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Research Artikel

THE CORRELATION OF GUIDED INQUIRY MODEL WITH SETS APPROACH ON STUDENTS' CRITICAL THINKING SKILLS

KORELASI MODEL INKUIRI TERBIMBING BERPENDEKATAN SETS TERHADAP KETERAMPILAN BERPIKIR KRITIS SISWA

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Abstract

Critical thinking skills in chemistry subject is still low. Teacher-centered learning is one of the causes of low critical thinking skills. The objective of this study was to investigate the correlation of guided inquiry learning model with the Science, Environment, Technology and Society (SETS) approach on students' critical thinking skills at chemical equilibrium material. The research method was Quasi Experiment with Nonequivalent Control Group Design, and the samples were taken using purposive sampling. The samples consisted of 36 students in the control and the experimental classes. The research instrument consisted of 12-item essay test which represented 11 indicators of critical thinking skill. Data analysis was performed using the Independent Sample T-test through SPSS 22 version. The results of hypothesis testing showed a correlation of the use of guided inquiry model with SETS approach on students' critical thinking skills in the experimental class with sig values <0.05. The percentage result of the posttest data showed an increase in critical thinking skills of students in the experimental class. The conclusion of this study is that the use of guided inquiry model with SETS approach can improve students' critical thinking skills. The highest critical thinking skills indicator in the experimental class is inducing and judging inductions, while the lowest indicator is observing and judging observation reports.

Keywords: guided inquiry model; SETS approach; critical thinking; chemical equilibrium; chemistry

Abstrak

Keterampilan berpikir kritis pada mata pelajaran kimia masih rendah. Pembelajaran yang berpusat pada guru adalah salah satu penyebab rendahnya keterampilan berpikir kritis. Tujuan penelitian untuk mengetahui korelasi model pembelajaran inkuiri terbimbing berpendekatan Science, Environment, Technology, dan Society (SETS) terhadap keterampilan berpikir kritis siswa pada materi kesetimbangan kimia. Metode penelitian adalah Quasi Experiment dengan desain Nonequivalent Control Group Design, dan teknik yaitu purposive sampling. Sampel penelitian sebanyak masing-masing 36 orang pada kelas kontrol dan eksperimen. Instrumen penelitian berupa tes esai sebanyak 12 butir soal yang mewakili 11 indikator keterampilan berpikir kritis. Analisis data menggunakan Independent Sample T-test melalui SPSS versi 22. Hasil uji hipotesis menunjukkan adanya korelasi penggunaan model inkuiri terbimbing berpendekatan SETS terhadap keterampilan berpikir kritis siswa kelas eksperimen dengan nilai sig. < 0,05. Hasil persentase data posttest menunjukkan adanya peningkatan keterampilan berpikir kritis siswa pada kelas eksperimen. Kesimpulan dari penelitian ini bahwa penggunaan model inkuiri terbimbing berpendekatan SETS mampu meningkatkan keterampilan berpikir kritis siswa. Indikator keterampilan berpikir kritis tertinggi di kelas eksperimen adalah membuat induksi dan mempertimbangkan hasil induksi dan indikator terendah adalah mengobservasi dan mempertimbangkan hasil observasi.

Kata Kunci: *model inkuiri terbimbing; pendekatan Sets; berpikir kritis; kesetimbangan kimia; kimia*

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INTRODUCTION

Education has an important role for human survival. Quality education is expected to produce quality and strong human resources, so they are able to compete with other nations in this era of globalization (Dewi and Riandi, 2015).

In fact, the quality of education in Indonesia is still relatively low. This can be seen from Indonesia's rank in the Programme for International Student Assessment (PISA) in 2015 assessing students' skills and abilities which was at 62 out of the 70 participating countries (OECD, 2016). One of the influencing factors in this case is that the problems used in PISA are contextual and real-life problems with the level of problems from level 1 to level 6, while students in Indonesia are still accustomed to solving problems with low levels at level 1 and 2 (Kertayasa, 2015).

