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THE EFFECT OF SETS LEARNING MODEL AND SCIENTIFIC ATTITUDE TOWARD STUDENT'S PHYSICS ACHIEVEMENT

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Abstract

The purpose of this study is determine the effect of science, environment, technology, and society (SETS) learning model and scientific attitude toward student's physics achievement in XI grade student. This study was conducted at SMAN 2 Indramayu. This study used quasi experiment method with Two Way Anova design. There are 64 students as the sample and it was selected by purposive sampling. Students in experimental group learned through Science, Environment, Technology, and Society. Meanwhile, in control group, students learned through Inquiry Learning. The result of this study are: the student's achievement given by Science, Environment, Technology and Society is higher than Inquiry; there is influence of interaction between learning models and scientific attitude toward student's achievement; student's achievement given by Science, Environment, Technology, and Society is higher than Inquiry in group of student's with high scientific attitude; and student's achievement given by Science, Environment, Technology, and Society is lower than Inquiry in group of student's who have low scientific attitude

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INTRODUCTION

Education is a guidance process that is carried out intentionally. Education in the broadest sense is all the learning experiences that students through all environments and throughout life. Education within narrow constraints is a learning process carried out in formal educational institutions (madrasas / schools) (Ramayulis, 2015). Learning is an activity that processes and is a very fundamental element in the implementation of every type and level of education. This means that the success or failure of achieving educational goals is very dependent on the learning process experienced by students, both when he is in school and in the home or his own family (Syah, 2010). In the learning process, the teacher will set goals or targets that must be achieved by students as a sign of successful learning. Learning in the 2013 curriculum requires changing patterns of teaching centered learning (TCL) towards student centered learning (SCL). When viewed from the essence, the structuring of learning in the implementation of the 2013 curriculum is a paradigm shift, from behavioristic to constructive. The behavioristic paradigm views knowledge as something that has been done, the one who lives is transferred by the teacher to students with the term transfer of knowledge. The constructivist paradigm views that knowledge is the result of construction or formation of students who are learning. Thus, learning is a process of seeking and forming or constructing knowledge that is active and takes place specifically (Mulyasa, 2015).

Science as a scientific discipline has a big contribution in the development of technology in a revolutionary way to meet the various needs of human life. The global era is characterized by the application of science in the field of information technology. Seeing the magnitude of the role of science and technology in fulfilling human needs, teachers or prospective school teachers are required to teach science with meaningful (meaningful). The progress of science is marked not only by the accumulation of facts but also by the development of scientific methods and scientific attitudes. So science is a learning process carried out by humans to understand various natural phenomena which are further simplified in the form of a collection of facts. Science emphasizes not just products but also the process of experimentation and observation as part of the scientific method so that these experiments and observations must be accompanied by scientific attitudes.

The current environment of the scientific community, achievements in physics have become one of the main parameters that determine the quality of a student (Mukhopadhyay, 2013). In general, the dilemma that has occurred so far is that physics learning outcomes tend to be lower when compared to other subjects. The results of preliminary observations carried out at SMAN 2 Indramayu found that there were still many among students who felt that physics material was difficult related to the concepts and formulas shown. There are still many students who obtain daily test results below the minimum completeness criteria which is 75. This is caused by several factors both internal and external factors. Internal factors include intelligence, motivation, interests, attitudes, and talents while external factors are environment, learning devices, and teaching material. Attitude as one of the internal factors is an action or a way of responding to physical material which is shown by feeling happy or unhappy, positive or negative. This is in line with research conducted by (Pitafi and Farooq) concluding that students' scientific attitudes are still lacking, this is indicated by the acquisition of an average score of 19.17.

The above problem is in line with the research conducted by (Lestari, et al., 2016) stating that the lack of curiosity of students and material that is so dense tends to dull students so as to cause low student physics learning outcomes. Student learning outcomes in science learning physics do not reach the average. This value is still below the Minimum Completion Standard (SKM) which is set at 75. Research conducted by (Olusola, et al., 2012) concludes that poor student performance in physics is due to lack of information, lack of confidence, inability to solve physics questions correctly using formulas the right thing is this is proven as much as 65% of students have not been able to see the relevance of physics with the community and only 35% of students can realize the facts of the concept of physics. In addition, based on the survey conducted (OECD, 2016) Indonesia is ranked 62 out of 70 countries with the acquisition of a science score of 403 where the international average score is 493.

