EFFECTIVENESS OF 5E LEARNING CYCLE IN DYNAMIC ELECTRICTY KELAS X SMA NEGERI 3 MEDAN

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ABSTRACT

The purpose of this research was to find out the effectiveness of 5E learning cycle in dynamic electricity kelas X SMA Negeri 3 Medan in Academic Year 2012/2013. The research method was quasi experiment. The samples were divided into experiment and control class. Population in this research was all students of grade X in SMA Negeri 3 Medan. The sample in this research consist of two class X_1 as experiment class and X_2 as control class determine by simple random sampling. The results that were obtained: (1) the post-test mean value of the experiment class was 76.29 is good category and 69.29 was the mean value for control class is good enough category. Standard deviations for both classes were 10.31 and 9.48. The t count was 2.94 and t table was 1.99 then the $t_{count} > t_{table}$. Hence, alternative hypothesis (Ha) was accepted and null hypothesis (Ho) was rejected.(2) Furthermore, the mean value of student's learning outcomes in experiment class from affective and psychomotor domain were 72.68 and 71.6 while in control class were 69.7 and 69.8. It was concluded that there were no effect difference of 5E learning cycle and direct instruction learning model for affective and psychomotor domain on students learning outcomes in dynamic electricity.(3) In addition, the mean value of instrument's sensitivity index in experiment class was 0.320 that was sensitive category while in control was 0.281 which meant that was not sensitive category. The percentage the result of class learning mastery in experiment class was 85.7% that was categorized passed meanwhile in control class was 57.1 % that categorized not passed. Then, the mean value of activities observation result in experiment class was 73.15 while in control class was 68.15 that were included in good category. It was concluded that 5E learning cycle is more effective than direct instruction learning model. Therefore, the effectiveness of 5E learning cycle was high on the student's learning outcomes

Keywords: 5E learning cycle model, learning outcomes, effectiveness

Introduction

Physics is one of the important sciences in improving the quality of human resources, in addition physics is a branch of natural science which emphasizes the provision of direct experience to develop competencies to enable students to explore and understand the concepts of physics. Basically physics as a science is interest, in which studied natural phenomena and try to reveal all the secrets of the universe and the laws that occur in our daily life. Still, learning physics is considered to be a difficult subject.

Interviews with Physics teacher Class X-1 SMA Negeri 3 Medan Sehat Anakampu said that the average value of student learning outcomes in the year 2012/2013 which is 60 while the minimum completeness criteria (KKM) learning outcomes will achieve is 70 . It means student's learning outcomes less optimal. Also said that active student is passive category in class. The low value of the average student's learning outcomes is 60 because teachers do not use variety of learning model. It can be concluded that during the learning process is still using lectures, notes, and work on the problems. These facts reinforce that learning is still dominated by the teacher centered, which focuses on the mastery of the learning outcomes of knowledge products aimed at students considering factual information.

One solution for this problem is to prepare student's to become good adaptive learners. That is students should be able to apply what they learn in school to the various situation in real life. Obviously, the traditional teacher as information giver, textbook guided classroom has failed to bring about desired outcome of product thinking students. An alternative is to change the focus of the classroom from teacher – centered to student-centered using a constructivist approach. With the emphasis on the learning, we see that learning is an active process occurring within and influenced by the learner as by the instructor and the school. From this perspective, learning outcomes do not depend on what the teacher present. Rather, they are interactive result of what information is encountered and how the student process it base on perceive notion and existing personal knowledge (Kilavuz,2005:15)

Learning cycle which is an inquiry–based teaching model is useful to teacher is designing curriculum material and instructional strategies in science. The model is derived from constructivist ideas of the nature of science, developer by Robert Karplus with the Science Curric ulum Improvement Study (SCIS) in 1964. The learning cycle of Karplus has three phases. These are exploration, term introduction and concept application. Over the years the learning cycle is revised and added several phases. So, 5E learning cycle is formed. It is developed by the Biological Sciences Curriculum Study (BSCS). It consists of the following phases: engagement, exploration, explanation, elaboration, and evaluation. The 5E learning cycle has been shown to be an

extremely effective approach to learning (Kilavuz, 2005:15).

