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Empowering Science Process Skill and Critical Thinking Through Guided Inquiry in Science Learning

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Abstract

The purpose of this research is to empower the Science Process Skill and critical thinking skills. This study is a quasi-experimental study. The research design uses Pretest Posttest Only Control Group Design which is divided into two groups namely experimental group using guided Inquiry and control group using lecture and discussion method. The sample in the study was taken from semester 2 consisting of 10 classes and then selected by cluster random sampling and taken 2 class, that is class 2C as experiment class by comparing pretest and posttest result and compare with class 2D as control class. The instruments used were questionnaires, observation sheets, interviews and tests. Analysis of research data influence Guided Inquiry model in empowering critical thinking ability using inferential analysis. Inferential statistical analysis was performed by Paired sample t test using SPSS 18 analysis program and calculated by Ngain. The result of hypothesis test analysis using t-test with significance level 5% result of significance equal to p = 0,000 and value = 0,013. The effectiveness of guided inquiry demonstrated a high category increase in Science Process Skill empowerment with 0.72 gain and significance of p = 0,000 and critical thinking ability with 0.70 gain and significance of p = 0,000.

Key Words: Guided Inqury, Science Process Skill (SPS), Critical Thinking

INTRODUCTION

Science is a science that provides a positive impact for the development of students, especially to answer the development of the 21st century. Learning Science by Toharudin (2011) will train students in improving the competence to understand the problems faced by modern society that depend on technology and progress, and the development of science . Science will produce quality learners with high level of values, attitudes and thinking skills, resulting in a generation that can think critically in the face of problems.

Learning Science prioritizes processing skills given that the essence of Science learning is process, product, and attitude. The learning process of science tends to emphasize the provision of direct experience to develop competence and foster thinking ability. Learning that emphasizes the process is central to the developmental demands of the 2013 Curriculum based on the learning process by prioritizing personal experience through observation, questioning, reasoning, and observation based learning to improve students' thinking skills so that the learning process is more optimal, not only Refers to the application of theory and concepts but the need for a process of skills in learning.

The process of skills in learning is directed to the formation of Science Process Skill (SPS) which is a performance skill. SPS contains two skills aspects, namely cognitive skills (cognitive skills) as intellectual skills and basic knowledge underlying the mastery of SPS and skill from sensorimotor side (sensory motor skill). The linkage between thought

processes and integrated skills to form SPS pesera, so with the application of SPS emphasizes the existence of intellectual physical and mental involvement that can be used to train and develop critical thinking skills.

Empowerment of the learning process to be more optimal not only refers to the application of the concept but the need for a process of skills in learning. Other skills needed to face the level of competition is the ability of high-level thinking, such as the ability to think critically. Individuals who have the ability to think critically can further optimize their learning outcomes, will be able to achieve the standards of competence established in the curriculum, as well as able to design and navigate life in the future that is full of challenges, and competition. This is supported by the opinion of Liliasari (2011) states that the existence of the demands of an increasingly advanced and complex globalization era, the process of science education should prepare quality learners that science-aware learners (science literacy), have values, attitudes and skills of high-level thinking (Higher order thinking skills) so that emerging human resources that can think critically, think creatively, make decisions, and solve problems.

The ability to think critically is an inquisitive thought to the information available to achieve a deep understanding. Facione's critical thinking skills (2011: 9) include interpretation, analysis, inference, evaluation, explanation, and self-regulation. Aspects of interpretation of students able to classify the problems received so that it has a meaning and a clear meaning. Aspects of student analysis are able to test ideas and recognize reason and statement. Student inference aspect is able to make a conclusion in problem solving. Aspects of the evaluation of students are able to assess the statement or opinion received from both yourself and others. The explanation aspect of the student is able to explain the statements and opinions that have been expressed to become a strong opinion. Aspects of student self-regulation can regulate their existence in the face of problem solving.

Based on the observation of science learning in PGRI Madiun University, shows the learning process has not been optimal to empower students. Students less developed independently through discovery in the process of thinking and in solving problems, Observation results show that the science learning process 73.4% of students are still weak in developing the SPS, seen in the process of learning students have not lead to proceed in a discovery that the essence of learning science. Students only adhere to the learning guide in the form of MFIs that become guidance when conducting an experiment, while the basic principles of SPS development provide students the opportunity to be real like formulating the problem, hypothesizing the design of the experiment until the application of the concept of some aspects has not been attached to the students.

Students are less able to develop the potential of the ability to think such as the ability to think critically. Students who tend to be passive and the use of less precise learning model will result in less optimal students in developing critical thinking skills. Only 23% of the identified students are able to develop a proven critical thinking ability from a range of critical thinking skills assessment instruments, so that when students are faced with a problem, it will be difficult to solve them.

In addition, the low critical thinking ability seen in the behavior of students of curiosity in seeking information is still low teridntifikasi of 32%. This is evident from the activities of students in the classroom is limited to listening to lectures, memorizing the material, recording material, doing exercises, and experimental methods rarely done, so that students' understanding of a material less than optimal.