Static fluid is a matter of physics that is quite important because the application of the concept of static fluid is very easily found in everyday life and is widely used in technological developments but there are still many among students who do not understand the concept of static fluid. The results of interviews with one of the XI IPA Teachers at SMAN 2 Indramayu state that students' understanding of static fluid material is not very good because some students assume that hydrostatic pressure is only influenced by the volume of water rather than the depth of water. In addition, student learning styles tend to memorize rather than interpret a material so that students are less creative and have difficulty in providing examples of the application of static fluids in everyday life. Research conducted (Putri, et al., 2018) concluded that understanding students 'static fluid concepts was still low with a mean score of 3.15 and standard deviation of 1.72 from a maximum score of 10.

In order for physics learning to be more attractive to high school students, a scientific attitude is needed. Scientific attitude is the character of a scientist when conducting an investigation can affect student's achievement. If a scientific attitude is formed in students, it will be easier for the teacher to direct students. Scientific attitude has several indicators, namely curiosity, critical, honest, open minded, optimistic, courageous and objective. The level of students' scientific attitudes can be observed from how students often ask questions which means having a high curiosity attitude, daring to express ideas without fear of being criticized, always using strong evidence in solving problems. Students who have a high scientific attitude will be easy to understand the concept of physics, this motivates students to get better achievement or learning outcomes while students who have a low scientific attitude will have difficulty in acting and understanding the concepts of physics. The scientific attitude that develops in students is expected to be able to take a decision, care about the environment.

Furthermore, the external factors that influence student's physics achievement are the teacher's skills in choosing the right learning model. Problems that often arise now are physics teachers who still use the lecture method in the learning process. In (Syah, 2010) teaching that uses the lecture method has an element of coercion. In this case students are required to see and hear and record without commenting important information from the teacher who is always considered right.

Based on the description of the problem above, to improve student's physics achievement, a learning model that is more empowering for students is a constructivist learning model. This learning model is a learning model that emphasizes the student-centered learning process. In the constructivist view of knowledge is not something that has been made and dynamic where the teacher directly transfers that knowledge to students but that knowledge is obtained from the results of constructs or formations of the students themselves through observation and experience. In constructivist learning if the teacher transfers a knowledge or concept to students, the task of students must develop the concept or knowledge in accordance with previous experience and prove it through observing the environment or objects around. Knowledge in constructivist view is a dynamic thing that will always develop by doing a lot of interaction with the environment or objects around so that knowledge of something becomes solid. Constructivist learning gives freedom to students to express ideas through their own language. Through constructivist learning students are given the opportunity to explore and remember more about previous experiences and dare to try something new that will later become a new experience so students can compare these experiences from general to specific.

Based on the explanation above, the constructivist learning model was chosen which was considered the most appropriate for addressing student learning problems, namely the Science Environment Technology Society (SETS) learning model and the inquiry learning model. This learning model is based on constructivism theory, namely learning is not just memorizing. Students construct knowledge in their own minds. The steps of this learning model begin with problems or issues that are around then an investigation is carried out to answer the problem. To answer these problems students are required to be more active in asking questions, thinking critically, honestly, skeptical, brave, tolerant, optimistic where all are characteristics of a scientific attitude. The higher the scientific attitude of students, the better the learning outcomes. This is in line with the research conducted by (Singh, et al., 2016), concluding that academic achievement is

positively also significantly correlated with scientific attitudes. This is indicated by the acquisition of correlation coefficient of 0.6307.