This is several researchers who have conducted research about 5E Learning Cycle Model, including; According to Nazila Ramadhani (2011:71) in the" Influence Of Constructivism 5E on Student's Learning Outcomes in SMA Laksamana Martadinata in Academic Year 2011/2012" *(Pengaruh Model Pembelajaran Constructivism 5E Terhadap Hasil Belajar Siswa DI SMA Laksamana Martadinata T.P 2011/2012)* conducted research as quasi experiment. Researcher's research shows that using the 5E Learning Cycle Model can provide the improvement of student learning outcomes and activities , this can be seen from result student's activity increase 74.4 using 5E Learning Cycle Model and with Conventional Model Learning is result student's activity is 61.5 with active category. In addition student learning outcomes which have increased from 33.5 to 66.3 and difference effect 5E learning cycle model and conventional model of student learning outcomes is 21.26%.

According to Satria Tinambunan (2012:54) in the "Influence of Learning Cycle Model Using Mind Mapping on Student's Learning Outcomes in Dynamic Electricity in Class X Semester II SMA Swasta Parulian 1 Medan Academic Year 2011/2012 " (*Pengaruh Model Pembelajaran Learning Cycle Berbasis Peta Konsep Terhadap Hasil Belajar Siswa Pada Materi Pokok Listrik Dinamis di Kelas X Semester II SMA Swasta Parulian 1 Medan T.P 2011/2012)*conducted research as quasi experiment method by designing with pre-test and post-test and observe how the activities of student during the learning model was applied. Researcher shows that using the learning cycle model can provide the improvement of student's learning outcomes and activity, this can be seen from student's learning outcomes which have increased from 40.28 to 64.42 In addition student's learning activity higher than student less active this learning

According to Meghann A. Campbell (2012:67) in the "The Effect of The 5E Learning Cycle Model on Students' Understanding of Force and Motion Concepts" conducted research as quasi experiment. Researcher shows that using the Learning Cycle Model can provide the improvement of student learning outcomes and activities. This can be seen from result student learning outcomes which have increased was increased as 70.3 and difference effect learning cycle model and conventional model of student learning outcomes is 14.8%.

According to Yeliz Kilavuz (2005) in the "The Effect of 5E Learning Cycle Model Based on The Constructivist Theory on Tenth Grade Student's Understanding of Acid – Based Concept" conducted research as quasi experiment. The results showed that there was no significant difference at the beginning of treatment between the two groups in terms of achievement of acid base concepts (t=-1.134, p>00.5) and attitudes toward chemistry as school subject (t=0.015 p>0.05) before treatment. The 5E learning cycle

model based instruction caused a significantly better acquisition of scientific conception related to acid-base concept than traditionally designed chemistry instruction and The pre and post test scores of Acid –Base Concept Achievement Test shows that experiment class achievement was increased. Thus, it can be concluded that the growth in understanding of acid –base concept is statically significant.

Here will conduct quasi experiment to increase student's learning outcomes whether it from cognitive, affective, and psychomotor domains in Dynamic Electricity material and also effectiveness of 5E Learning cycle model.

Based on the above researcher are interested in conducting research entitled "Effectiveness of 5E Learning Cycle Model in Dynamic Electricity Kelas X SMA Negeri 3 Medan".

5E Learning Cycle

The learning cycle model is the teaching procedure that was invented to satisfy the requirements of the nature of science teaching and the nature of the learner. The learning cycle moves children through a scientific investigation by allowing them first to explore materials, then to construct a concept and finally to apply this concept to new ideas. The learning cycle is a model for teaching in all subject area; it provides a basis for thematic and integrated instruction and offer many opportunities to measure real learning. The learning cycle model is based on Piaget theory and involves a constructivist approach to teaching. It is proposed to help students progress from concrete to abstract thinking about context. Learning cycle is teaching model based on the knowledge organization process of mind. It helps student to apply concept and make their scientific knowledge constant. A well known model of science teaching and learning is called " the learning cycle " or by an alternative model is called the "5E".(Soomro et.al,2010)

5E model is a popular version of constructivism (e.g. Hanuscin & Lee, in Kurnaz & Calik, 2008), because each "E" contains a part of the process that helps students learn to run in the correct order in connecting prior knowledge with the new concept, the model consists of engagement, exploration, explanation, elaboration, and evaluation (Bybee et.al, 2006).