The preliminary study through field observation activities suggests that the current learning is still teacher-centered (Dewi and Riandi, 2015). Based on the results of observation on teacher questionnaire, teacher-centered chemistry learning causes students not to be trained to think critically which leads to students' low critical thinking skills (Qurniati, Andayani, and Muntari, 2015). Critical thinking is basically an important part of the problem solving process (Zhou, Huang, and Tian, 2013). Thus, critical thinking skills is pivotal skill to have (Haseli and Rezali, 2013), so students are able to solve problems that occur in their lives (Dewi and Riandi, 2015).

Therefore, to train and develop students' critical thinking skills in the 21st century, an innovative learning process is needed by taking into account the development of science, technology and their relation to contextual problems. It takes learning that can meet the needs of students by applying the SETS approach. The word SETS comes from Science, Environment, Technology, and Society (Nursamsudin, 2016). The goal of SETS learning is to direct students into a close-to-real-life atmosphere, so that they are able to develop their knowledge and solve problems that arise in their lives (Khasanah, 2015).

In order to support this SETS approach, it is necessary to use a learning model that can present problems at the beginning of learning to facilitate students in building their knowledge, and one of which is guided inquiry learning model. The process of critical and analytical thinking in searching for and finding the answer to a problem is a series of guided inquiry model by actively involving students in learning activities to develop their intellectual power (Isindanah and Azizah, 2016). Previous studies show an increase on students' critical thinking skills after the application of guided inquiry model indicated by good results at chemical equilibrium material (Santi and Muchlis, 2017). Chemistry learning will be more meaningful if students are actively involved in the learning. Many situations that can be found in life are closely related to chemistry and involve scientific knowledge (Yoruk, Morgil, and Secken, 2010). Chemistry material and critical thinking skills are inseparable since chemistry material can be understood through critical thinking skills, and in turn critical thinking skills can be trained through chemistry learning (Dewi, 2016).

Based on the elaboration, this study was conducted to investigate the correlation of guided inquiry model with SETS approach on students' critical thinking skills at chemical equilibrium material.

METHOD

The research method used in this study was Quasi Experiment with Nonequivalent Countrol Group Design, namely a design consisting of control and experimental groups. This design started from the administration of pretest on both groups, and the experimental class was given a particular treatment. Subsequently, both groups were given posttest to observe the effect of the treatment applied in the experimental class (Suharsaputra,2014). The posttest was administered at the final meeting to investigate the correlation and the treatment effect on students' critical thinking skill. The design of this study can be seen in Table 1.

Table 1. ***Quasi Experiment with Nonequivalent Control Group Design***

Exp. C	O	X	O
Control C	O		O

Note:

O : pretest/posttest

X : learning treatment using guided-inquiry model with SETS approach (Suharsaputra, 2014)

The study was conducted on November 17-30, 2017, in the academic year of 2016/2017 at SMAN 47 Jakarta, located on Delman Utama I Street, Kebayoran lama, South Jakarta. The population comprised all students of class XI at

SMAN 47 Jakarta. The sampling technique used was purposive sampling, a technique used if researchers have certain considerations in sampling or determine samples for specific purposes (Riduwan, 2013). The samples of this study were students of class XI MIA 2 as the experimental class and students of class XI MIA 4 as the control class with the total number of 36 students in each class.

The instrument in this study was an essay test consisting of 12 items that function to measure students' critical thinking skills. The critical thinking indicators measured in this study were 11 indicators proposed by Robert H. Ennis at chemical equilibrium material. Student worksheet and observation sheet as research supporting tools function to observe the implementation of the learning model applied in the experimental class. The data collected were then processed and analyzed using the normality test with Kolmogorov-Smirnov, homogeneity test with Levene test, and hypothesis testing using Independent Sample T-test by means of SPSS 22 software.

