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The Effect of a Macromedia Flash-based Guided Inquiry on Students’ Critical Thinking Skill and Self-Regulated Learning

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Abstract. This study aims to determine the effect of a macromedia flash-based guided inquiry model on students’ critical thinking skill and self-regulated learning. This study was a quasi-experiment, with a post-test only group design. The subjects were 96 eleventh-graders of divided into two groups. Fifty students in the experimental group used macromedia flash-based guided inquiry model and 46 students in the control group used direct instruction model. Data collection techniques were a test of critical thinking skill consisting seven essay questions to see students’ critical thinking skill and a questionnaire of self-regulated learning consisting 33 statements to see students’ self-regulated learning. The data were analyzed using MANOVA. The results showed that students taught with macromedia flash-based guided inquiry model have a statistically difference on their critical thinking skill and self-regulated learning at significance level 0.05 while students taught with direct instruction model showed critical thinking at lower level. In conclusion, a macromedia flash-based guided inquiry model can improve students’ critical thinking skill and students’ self-regulated learning.

1. Introduction

Teacher has an important role in learning. Learning strategies including learning model, method, and media used in the learning activity determine students’ thinking skill and students’ independence [1]. As stated in the basic competence of the 2013 curriculum, students are expected to show logical, critical, consistent and thorough, responsible, and responsive attitudes, and the students are also expected not to give up easily in solving problems. Based on the results of the survey conducted by PISA (Programme for International Students Assessment), Indonesia is still far below the international average in that Indonesia ranks the third from the bottom in the science performance if viewed from the average score obtained in the division of men and women [2]. There are several factors influencing the low level of students’ critical thinking skill, namely the teachers who still use conventional learning [3], the one-sided learning where the teacher prefers to focus on one student rather than on most students [4], and teacher’s domination in the learning that causes students to have less practice in developing the students’ thinking on problem solving and in applying the concept that they have learned in the class to real life [5]. Teacher’s conventional learning is very familiar with transferring knowledge and mostly encouraging students to have mathematical learning exercises. This learning can foster the learning with memorizing method that facilitates less learning than deep understanding [6].

Science plays an important role in the education field. At high school level, science lessons are divided into Physics, Chemistry, and Biology. Particularly, chemistry has the scope of chemical materials which mostly consist of abstract concepts [7]. This abstract material brings students to have difficulties in learning chemistry [8-9].
In order to help students in increasing their critical thinking skill, the learning process should be interactive, innovative, interesting and motivating to students so that they can actively involve in the learning. The learning process should also provide enough chance for students’ independence. To achieve learning activity well, the learning model and media are needed as tools in the learning process. Importantly, the students will succeed in their academic achievement if they have self-regulated learning or independent learning [10].

The learning model and media that support the statements above are guided inquiry and macromedia flash. Guided inquiry model is a learning model that is centred on constructivist theory [11]. Constructivist teaching leads students to develop knowledge and meaning from individual’s experience [12-13]. According [14], teacher’s role are to ensure that the students can understand the concept which has learned and to guide students in dealing with the concept. The steps of guided inquiry learning model are (1) identifying problems; (2) suggesting hypothesis; (3) collecting data; (4) testing hypothesis; (5) suggesting temporary conclusion; (6) replicating; (7) drawing final conclusion [15].

In the learning process, guided inquiry needs suitable media. One of media that supports guided inquiry is macromedia flash. According to [16] macromedia flash is a vector-based interactive animation program that has action script facilities. The vector-based interactive program is widely used to create games, cartoons, presentations, and interactive learning models [17]. User can include text, graphic, animation, simulation, audio and video into macromedia flash application. Moreover, media that can display animation is a medium that can reduce students’ difficulties in receiving learning material. Through animation, analogies can be created to visualize abstract materials. Conceptual visualization in the form of animation and analogies is very fruitful for students in understanding chemistry [18].

Based on the elucidation above, this study was aimed to determine the effect of macromedia flash-based guided inquiry learning model on students’ critical thinking skill and students’ self-regulated learning in the material of chemical equilibrium concept.