5E model is continuations of the learning cycle model proposed Atkin Karplus early 1960 and were later used by the SCSI (Curriculum Improvement Science Study) (Bybee et.al, 2006). SCSI learning model (model Atkin and Karplus) consists of three phases, namely exploration, term introduction, and concept application. In the model 5E, SCSI is coupled with the two-phase engagement at the beginning and at the end of the evaluation phase.

Since the late 1980s, BSCS (Brain, Mind, Experience, and School) has been one of the main learning models used extensively in the development of new curriculum materials and professional development experience. This model is commonly referred to as the BSCS 5 E Instructional Model, or 5E, and consists

of the following stages: engagement, exploration, explanation, elaboration, and evaluation. Each stage has a specific function and contributes to the teacher's instructions and formulating coherent learning from a better understanding of the scientific and technological knowledge, attitudes, and skills (Bybee and Taylor, 2006). Comparison between models; BSCS 5E with SCSI models is shown in the following table:

In the book The Science Teacher, there is a learning model called the learning5E learning model Constructivism, 5E learning model Constructivism learning cycle is a model that can help students in the learning process is learning cycle is the process of transferring knowledge from prior knowledge to form coherent knowledge and concept.

Bybee et al. (In Kurnaz & Calik, 2008) has summarized the phases of learning in the model 5E, as follows.1. Engagement: To access students' pre-existing knowledge teacher gets students to engage in short activities or question that promote curiosity and draw out prior knowledge is supposed to make a connection between prior and current learning experiences so that the teacher is able to organize students' thinking toward the learning outcomes of current activities. 2. Exploration : Student complete lab activities or group discussion or hands-on activities or role playing or analogies; enable them to exploit their own pre-existing knowledge to produce new ideas, explore questions, and devise and implement a preliminary investigation. 3. Explanation: This phase which needs a more teacher engagement, also gives opportunities, for teachers to directly introduce a conceptual process, or skill. Further, students understanding of the concept or track their correct and incorrect knowledge claims. Finally, the teacher leads them to hold a deeper understanding, which is a critical part of this phase.4. Elaboration: To elaborate student's conceptual understanding and skills, student attempt to extend their newly structured knowledge to deeper and broader understanding, more information, and adequate skills. Also, they can apply their understanding of the concept. 5. Evaluation: The phase the students to assess their comprehension and abilities and gives opportunities for teachers to know how to evaluate their students progressed to accomplish the educational objectives.

Research Method

This research was conducted at SMA Negeri 3 Medan in even semester academic year 2012/2013 during April - May. The population in this research is all students of first grade of science in high school and consists of 15 classes. The total student is 525 students where the number in each class is 35 students. Sampling technique this research is using simple random sampling. This technique provides the same chance for every part of population to select into sample. Sample selected randomly and obtained two classes that used an experiment and control class. From the result of random selection, then X-1

class choose as control and X-2 as experiment class.

Research design is shown as below:

Table 3.1 Two Pretest–Posttest Design

Sampel	Pre-Tes	Treatmen	Post-Test
Experiment	X_1	**S**	X_2
Control	X_1	**O**	X_2

Description:

X_1 = Pre-test

X_2 = Post-test

S = Treatment by 5E learning cycle model

O = Treatment by direct instruction learning

The selection of the data aimed to observe whether sample come normal population distribution or not. The test used Liliefors test and Homogeneity test for know both samples from homogeneity population with formula:

$$F_{count} = \frac{S_1^2}{S_2^2}$$

If $F_{count} \geq F_{table}$ H_0 is refused (have different variance). Where

Ftable= F ½ ∝ (v_1,v_2) by opportunity $\alpha = 0.05$ with freedom degree $V_i = n_1-1$ dan $V_j = n_j-1$

Hypothesis test is use t test with formula: $t = \dfrac{\overline{x_1} - \overline{x_2}}{S\sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}}$