RESULT AND DISCUSSION

This study aimed to investigate the correlation of guided inquiry learning model with SETS approach on students' critical thinking skills at chemical equilibrium material. The difference between pretest and posttest average scores of students' critical thinking skills in the control and the experimental classes can be seen in Figure 1.

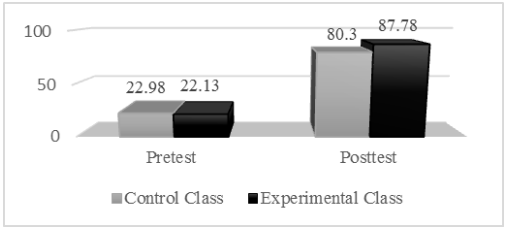

Figure 1. Average Score of Pretest and Posttest in the Control and the Experimental Classes

Based on Figure 1, the pretest average scores showed that both students in the control and the experimental classes had the same initial ability. The results of the posttest average scores showed that the experimental class outperformed the control class that used conventional model through the lecture method. This is because conventional learning does not provide opportunities for students to practice skill of questioning and expressing opinions (Nugraheni, Mulyani, and Ariani, 2013). In contrast, guided-inquiry model and SETS learning can relate the concept of chemistry to contextual phenomena in everyday life (Astyana, Leni, and Saadi, 2017).

The data of students' critical thinking skills were obtained from the pretest and posttest. The results of the tests from the two classes were analyzed using normality, homogeneity and hypothesis tests. The results of the three tests can be seen in Table 2.

Test	*Pretest*		*Posttest*	
	Control	Experimental	Control	Experimental
Normality (α= 0,05)	0.133	0.167	0.200	0.137
Homogeneity (α= 0,05)	0.824		0.062	
Independent Sample T-test (α= 0,05)	0.512		0.000	

Note: 1= focusing on question, 2= analyzing arguments, 3= asking and answering of clarification questions, 4= judging the credibility of a source, 5= observing and judging observation reports, 6= deducing and judging deductions, 7= inducing and judging inductions, 8= making and judging value judgments, 9= defining terms and judging definitions, 10= identifying assumptions, 11= deciding on an action.

Based on Table 2, the results of the normality test and homogeneity test on the pretest data from both classes showed sig. values > 0.05. Thus, the pretest data were normally distributed and homogeneous. The hypothesis testing resulted in the value of sig. (2-tailed) > 0.05, so null hypothesis (H_0) was accepted. This means that there was no difference in the average critical thinking skill between the students in the control class and those in the experimental class before being given the treatment.

The results of the posttest data showed that the two classes were classes which were normally distributed and had homogeneous variance of data indicated by sig. > 0.05. The hypothesis testing showed the value of sig. (2-tailed) < 0.05, which indicated that H_1 was accepted. This suggested that there was a difference in the posttest average score between the control and the experimental classes

which indicated the correlation of the learning model applied on students' critical thinking skills at chemical equilibrium material.

This study further measured 11 indicators of Robert H. Ennis's critical thinking skills presented in the graph of the posttest results from the control and the experimental classes in Figure 2.

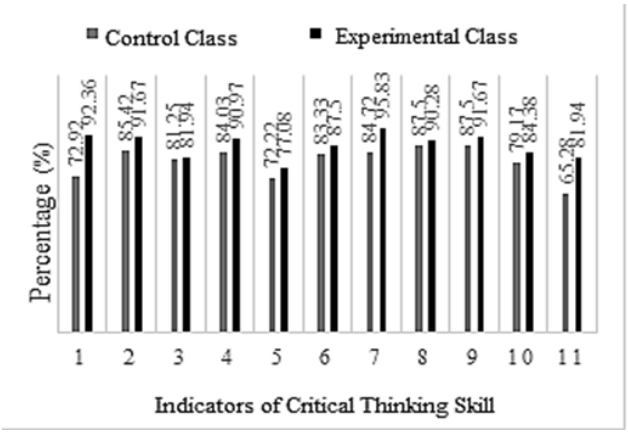

Figure 2. The Difference of Percentage Average (%) between the Control and the Experimental Classes based on Critical Thinking Skill Indicators