One alternative solution to handle the above problems is with the use of learning models that can empower the skills of the process of saians and able to develop students' thinking skills. The applied learning model is a guided inquiry model. The guided inquiry learning model is in line with constructivism theory where students find their own knowledge with the guidance of lecturers. The guided inquiry model emphasizes the Science Process Skill, which places students as a center for learning (student centered learning), and engages students actively in intellectual activities through experiments and experiments, enabling students to train critical thinking. Callahan, Clark, and Kellough (1992: 293-294) suggest that inquiry learning is one of the higher level mental that directs students to the discovery of concepts independently and helps students in skills development. The guided inquiry model with the syntax of learning is formulating problems, formulating hypotheses, designing experiments, conducting experiments, collecting and analyzing data, and making conclusions, with lecturer guidance can help students develop competence of inquiry and subject knowledge, help develop motivation, responsibility, cognitive, Problem solving, understanding skills.

METHOD

The research was conducted at Universitas PGRI Madiun Semester Even Semester of 2015/2016. The sample in the study was taken from semester 2 consisting of 10 classes and then selected by cluster random sampling and taken 2 class, that is class 2C as experiment class by comparing pretest and posttest result and compare with class 2D as control class. The research was done by using quasi experiment method (Quasi exsperimental research). Pseudo experimental methods are used because many of the research subjects can not be controlled or controlled (Darmadi, 2011). The research design used is Pretest-Posttest Design where in the design group or class is chosen randomly as much as one class. The selected class is the class given treatment or treatment in the form of Guided Inquiry learning model. The data obtained is then processed and analyzed to determine whether there is influence of Guided Inquiry learning model in empowering critical thinking ability of 2nd semester student of Universitas PGRI Madiun. Analysis of research data influence Guided Inquiry model in empowering critical thinking ability using inferential analysis. Inferential statistical analysis was performed by Paired sample t test using SPSS 18 analysis program and calculated by Ngain.

RESULT AND DISCUSSION

The result of empowerment of Science Process Skill and critical thinking ability through Guided Inquiry was obtained from Science Process Skill data through hypothesis test and mean Result of hypothesis test of Science Process Skill data presented in Table 1 and critical thinking data through hypothesis test and

average of hypothesis test result of critical thinking data Are presented in Table 2. The results of the Gain and PPP Test and analyzing ability are presented in Table. 3.

Table 1. Hypothesis Test Results Science Process Skill

Test	Class	Test Type	Result	Decision	Conclucion
Normality	Experiment	*Kolmogorov Smirnov*	Sig *posttest*= 0,084	Ho received	Normal data
	Control		Sig *posttest*= 0,077	Ho received	Normal data
Homogenity	Experiment Control	*Levene's test*	Sig 0.081	Ho received	Homogen Data
Hypothesis testing	Experiment Control	*t-Test*	t_{hitung} = 0,007 p= 0,000	Ho rejected	There is difference

Tabel 2. Hasil Uji Hipotesis Berpikir Kritis

Test	Class	Test Type	Result	Decision	Conclucion
Normality	Experiment	*Kolmogorov Smirnov*	Sig *posttest*= 0,075	Ho received	Normal data
	Control		Sig *posttest*= 0,086	Ho received	Normal data
Homogenity	Experiment Control	*Levene's test*	Sig 0.089	Ho received	Homogen Data
Hypothesis testing	Experiment Control	*t-Test*	t_{hitung} = 0,006 p= 0,000	Ho rejected	There is difference

Table 3. Result of gain test and Ngain SPS and Critical Thinking

Jenis data	N	Mean	
		gain	N_{gain}
SPS	37	27,21	0,70
Critical Thinking	38	25,23	0,72

Based on the results of research and discussion it can be concluded that guided inquiry is effective in empowering the ability of Science Process Skill and critical thinking ability. Based on the test results there is a difference in the ability of students' Science Process Skill in the experimental class and control class. It is proven from statistical test that there is difference of student's KPS and critical thinking, with result p = 0,000 and value = 0,013.

Guided inquiry is a series of learning that involves students' ability to search and investigate systematically, critically, logically, analytically, so that they can formulate their own findings with the help of guiding questions (Wenning, 2005). Research shows that guided inquiry can improve students' activeness, process skills, motivation and learning experiences (Andriani, 2011; Suwasono, 2011; Lynn, 2012). Other studies have shown that inquiry has an effect on improving student achievement (Kholifudin, 2012, Deta, 2013).

The guided inquiry learning model involves students in answering teacher questions. Students conduct investigations, while teachers guide them toward the right. In this learning model, teachers need to have the skills to provide guidance, which is to diagnose students' difficulties and provide assistance in solving the problems they face. Guided inquiry model still plays the role of teacher in choosing topic / discussion, question and providing material. Students are required to design or design investigations, analyze results, and to conclusions.

Problem analysis in guided inquiry should enable students to think critically and creatively using analytical skills to practice experiments, writing, solving problems, decision making, and communication skills; 5) is cross-disciplinary science. Problems refers to the knowledge and experience of different disciplines and perspectives. The investigation process as part of the guided inquiry phase relating to SPS is considered an open process which means students have their own questions and seek their own answers (Kim, 2008). Little by little the group of students communicates more effectively and enhances their ability to reason and solve problems together on a task-based basis (Piliouras et al., 2006).

CONCLUSION

Guided Inquiry proved able to empower the Science Process Skill and critical thinking skills derived from the

assessment of Kain KPS and Critical Thinking has a value of 0.72 and 0.70 which means having an increase in the "High" category. After the statistical test, there were differences in SPS capability and critical thinking before and after the Guided Inquiry was applied with the result p = 0,000.

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