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IMPLEMENTATION OF GUIDED INQUIRY PHYSICS INSTRUCTION TO INCREASE AN UNDERSTANDING CONCEPT AND TO DEVELOP THE STUDENTS' CHARACTER CONSERVATION

IMPLEMENTASI PEMBELAJARAN FISIKA *GUIDED INQUIRY* UNTUK MENINGKATKAN PENGUASAAN KONSEP DAN PENGEMBANGAN KARAKTER KONSERVASI SISWA

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ABSTRAK

Pembelajaran Fisika (PF) dilaksanakan melalui implementasi model eksperimen inkuiri terbimbing. Tujuan utama penelitian ini untuk mengungkap konsep besaran dan pengukuran dan mengembangkan nilai karakter konservasi siswa SMA. Metode penelitian ialah eksperimen kependidikan dengan post-test control group design digunakan. Subjek penelitian adalah kelompok perlakuan dengan tutorial dan non tutorial masing-masing 32 siswa. Data penelitian konsep besaran dan pengukuran dan nilai karakter konservasi dikumpulkan dengan tes uraian dan lembar observasi. Data dianalisis menggunakan uji t dan uji korelasi. Hasil penelitian yaitu: a) ditemukan korelasi positif antara nilai karakter konservasi dan penguasaan konsep besaran dan pengukuran pada kategori tinggi dan sangat signifikan (p = 0,002), dan b) diperoleh perbedaan penguasaan konsep yang signifikan antara kelompok tutorial dan non tutorial. Simpulan penelitian bahwa implementasi model eksperimen inkuiri terbimbing efektif untuk meningkatkan penguasaan besaran dan pengukuran dan mengembangkan nilai karakter konservasi siswa SMA.

ABSTRACT

The Measurement Concepts Instruction (MCI) is carried out by implementation of guided inquiry experiment model. The objectives is to develop the understanding concept and SMA students' character. The method used experiment educational research, with post- test control group design. The data of the understanding on property and measurement is collected by essay test and an observation sheets for students' character conservation. The subject of tutorial and non tutorial groups consist of 32 students respectively. The data were analyzed by t test and correlation analysis. The results showed a) the positive correlation between students' character and mastery on concept in high category (p = 0.002) and b) students' character conservation is significantly difference between tutorial and non tutorial groups. It can be concluded that the implementation of the guided inquiry experiment model to effective increase the understanding property and measurement and to develop students' character of senior high school students.

Keywords: guided inquiry, property and measurement, character conservation.

INTRODUCTION

The ability of inquiry is often associated with the activities of the investigation or experimentation. On investigation activities, students can construct an understanding through asking questions, making the design, and implement in the form of investigations, conduct analysis, and communicate the invention. One of the main principles of inquiry, i.e. students can construct their own understanding by doing activity through the investigation of knowledge.

Model experiment of inquiry is a very po-

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werful model using constructivist principles of learning, which explained that the knowledge constructed by learners. The main of the model inquiry is a process of investigation is taught using the principle of learning community in a sustainable manner. Through the process of the investigation, at the end of the learning process of students can find the knowledge learned.

The inquiry syntax according to a number of experts there are differences, but the main activity of inquiry include: identifying problems, create hypotheses, collect and analyze data, and take a decision. Students who do inquiry experienced a learning process with the sharpening aspect of cognitive and affective aspects that support the learning patterns of metacognition. In order for learning to take place in conducive need student involvement in direct and active.

According to Suparno (2007) express that the activities of the inquiry experiments will work effectively if it fulfill conditions: 1) the freedom to discover and find information, 2) environment or atmosphere that is responsive, 3) focus issues namely the clear directions and can be solved students, 4) less pressure, i.e. not much pressure so that students doing more thinking critically and creatively.

Inquiry can be viewed as learning strategies if the entire learning procedure using activities that characterize inquiry. Learning inquiry grouped into three namely structured inquiry, guided inquiry, and the open inquiry. On the activities of the laboratory inquiry in general consists of problem formulation and identification, data collection, data processing, preparation of reports and communicate the results. Activities of the laboratory of inquiry is different from the regular laboratory activities. The difference of the regular laboratory activities and inkuiri as expressed by Wenning (2006) are shown in Table 1.