SETS learning model has 5 stages, namely (1) Introduction, (2) concept formation, (3) application of concepts, (4) consolidation of concepts, and (5) evaluation. These learning steps aim to train students to think critically to solve problems that exist around the community, in solving these problems students must involve the four elements of SETS. SETS learning can train students' sensitivity and concern for problems in the environment due to the impact of using technology as a result of applying science. To solve problems students are required to be more active in the learning process. Student activity can be characterized by how often students ask and dare to express ideas and ideas related to the problems faced. The inquiry learning model is a learning activity that emphasizes the thought process to solve a problem. The steps of inquiry learning are (1) Orientation, (2) Formulating problems, (3) Proposing hypotheses, (4) Collecting data, (5) Testing hypotheses, and (6) Formulating conclusions. The purpose of using this model is to develop critically and logically so that this model does not only require students to master the material but also can develop the potential that exists in students. This model can increase students' self-confidence because students are only directed and given the freedom to learn according to their learning style. It is expected that this learning model can foster students' scientific attitudes and improve student achievement.

METHODS

The Method of this study was quasi-experimental with treatment by (2× 2) design. Purpose sampling technique was used. Subject in this study are four classes, each class have 30 students. Two classes as an experimental group used SETS learning model and two classes as an control used inquiry learning model. The instrument in this study were scientific attitude questionnaire and student's achievement test. Furthermore, the initial implementation in the learning process was carried out by giving a scientific attitude questionnaire to group students into groups of students with high scientific attitudes and a low scientific attitude. The values obtained from the questionnaire are sorted from the lowest to the highest. Then it will take 27% of the group of students who have a high scientific attitude and 27% of the group of students who have a low scientific attitude. So that the number of samples in this study is 64 students. The final stage is measuring the student's achievement to find out whether there are differences in student's achievement. Questionnaire The scientific attitude in this study has several aspects including curiosity, critical, honest, open minded, optimistic, courageous and objective with the number of statements as many as 36 items. While the test student's achievement in this study are based on Bloom's taxonomy domain, namely: (1) knowledge, (2) understanding, (3) application, (4) analysis, (5) synthesis and (6) (evaluation). The student's achievement test is 38 items. Data analysis techniques in this study used two-way ANOVA test and Tukey test. Before testing the hypothesis it is necessary to do a normality test and homogeneity test.

RESULTS AND DISCUSSION

The hypothesis testing in this study was using two-way Anova. In the two-way Anova test there are three types of hypotheses that will be tested, namely main effect hypothesis, interaction effect hypothesis and the simple effect hypothesis. If the testing of the interaction effect hypothesis is tested significantly, a further test will be carried out, namely the simple effect hypothesis test using the Tukey test. Furthermore, to be clearer the research hypothesis will be presented as follows:

1. The first hypothesis (main effect): The student's achievement using a science environment technology society learning model (A_1) is higher than students given the inquiry learning model (A_2).
2. The second hypothesis (interaction effect): There is a positive interaction effect between the use of learning models (A) and scientific attitudes (B) towards student's achievement.
3. Third hypothesis (simple effect): There are differences in student's achievement between groups of students who have a high scientific attitude who are given science environment technology society learning model (A_1B_1) with a group of students given an inquiry learning model (A_2B_1).

4. Fourth hypothesis (simple effect): There are differences in student's achievement between groups of students who have a low scientific attitude who are given science environment technology society learning model (A_1B_2) with a group of students given an inquiry learning model (A_2B_2).

Below is a summary table of the results of hypothesis testing using two-way Anova:

Table 1. Summary of hypothesis testing results using two way anova

Source of Varians	Db	JK	RJK	F_{hitung}
Between A_1 dan A_2	1	770,0625	770,0625	69,10
Interaksi on A X B	1	1892,25	1892,25	56,60