With combination deviation standard:

$$S^2 = \frac{(n_1 - 1)S_1^{\ 2} + (n_2 - 1)S_2^{\ 2}}{n_1 + n_2 - 2}$$

Where

t =t distribution

$\bar{X}_1$= mean value of experiment class

$\bar{X}_2$= mean value of control class

n_1 = size of experiment class

n_2 = size of control class

S_1^2 = variance of experiment class

S_2^2 = variance of control class

Testing criteria (Sudjana, 2005;239) accept H_O if $-t_{1-1/2\alpha} < t < t_{1-1/2\alpha}$.Where $t_{1-1/2\alpha}$ got from t distribution list where dk= $(n_1 + n_2 - 2)$ and opportunity $(1 - 1/2\alpha)$ and $\alpha = 0.05$ for other t H_O refused.

Research Result

The result of research show that there was difference effect in cognitive domain on student's learning outcomes by using 5E learning cycle model and direct instruction model in dynamic electricity for grade X SMA Negeri 3 Medan. This was reinforced by the acquisition of the mean value of post test in experiment class was 76.29 with standard deviation was 10.31.While in control class the mean value of post test was 69.29 with standard deviation was 9.48.

Student's learning outcomes in affective domain of experiment class that used 5E learning cycle model at the meeting I 69.14 was and meeting II 76.22 was, so the mean value of student's learning outcomes in affective domain of experiment class was 72.68. While, student's learning outcomes in affective domain of control class that used direct instruction learning model at

meeting I was 70.7 and meeting II was 68.6. The affective domain in experiment class increase each indicator because given treatment 5E learning cycle, student have good attitude in participation in group ,hearing, increase logic, critical thinking ,creative and student has good listen for regulation each for phase of 5E learning cycle While in control class has decrease because only teacher center, direct instruct make student bored and lost concentration, so the mean value of student's learning outcomes in control class was 69.7. Both in experiment and control class were included in good category.

Student's learning outcomes in psychomotor domain of experiment class that used 5E learning cycle model at meeting I was 68.13 and meeting II was 75.09, so the mean value of student's learning outcomes in psychomotor domain of experiment class was 71.6. While student's learning outcomes in psychomotor domain of control class that used direct instruction learning model at meeting I was 72.2 and meeting II was 67.5. In experiment class psychomotor domain has increase because the student to be active in each phase 5E learning cycle, student engaged in experiment, student give explain about the experiment, student give conclusion the subject material, and the student must be creative and critical thinking .5E learning cycle is based on student centre. In control class teacher active in learning process and the student only listen and write explain from teacher. Direct instruction make the students is passive and bored, because based on teacher centre. So, the mean value of student's learning outcomes in psychomotor domain of control class was 69.8. Both in experiment and control class were included in good category.

In this research, on the result of affective and psychomotor assessment that has obtained was concluded that there were no effect difference of affective and psychomotor domains on student's learning outcomes whether using 5E learning cycle model or direct instruction learning model in dynamic electricity for grade X SMA Negeri 3 Medan. Both in experiment and control class were included in good category whether it affective and psychomotor domains.

In addition the result of research showed that 5E learning cycle model was more effective than direct instruction learning model in dynamic electricity for grade X SMA Negeri 3 Medan. It was determined from the fulfillment of three requirements a learning effectiveness, they are sensitivity index of instrument, learning mastery and activities observation result. The mean value of instrument's sensitivity index in experiment class that used 5E learning cycle model was 0.320.This was included in sensitive category. While the mean value of instrument's sensitivity index in control class that used direct instruction learning model was 0.281. This result was not fulfilling the requirement of sensitive the sensitivity index of instrument.

Class learning mastery in experiment class that used 5E learning

cycle model was 85.7 %, it was categorized passed. While the result of learning mastery in control class that used direct instruction learning model was 57.1%, it was categorized not passed. The mean value of observation result teacher activity that was conducted by observer in experiment class that used 5E learning cycle model at meeting I was 71 and meeting II was 75.3, so the mean value for the entire meeting was 73.15, it was included in good category. Based on these results was concluded that the activities in experiment class was increased, while in control class was decreased. In experiment class activity of teacher is increase because teacher develops creativity in management of class and time.