Significant difference was evident in the posttest results from the control and the experimental classes. The use of guided inquiry model with SETS approach had a high percentage compared to the control class that used conventional learning model with lecture method. The class in which the guided-inquiry model with SETS learning was applied received positive responses from students and successfully improved the science process skills and student learning outcomes (Astyana, Leni, and Saadi, 2017). The guided inquiry model and SETS approach are preceded by the presentation of problems. The guided inquiry model begins learning activities when students receive and identify a problem (Ngalimun, 2016), while in SETS learning students are encouraged to present their initial knowledge of the daily phenomena given by teacher (Nursamsudin, 2016).

Based on the difference in percentage average of critical thinking skills between the control and the experimental classes in Figure 2, the discussion on the research results is presented as follows.

Focusing on Question

Focusing is an important thing to do related to the occurring situation so that people can find important points from an event, issue, and problem (Ennis, 1996). The percentage of achievement of the experimental class on this indicator was higher than the control class, namely 92.36% with very good category. Similar result is also found in other studies that the experimental class obtained higher results than the control class on the indicator of focusing on questions (Qurniati, Andayani, and Muntari, 2015). This is caused by the invitational learning stage which starts from the teacher giving daily-life phenomena (Nursamsudin, 2016). Through problems associated with daily life, students have the opportunity to find new knowledge, solve problems, and actively participate in making solutions to problems (Brigili, 2015).

Analyzing Arguments

The level of achievement will be more visible in the posttest results in the control and experimental classes (Yoruk, Morgil, and Secken, 2010). The percentage obtained by the experimental class from the posttest result on this indicator was 91.67%, higher than the control class which obtained the percentage of 85.42%. This is because during the invitation phase, the teacher can explore the opinions of students regarding the material studied (Nursamsudin, 2016). The SETS approach can improve students' ability in high-level thinking that will eventually improve students' critical thinking skills (Zoller, 2013).

Asking and Answering of Clarification Questions

The indicator of asking and answering clarification questions in the experimental and the control classes was at good category with higher achievement gained by the experimental class. This is due to the learning activities in the control class that rely solely on information obtained from the teacher's explanation without going through the active thinking process, so the information obtained is limited to memorization. This causes students' minds unable to develop properly since students are not given the opportunity to explore

their abilities (Sutama, Arnyana, and Swasta, 2014). It is different from the experimental class which emphasizes the active role of students in the learning process, and the SETS approach in the early stages of learning provides opportunities for students to communicate and illustrate their understanding of the concept (Nursamsudin, 2016). Students' critical thinking skills can be trained by always asking questions and questioning various phenomena being studied (Sutama, Arnyana, and Swasta, 2014).

Judging the Credibility of a Source

Based on the answers given at the posttest, the experimental class obtained a higher percentage on this indicator than the control class since the experimental class provided better answers based on the relevant sources they found. This is supported by the exploratory learning stage which involves students to understand and learn the given problems. The involvement of students in this stage will train them in understanding and finding their own answers through experimental activities to develop their critical thinking skills (Nursamsudin, 2016).

Observing and Judging Observation Reports

Mastery of students on this indicator can be seen from the answers given at the posttest. The experimental class obtained a higher percentage than the control class. This is because after students collect experimental data, learning activities will continue in group discussion. This learning activity takes place in the exploration stage. Through this stage, students can fulfill their curiosity and adjust the results obtained with previously discovered theories (Nursamsudin, 2016).

Deducing and Judging Deductions

Deducing as the ability to determine certain conclusions needs to follow the information in the questions given (Kowiyah, 2012). The percentage gained by the experimental class on this indicator was higher than the control class. The solution stage to support this indicator is done well. Solution or problem solving given is in accordance with information obtained from the previous learning stage (Nursamsudin, 2016).