In the laboratory activities guided inquiry, the teacher does not explain the first concept to be studied so that learners do not yet know the results of the activities they will be doing. These laboratory activities inquiry to train students to think inductively very helpful in developing a general knowledge of the concept to be learned from a physical phenomenon. According Kaltacki & Oktay (2011) express activities guided inquiry laboratory load qualifying activities as presented in Table 2.

According to Wenning (2007) the activities of inquiry is not just conducting experiments but more emphasis on imagination and ability of the students to find empirical evidence. For students who have not had experience of such an inquiry, the right to basic education and secondary use of guided inquiry. On the guided inquiry students gain clues that are not in the form of a recipe or questions that are guiding.

According Suardana (2007) guided inquiry learning model is more oriented to activities of student centered classrooms and allow students to learn to use a variety of learning resources. The role of the teacher as a resource that provides assistance in the form of questions that help students to think about the steps next observation. Inquiry learning step by Carin & Sund (1989) is presented in Table 3.

Based on the above differences, guided inquiry activities was the transition from laboratory activities structured inquiry that leads to an open inquiry laboratory activities. On the guided inquiry learners autonomously carry out each stage of identifying problems with members of the group to resolve the issue and teachers as

Table 1. Differences between Structured Inquiry Experiments and Guided inquiry

No	Structured Inquiry	Guided Inquiry
1.	Step written instructions step by step	1. Activities are arranged in the guiding question
2.	Focus student activities to verify the information	2. Student activities focus on collecting data to find the concept
3.	Provide implicit experience in carrying out scientific procedures	3. Independently provide explicit experience in carrying out scientific procedures
4.	Does not allow students to deal with errors n the implementation of activities	4. Giving students the opportunity to learn from mistakes

Source : Wenning (2006)

Table 2. Qualifications and Activities of Guided Inquiry Laboratory

No	Qualifications	Guided Inquiry Laboratory
1	Purpose	Finding interconnectedness concept
2	Selection experiments	Experiments selected can cause cognitive conflict for students
3	L a b o r a t o r y Introduction	At the beginning of the event given the pretest to determine the initial concept of students
4	L a b o r a t o r y procedure	The procedure is given through the question of finding a concept to capture the data and make inferences
5	Students Involvement	Students create a hypothesis , collect data and make conclusions with members of his group
6	T e a c h e r Involvement	Guiding students with questions that allow students to think independently

Source: Kaltacki & Oktay (2011)

Table 3. Syntax Learning Inquiry

No	Phase	Activities
1.	Finding the problem	Shows physical phenomena
2.	Develop hypotheses	Provide opportunities for students express their opinions in formulating hypotheses
3.	Designing the experiment	a. Define variables b. Collecting data
4.	Analyzing the data	Develop explanations related to the physical phenomena
5.	Make Conclusions	Teachers guide students to make conclusions

Source : Carin & Sund (1989)

mentors. All stages of guided inquiry directed learners and their active role more independent in thinking and implementing learning activities. Laboratory activities can develop skills and learning outcomes cognitive it is very important to develop inquiry based laboratory activities were more centered on the learner.

Syntax inquiry model, according to some experts there are differences, but the main activity of inquiry include the process: identify problems, make hypotheses, collect and analyze data, and make decisions. Students who do inquiry in the learning process is able to hone cognitive and affective aspects, which supports learning patterns metacognition. So that learning takes place in a conducive need direct student involvement and active. According Suparno (2007) states that the activities of experimental inquiry will be managed effectively if it fulfill the following requirements: 1) the freedom to find and search information, 2) environment or atmosphere that is responsive, 3) focus on the problem that is without clear direction and can be solved students, 4) less pressure, which is not a lot of pressure so that students do more creative and critical thinking.

METHODS

The research was conducted on a grade X SMA Negeri Semarang Central Java. This research used experimental research with pre-posttest design only one group that is part of the research and development (Gall et al., 2003). The subject of research is the study of physics on the topic of property and measurement with guided inquiry learning model on high school students in Semarang in the academic year 2015/2016. The subjects of the study consisted of two study groups made up of the tutorials (treatment) and without tutorial (control) group, each totaled 32 students. Methods of determining the research subjects using purposive sampling techniques.