The mean value of observation result student activity that was conducted by observer in experiment class that used 5E learning cycle model at meeting I was 69.6 and meeting II was 77.03, so the mean value for the entire meeting was 73.31, it was included in good category. Based on these results was concluded that the activities in experiment class was increased, while in control class was decreased. In experiment class student be more active doing activity in class and laboratory because student must follow 5E learning cycle demanding high active for develop an interest and curiosity of the material that will be taught, make experiment, trying explain concept, elaborate in make decision and solve problem, and evaluate, student must give conclusion about material.

5E learning cycle model is a better than direct instruction learning because in 5E learning cycle model student actively participate in the learning process and understand how that they learn. In addition, by the expert group, students will be more focused and feel responsible for solving and working problems which is a part of them so that when turned to origin group could teach other group members. Beside 5E learning cycle model more emphasis on the mastery concept and students will be more active in class because each group has different problems and the students understand the subject matter easily, while in the control class that use direct instruction learning model students just sit and listen to the teacher's explanation without trying to solve its own problem though also given worksheets.

This several researchers who have conducted research about 5E learning cycle model , including; Nazila Ramadhani (2011) that researched students in SMA, Satria Tinambunan (2012) that researched in SMA, Meghan A Campbell (2012) that researched in Senior High School and Yeliz Kilavuz (2005) in Senior High School. These researchers' shows that by using 5E learning cycle model in learning can improve student's learning outcomes, student's activities and enhance student's interest that was activeness in following the learning process.

This was happened because the indicators that was used to assets student's learning outcomes has not appropriate to find out student's learning outcomes whether if affective

or psychomotor domains. Furthermore there are two meeting only this research so it has not enough to assets student's learning outcomes from affective and psychomotor domains. To improve student's learning outcomes in affective and psychomotor domains. To improve student's learning outcomes in affective and psychomotor domains for next research, better to select and make the more appropriate indicators whether it for affective or psychomotor domains in order obtain the appropriate result accurately and making the addition of learning meeting. Beside of it, more knowing the ability, attitude, and value of students.

During learning process there were some constraints encountered, namely the noisy of students in forming a group whether it when forming the origin or expert group. In addition there were several students who were less concerned with was assigned to him and less active in learning. This was happen because there were students who felt himself unsuitable with the other members of the group so that students are not active in the group. There are also students who keep silent because did not understand the given task. The other constraint is the lack of time in this research so not all groups can present results of their discussions.

Therefore it is desirable for further researcher to do better observation and guide students do working in groups by asking questions to each student about what he had done in groups and constraints faced by students during discussions. Furthermore, more attention to the steps in learning to achieve improve of learning outcomes, anticipate the time addition of the research and try to find out the other requirements of the learning effectiveness.

Conclusion

Based the analysis of result of research, it was concluded:

(1) There was significant effect difference of 5E learning cycle model and direct instruction learning model for cognitive domain on student's learning outcomes in dynamic electricity. 5 e learning cycle model was better than direct instruction learning model.(2)There was no significant effect difference of 5 e learning cycle model and direct instruction learning model for affective and psychomotor domains on student's learning outcomes in dynamic electricity. Both 5E learning cycle model and direct instruction learning model were included in good category.(3)The effectiveness of 5 e learning cycle model was high than direct instruction learning model for cognitive domain on student's learning outcomes in dynamic electricity. Furthermore, 5E learning cycle model was more effective than direct instruction learning model on student's learning outcomes. It was obtained by fulfilling the three requirements of the learning effectiveness, namely index sensitivity of instrument, learning mastery and activities observation result.

Suggestion

Based on the results and conclusions in this research, there were some suggestions, namely:

(1) Researcher who want to conduct research using 5E learning cycle model is suggested that better monitor the activities of students in the group by observing and guiding students for working in groups by asking questions to each student about what he/she had done in group and constraints faced by students during discussion.(2)For further researcher is suggested to be more creative in managing the classroom and to be more efficient in time.(3)For further researcher who want to find out about affective and psychomotor domains is suggested to find out the more appropriate indicators that will be used to student's learning outcomes in order obtain the appropriate result accurately.

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