning resources that only came from textbooks (enrichment), students had difficulty understanding. The solution to this problem is that the teacher provides learning materials to complement the textbook (Buzan, 2013).

Based on the research data that has been collected and carried out data processing, this discussion will answer the formulation of the problem that has been determined. It is known that there is an influence of the concept map learning method on the biology learning outcomes of the students of SMA Al-Hidayah Medan. This can be known through data

analysis of test results (Pre-test and Post-Test) which were tested on the experimental class and the control class. The following is an explanation of the research results.

This research was conducted in the experimental class (X1) whose learning uses the concept map method after the researchers processed the data obtained from the test (Arikunto, 2013), in the form of multiple choice as many as 20 item questions used to determine students' biology learning outcomes, then the grades were obtained in the class. The experimental results obtained an average of 77.031 with the highest score of 90 and the lowest score of 65. While the control class obtained an average of 72.813 with the highest score of 85 and the lowest score of 60. KKM or < 75.

Based on the results of data processing, normality testing was carried out using the Shapiro-wilk technique at the value of Sig = 0.05 where if the value of Sig > 0.05 then the data was normally distributed and the data obtained in the control class and experimental class respectively Sig> 0.05 i.e. 0.158 and 0.152. Then the data on the value of biology learning outcomes for the two classes is normally distributed. Furthermore, in this study, hypothesis testing uses data from the post-test differences between the experimental class and the control class. The results of data processing using the Independent Test Sample t-test at the value of Sig = 0.05 where if the value of Sig> 0.05 then Ho is accepted, meanwhile if the value of Sig <0.05 then Ha is accepted, which is where the Sig value is obtained. (2-tailed) = 0.000 < 0.05. This shows that t-count > t-table. Thus it can be concluded, there is an effect of the concept map method on student learning outcomes.

This is supported because the application of concept map learning requires students to be more active, foster an attitude of responsibility and increase students' confidence in solving a problem in learning. During the learning process, the teacher provides opportunities for students to discuss with each other and seek answers to a question through an oral question from the teacher in a pleasant learning atmosphere. Beginning with a discussion and ending with a question and answer session, it will be easier for students to remember and understand ecosystem material so that it can improve student learning outcomes. One of the supporters of increasing experimental class student learning outcomes is the use of concept maps that encourage students to actively participate in learning, so that students are more active in listening to explanations from other groups and from their own groups.

The results of this study are in line with previous research conducted by Iskandar (2013) which states that learning using concept maps can improve eye abilities and can strengthen brain processes on cognitive and metacognitive abilities between the experimental class which is higher than the control class. This happens because students do more analytical thinking to

be able to construct the knowledge they learn in a certain form. Based on the research, the posttest value of the experimental class was 71.46 and the control class was 57.33. With this, the concept map had an effect on the biology learning outcomes of the tenth grade students of SMA Al-Hidayah Medan. Research shows the results of data analysis that students who are taught with concept maps have a higher learning value, namely the average value of 83.833 while the control class with an average value of 70.667. The results of this data analysis are supported by research by Arnidha (2015), which shows that the concept map learning model has a significant effect on student learning outcomes. The learning completeness for the experimental class was almost 100%, while the control class was 66.7%.

Thus, active learning using concept maps is able to provide learning that improves learning outcomes of activeness and learning mastery, adds scientific nature, can lead to collaboration with others, develops analytical and creative thinking skills, develops knowledge, skills and self-confidence. In accordance with the objectives of learning biology subjects in SMA/MA. Based on the explanation above, it can be concluded that the use of the concept map method has an effect on student biology learning outcomes on ecosystem material in class X SMA Al-Hidayah Medan.

CONCLUSION

The results of experimental research by applying the concept map method with the aim of knowing its effect on the learning outcomes of class X students of SMA Al-Hidayah Medan. Based on the results of the research and discussion above, it can be concluded that there is an effect of the concept map learning method on the biology learning outcomes of students at SMA Al-Hidayah Medan. This is based on the Independent Test Sample t-test at a value of Sig = 0.05 where t-count > t-table. So there is a significant influence on student learning outcomes.

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