*F_{table} ($\alpha = 0.05$) = 3,15

1. Hypothesis of the main effect between groups A_1 and A_2

Based on the results of data analysis, the F_{count} = 69.10 and F_{table} = 3.15 obtained at the significance level (α) = 0.05. The value of $F_{count} > F_{table}$, then H_1 is accepted so that it can be concluded that the result student's achievement using the learning model of the science environment technology society (A_1) are higher than the students given the inquiry learning model (A_2). SETS learning model has stages of learning, namely: (1) introduction, (2) concept formation, (3) application of concepts, (4) consolidation of concepts and (5) assessment. While the stages of Inquiry learning are: (1) Orientation, (2) formulating problems, (3) submitting hypotheses, (4) collecting data, (5) testing hypotheses, (6) formulating conclusions. The stages in both of these models make students who were passive become active in class, students can be more free in expressing ideas or giving questions. Students no longer become monotonous subjects who only receive knowledge from one direction. The existence of these two models facilitates students to develop their thinking processes. Even the teacher no longer dominates learning but remains the main controller in the learning process. The SETS learning model has more advantages than the inquiry learning model because in the SETS model students are required to look at the overall relationship between the concepts of science, technology, environment, and society. This makes students more active in finding solutions to problems. The problem presented also relates to the events in everyday life that unwittingly these problems can be overcome by understanding the concepts of physics, especially in static fluid material, after students understand what concepts and technologies are produced, students are required to explore information about positive impacts and negative from the application of technology to the environment and society. So that students are more aware of the importance of physics concepts in static fluid material and are more sensitive to the surrounding environment. This is in line with the research conducted by Ackay concluded that the SETS model significantly increases students' understanding of the nature of science and attitudes toward science (Ackay, 2015). In SETS learning, one of the teacher's tasks is to check the extent to which students' understanding of the material being taught is done by question and answer and discussion between teacher and students. Questions are not always from the teacher, the teacher as the facilitator provides an opportunity for students to ask questions if there are things that have not been understood. The following are some studies that show positive results related to the use of the SETS model: a study conducted by Primastuti and Atun concluded that the SETS learning model can be used to improve students' cognitive learning outcomes (Primastuti and Atun, 2018). The research conducted by Sulistyorini concluded that the SETS model effectively improves student learning outcomes and learning activities because this SETS learning makes students develop ideas, feel challenged, think creatively and foster curiosity. In addition, the SETS model is able to exploit students' abilities in discovering concepts of science, environment, technology and society (Sulistyorini, 2016).

The inquiry learning model becomes less effective in the learning process this is because the success of this model is very much supported by the maturity of students in mastering the material coupled with the steps of learning it really takes a long time to make the learning process less effective so that students do not optimize exist in students. In addition, the

investigation steps in this model only direct students to understand the material concepts of physics but do not invite or direct students to see the relevance between the concept of static fluid and the technology created and the impact of the technology on the environment and society.

2. The interaction effect hypothesis between groups A x B

Based on the calculation results obtained F_{count} of 56.60 and F_{table} of 3.15 at the significance level (α) = 0.05. The value of $F_{count} > F_{table}$, then H_1 is accepted so that it can be concluded that there are positive interactions between the use of constructivist learning models and scientific attitudes towards student's achievement. Scientific attitude is an attitude that is embedded in students in solving a problem. Scientific attitude already exists in students only need a push or stimulus so that this scientific attitude is more developed. The scientific attitude that students have is high and some are low. Therefore we need an appropriate learning model to deal with differences in scientific attitudes and provide better learning outcomes and the learning model is considered appropriate, namely SETS learning model and inquiry. Both of these models are very good for developing students' scientific attitudes because in their implementation students must be more active in everything, this activity triggers curiosity, critical thinking and higher objectivity. The results of this study indicate that students who have a high scientific attitude are very appropriate given the SETS learning model rather than the inquiry learning model because student's achievement are better. Conversely students who have a low scientific attitude are more appropriate to be given an inquiry learning model than the SETS learning model because student's achievement are better. On the basis of this matter, it is concluded that there is an influence of the interaction between the learning model and the scientific attitude towards student's achievement. This is evidenced by research conducted by Abdi, concluding that students who use the inquiry learning model have higher learning outcomes when compared to students who use traditional learning models (Abdi, 2014). The research conducted by Ahuja concluded that there was a positive significant relationship between scientific attitudes and student's achievement (Ahuja, 2017). The research conducted by Hairida concluded that groups of students studying through SETS were effective in improving students' conceptual understanding (Hairida, 2017).