Data mastery of the concept of property and measurement collected using essay test and character of the conservation value of data collected by the observation sheet of students. The scoring results of the test the concept of using a scale of 1-100. Scoring graded (scale of 1 to 4) applied to character of the conservation value is collected by using observation sheet. Scoring on the character of the conservation value of the data collected through observation based on a scoring system Marzano (2006). Data concepts and measurement scale was analyzed using two-sample t test with significance level of 5 %. Data observational study score conservation character values are analyzed using descriptive-percentage. Effect of inquiry learning towards mastery of concepts tested by regression analysis. Criteria for success is based on the applicable reference assessment in Semarang City Department of Education. Statistical data processing using the menu of SPSS for Windows v. 16.

RESULTS AND DISCUSSION

The data revealed in the implementation of the experimental model of the wave guided inquiry that mastery of the concept and measurement of the magnitude and character development of high school students. Data mastery of scale and measurement with regression test are presented in Table 4. Testing of individual mastery used to determine the average grade of the final data on the sample achieve mastery individual or not. Based on tests of normality and homogeneity of the final data we concluded that both groups were normally distributed and homogeneous sample, the test statistic used to test the completeness of the individual is the t test.

Based on the calculation results with the experimental group using the t test obtained by value t = 3.115. Referring to df = 31 and 5% significance level values obtained t table = 2.042. Results of comparative tests of processing two students namely $t_{count} > t_{table}$. Based on the results of comparative testing of the application of experimental model of guided inquiry resulted in an average score scale concept mastery test and measurement experimental group tutorial KKM score higher than 60. The resulting achievement of classical completeness 66 % of the total number of students in the experimental group.

Based on the calculation of the control group using t test obtained by value t = 1.78. Referring to df = 31 and a significance level of 5 % was obtained t table = 2.042 and the value of the results of comparative analysis of test calculations revealed that $t_{count} < t_{table}$. Based on the analysis concluded that the application of an experimental model without tutorial produces the average value of the mastery of the concept is better than the KKM 60, reaching only 59 % classical completeness.

Analysis of the students in the classical mastery learning

From the results of the previous analysis, has obtained a percentage of classical completeness students to learn the results of the evaluation value and the final value. For the experimental group, the percentage of classical completeness of value evaluation of learning outcomes in this case is the post-test value of 66%. For the control group the percentage of classical completeness of the value of post-test or evaluation of learning outcomes is of 59%.

The test results achieved by students after the end of the following study during two meetings of the experimental and control groups described in the following section. Based on the data analysis of the experimental group of 32 students on average score mastery of scale and learning measurement after reaching 69.03, while the control group of 32 students reached 64.91. The highest and the lowest score of the experimental group were 100 and 36. For the control group 96 and 38; refers to a score range of 0 - 100. The percentage of classical completeness treatment group gained 66 % and 59 % for controls.

Guided Inquiry Learning Regression Analysis of the Concept Mastery Students Group Experiments

Produced a regression equation of the

Table 4. Regression Analysis Guided Inquiry with Concept Mastery Students

Equation	Type test	Calculation	df	Results	Explanation
$Y_1 = 1{,}35X_1 - 38{,}61$				a = 5%	Resulting linear line with a coefficient of 1.35 means that a positive relationship between the variables X_1 and Y_1
	Linearity test	F_{hitung} = 1,40	1,30	4,171	
	Significance test	F_{hitung} = 54,372	1,30	4,171	
	Correlation test	R_{hitung} = 0,580	31	R_{tabel} = 0,349	
	Determination	R^2 = 0,644			

Table 5. Regression Analysis Guided Inquiry with the Student Conservation Character Development

Equation	Type test	Calculation	df	Results	Explanation
$Y_2 = 0{,}51\ X_1 + 28{,}06$				a = 5%	Resulting linear line coefficient of 0.51 , meaning a positive linear relationship between the variables X_1 and Y_2
	Linearity test	F_{hitung} = 0,56	1,30	4,171	
	Significance test	F_{hitung} = 6,2731	1,30	4,171	
	Correlation test	R_{hitung} = 0,4159	31	R_{tabel} = 0,349	
	Detremination	R^2 = 0,1729			

implementation of guided inquiry is to increase students' mastery of concepts namely, Y_1 = 1.35 - 38.61 with variable Y_1 explain the results of mastery of concepts and variable X_1 declare score guided inquiry learning model implementation.