Inducing and judging inductions

Inductive reasoning is a specific reasoning, in which conclusions are drawn based on a set of facts of a general event or statement. The conclusions are drawn based on experimental data that have been tested according to the hypothesis (Dewi, 2016). The percentage of achievement indicating the results of students' critical thinking skills in the experimental class on this indicator was still superior to the control class and was the highest indicator in the experimental class. The existence of a solution stage can help students to make conclusions and hypotheses. The solution stage can help students to form conclusions based on the results of their observations strengthened by the support from the teacher (Nursamsudin, 2016).

Making and Judging Value Judgments

Making judgment of a fact-based decision must be done carefully given that it must be able to distinguish between facts and non-facts (Ennis, 1996). The percentage obtained by the experimental class on this indicator was higher than the control class and was the highest indicator obtained in the control class. The possible reason is that in the control class students gain knowledge through the delivery of material directly by the teacher through the lecture method and do not build their own knowledge (Qomariyah, 2016). In contrast, in the experimental class, students are given the opportunity to complete and provide solutions to the problems being studied through the solution stage. Through the solution stage, students will conduct discussions and try to explain what is happening and explain why it happen and then provide solutions to the problems being discussed (Nursamsudin, 2016).

Defining Terms and Judging Definitions

The achievement of the experimental class on this indicator was higher than the control class, and was the highest indicator in the control class with the same percentage as the indicator of making and judging value judgments. This is due to the learning that still requires students to memorize the information conveyed by the teacher so that the students' thinking ability becomes less

developed because it only transfers information from the teacher to students (Wulandari, Kurnia, and Sunarya, 2013). By observing this finding, the control class and the experimental class go through a different learning process. The experimental class goes through the process of searching for and finding information independently that are not simply done by listening to information and knowledge delivery as what occurs in the control class. The student in the experimental class pass through the application stage which provides opportunities for them to overcome problems that arise from the invitations stage (Khasanah, 2015).

Identifying Assumptions

The achievement result gained by the experimental class on this indicator was higher than the control class. The application stage provides opportunities for students to use concepts that have been obtained through concrete actions in solving problems that arise in the early stages of learning (Khasanah, 2015). By identifying assumptions, students can overcome difficulties encountered by distinguishing between explanations of statements and not statements, and constructing students' arguments (Dewi, 2016).

Deciding on an Action

The posttest results showed that the indicator of deciding an act in the experimental class was at the good category compared to the control class. This might be caused by the existence of concept strengthening stage where the teacher can provide feedback/reinforcement on the concepts obtained by students (Khasanah, 2015). The teaching process that focuses on critical thinking will sharpen students' ability to analyze information they receive to make the right decisions (Sriarunrasmee, Suwannattachote, and Dachakupt, 2015).

In addition to essay test instrument, the students in the experimental class were also given student worksheet and observation sheet. The observation sheet serves to see how well the model is applied. The student worksheet is adjusted to the guided inquiry learning phases with SETS approach to help students experiment and understand chemical equilibrium material, and invite students to do the thinking process and discuss with their peers from their group. Based on the description of critical thinking skill indicators from the control and the experimental classes, it can be concluded that the experimental class gains higher average than the control class. This is understandable since the stages of guided inquiry learning model combined with the SETS approach are able to create an active atmosphere that involves thinking processes to support students' critical thinking skills. Students in the experimental class are trained to be familiar with contextual issues/problems in everyday life. Problem solving is done through independent information retrieval by students and the searching of the right solution to solve the problem. This can improve students' critical thinking skills and enable them to be active thinkers in learning activities.

CONCLUSION AND SUGGESTION

Based on the study that has been conducted, it can be concluded that the use of guided inquiry model with SETS approach has a correlation that can improve students' critical thinking skills at chemical equilibrium material. The highest indicator obtained by the experimental class is inducing and judging inductions, while the lowest indicator is observing and judging observation report.

As for suggestion that can be considered, teachers should be able to apply guided inquiry model with SETS approach as a variety of learning models with material that involves contextual problems in everyday life.

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