3. Simple effect hypothesis between groups A_1B_1 and A_2B_1

Testing of the interaction effect hypothesis shows significant results, namely there is an interaction effect between constructivist learning models and scientific attitudes towards student's achievement, then further testing of the simple effect hypothesis is carried out using the Tukey test. Based on the calculation results, the value of Q_{count} = 21.34 and Q_{table} is 4.05 at the significance level (α) = 0.05. It can be seen that the value of $Q_{count} > Q_{table}$, H_1 is accepted so that it can be concluded that the student's achievement between groups of students who have high scientific attitudes are given science environment technology society (SETS) higher than the group of students given the inquiry learning model.

This is because when participating in the SETS learning model a group of students who have a high scientific attitude plays a more active and independent role in finding solutions to problems and also this group of students feels more challenged to see the interrelationships of the four elements of SETS. Students are invited to explore events related to the concept of material being studied so that students can feel the usefulness between deeper concepts of physics. This further motivates students in learning so that it influences student's achievement. This is in line with the research conducted by Yoruk, namely SETS learning allows students to make more connected to the topic being studied, increases interaction during lessons and creates a student-centered learning environment. This study concludes that, when students make connections between what they learn and what they experience in real life through SETS learning, students' attention to learning is also positively affected (Yoruk, 2010). Another study that supports this finding is that research conducted by del Rosario revealed that being familiar with environmental problems can make the experience more effective. The SETS model can provide a unique learning climate with the methodology used that can affect academic performance. Environmental problems

challenge students' willingness to solve problems. Another positive factor in this approach is that students are given the opportunity to discuss as a group. In this activity, students are challenged to be creative and work as a team (del Rosario, 2008). The research conducted by Yuniastuti (2016) and Fitria et al (2016) concluded that there was a significant influence between SETS learning models on student's achievement. While the group of students who have a high scientific attitude that follows the inquiry learning model students are highly required to master the learning material. Mastery of students' material in this learning does not involve the impact of science in everyday life, this is what causes groups of students who have a high scientific attitude on the inquiry model to be less motivated in the learning process.

4. The simple effect hypothesis between groups A_1B_2 and A_2B_2

Testing of the interaction effect hypothesis shows significant results, namely there is an interaction effect between constructivist learning models and scientific attitudes towards student learning outcomes, then further testing of the simple effect hypothesis is carried out using the Tukey test. Based on the calculation results, the value of Q_{count} = 4.71 and Q_{table} is 4.05 at the significance level (α) = 0.05. It is seen that the value of $Q_{count} > Q_{table}$, H_1 is accepted so that it can be concluded that there are significant differences in student's achievement between groups of students who have low scientific attitudes who are given science environment technology society (SETS) learning models and groups of students given the inquiry learning model. Where student's achievement between groups of students who have a low scientific attitude who are given a learning model of science environment technology society (SETS) is lower than the group of students who are given an inquiry learning model. This is because when following the inquiry learning model groups of students who have low scientific attitudes are greatly helped by the principle of asking questions from the teacher. The questions given by the teacher spur students to give feedback this makes students become confident in the learning process. In this learning model students are guided to use all the abilities that exist in students this is what causes students who have a low scientific attitude to be more enthusiastic to learn, which affects the student's achievement. In addition, the stages of formulating problems and submitting hypotheses in the inquiry model are very helpful for students who have a low scientific attitude to train deeper thinking about the factors that cause the problems being studied. This is supported by research conducted by Hastuti concluded that inquiry learning has the potential to improve critical thinking and scientific attitude of students (Hastuti, et al, 2018). Njoroge's research concluded that student learning outcomes through the inquiry learning model were higher than conventional learning models (Njoroge, 2014). Another case with students who have a low scientific attitude that follows the SETS learning model of students in this model group is a little difficult to see the relevance of the elements of SETS because it requires extensive knowledge and experience from the students themselves.

CONCLUSION

The conclusion in this study are:

1. The student's achievement given by Science, Environment, Technology, and Society is higher than Inquiry.
2. There is influence of interaction between learning models and scientific attitude toward student's achievement.
3. Student's achievement given by Science, Environment, Technology, and Society is higher than Inquiry in group of student's with high scientific attitude.
4. Student's achievement given by Science, Environemnt, Technology, and Society is lower than Inquiry in group of student's who have low scientific attitude.

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