Results of regression test data can be stated that there is a positive effect of the application of Guided Inquiry learning model to the students' mastery of concepts shown positive coefficient value of 1.35 and the regression line cuts the y-axis intercept value of 38.61.

Regression Analysis of Guided Inquiry Learning with Conservation Character Development Group Experiments

Produced a regression equation of guided inquiry learning on students' character development conservation namely, Y_2 = 0.512 X_1 + 28.06. Variable Y_2 explains score conservation character of students and X_1 explain the implementation of guided inquiry learning model. The results of data processing using linear regression analysis are presented in Table 5.

Results of regression analysis of the data can be expressed that there is a positive influence on the implementation of inquiry learning model towards the understanding of the concept, which indicated a positive coefficient value of 0.51 and a value on the y-axis intercept of 28.06. Based on data analysis concluded that "Implementation of Guided Inquiry is effective to develop the character of the conservation of high school students of grade X".

Studied the practice and concept of mass measurements in everyday life, is expected to foster a sense of sensitivity toward the environment so that students are able to establish a student's character better. This is in line with research Hidayah (2015), that the combination of multiple intellegences with character conservation students can be developed through guided inquiry learning that involves students doing research groups actively.

Guided Inquiry learning process in this study lead students to observe on the magnitude and direct measurement, laboratory activities. It is expected the students more interested in learning. This is supported by the statement Masfuah et al (2013), that the use of teaching materials physics contextual approach can develop an atmosphere of learning interesting and fun, so that students are motivated to learn.

In this study, there are two aspects that

are measured include measures mastery of the concept and character development of students. Mastery of concepts students will be measured on student learning outcomes in the cognitive and character development of students is measured by direct observation of student behavior.

Guided Inquiry with tutorials applied in the experimental class and to control class with guided inquiry learning without a tutorial that his schedule as a schedule of activities with guided inquiry. Both of these classes are taught by researcher, with two observers to help observe the student activity which is currently practical implementation and discussion. Conducting a guided inquiry begins with the teacher in the classroom to motivate students in the form of questions regarding the size and measurement in everyday life with the goal of keeping students interested in the learning process and have the initial allegations to seek a solution in the conduct guided inquiry.

As stated by Mehalik et al. (2008) that the inquiry approach gives students the opportunity to do step by step instructions for every aspect of the investigation. Students who do inquiry closely tied to the activity of work in teams, using laboratory equipment, observe, decide how to collect data and analyze it.

The development of psychomotor skills students need to be done so as not to cause the difference between theoretical understanding and physics that displayed the concept. Therefore, students need to interact directly with the objects that concrete because physics theory that explains not only the physical phenomena, but also the process to seek an explanation of physical phenomena. With the implementation of guided inquiry learning strategy, the students are guided to find the concept through laboratory activities that each stage requires creativity of students in formulating hypotheses, designing experiments, collecting data to make conclusions.

In each phase of laboratory activities, teachers continue to give direction to students through the questions that are guiding. Students have the opportunity to use the ideas and opinions of laboratory operations are carried out. Research guided inquiry with peer instruction has succeeded in developing students' critical thinking skills (Kurniawati et al. 2014). Research that supports, Sarwi et al. (2012) reported on the implementation of inquiry wave experiments are able to develop critical thinking skills on the concept of a wave.

Activities are assessed in this study include assessment of practical implementation and discussion. Aspects observed in practical implementation are: (a) setting up equipment and materials, (b) measures, (c) to read the measurement results, (d) write observational data, (e) the discipline of time and aspects considered in the discussion are: (a) attention during the learning, (b) cooperation within the group, (c) answer the question (d) ask or respond, (e) present the results of activities. Scoring refers to a score range of 1 to 4. According to Dahniar (2006) reported that psychomotor aspect is important in physics learning because students do not just memorize formulas and facts but more important is how the students have direct experience to develop competence in understanding natural phenomena scientifically.

CONCLUSION

Based on the results of the analysis concluded some of the following. Implementation of experimental model of guided inquiry on the size and measurements can be carried out effectively. The conclusions of research that there are significant application of guided inquiry learning model to the students' understanding of the concept. Based on the regression analysis resulting correlation coefficient r = 0.58 and r = 0.42 in the medium categories. General conclusions stated: "The implementation of Guided Inquiry to effective Improve Understanding Concept of Property and Measurement and to develop character Conservation Values High school students of grade X".

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