2. Methods
This study was a quasi-experiment with post-test control group design. The population of this study were eleventh-grade students. Ninety six students were randomly selected as samples of this study and were grouped into experimental group and control group. Macromedia flash-based guided inquiry learning model was implemented in the experimental group while direct instruction model was implemented in the control group. The study was conducted by taking the material of chemical equilibrium concept. The sample size of the study is presented in the Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>50</td>
</tr>
<tr>
<td>Control</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
</tr>
</tbody>
</table>

2.1 Research instruments
This study used the following instruments:

2.1.1 Validation test of media consisting of four aspects. The media was validated by material and media experts. After validated by experts, the score 3.84 was obtained.

\[ M_i + 0.5 SB_i < X \leq M_i + 1.5 SB_i \]  

(i)

The score range showed that the media is categorized to good and feasible to use.

2.1.2 Seven items of critical thinking test on the concept of chemical equilibrium. The type is a test with essay question. Before the test is used, the test was validated theoretically and empirically. The instrument was tested using QUEST with difficulty index of the test between -2.90 and 4.26
and reliability 0.87. Reliability coefficient is above 0.7 which is acceptable. These indicated that there is a good internal constituency of the items [19].

2.1.3 Questionnaire responses about students’ self-regulated learning in the chemistry learning consist of 33 items using a 4-Likert scale. Before the questionnaire is distributed to students, the questionnaire was theoretically validated by experts.

2.2 Teaching intervention
Learning material taught to students was chemistry equilibrium. The experimental group was taught using macromedia flash-based guided inquiry model and the control group was taught using direct instruction model. Each group had five meetings for learning and one meeting for a post-test. The test, namely critical thinking skill test, was given to students after the learning as well as the questionnaire about self-regulated learning in the chemistry learning. Because the activities in the guided inquiry learning optimally involve the students’ skills to discover and investigate systematically, critically, logically, and analytically, the students are able to find out the findings by themselves with confidence [20]. The guided inquiry learning emphasizes the thinking process that relies on the learning process and learning outcomes, and it does not only develop students’ intellectual skills. Knowledge will be embedded longer if the students are involved directly in the learning process. This is also due to the advantages of guided inquiry learning for students. The advantages are that the students are able to develop their own understanding, gain their independence in the learning, and improve high motivation and participation in the learning [21].

2.3 Data analysis
To compare the score obtained from students’ critical thinking and self-regulated learning test, one-way MANOVA was analyzed using SPSS version 21 (a software package used for statistical analysis).

3. Results and discussion
This study was conducted to see the different influence of students’ critical thinking skill and students’ self-regulated learning. The experimental group used macromedia flash-based guided inquiry while the control group used direct instruction in the learning process. Macromedia flash was validated before it was used in the learning. The validation result carried out by media expert revealed that the mean score of media quality was 3.84.

Assessment of students’ critical thinking skill was taken from the results of post-test and assessment of students’ self-regulated learning was taken from students’ questionnaire response. Based on the result of one-way MANOVA, there is a difference of students’ critical thinking skill between experimental group and control group in the material of chemical equilibrium concept with significance level 0.05. The results of one-way MANOVA can be seen in the Table 2.

Table 2. MANOVA results of critical thinking skill and self-regulated learning.

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>F</th>
<th>Hypothesis df</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>0.142</td>
<td>6.609</td>
<td>2.000</td>
<td>0.002</td>
</tr>
</tbody>
</table>

bExact statistic.

The results revealed that the significance level is 0.002 which is lower than 0.05. It showed that there is a difference of students’ critical thinking skill and self-regulated learning between experimental group and control group. In addition, the following table is a difference test result of students’ critical thinking skill between experimental group and control group.

Table 3. Result of between-subject effect test for students’ critical thinking skill

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
</table>

3
Based on the significance value 0.015 < 0.05, $H_0$ was rejected so that there is a difference of students’ critical thinking skill. In other words, students who learned using macromedia flash-based guided inquiry model have higher critical thinking skill. Guided inquiry enables students to be actively involved in the learning process. The students are encouraged to be active in recognizing problems, making hypothesis, analyzing and interpreting data, finding answers and discussing the results until they make final conclusion. In line with results of the study by [23-26], they demonstrated that guided inquiry contributes to improving critical thinking skill.

In addition to learning model, media also affect students’ critical thinking skill. Media is one of components of delivery system. The delivery system is the delivery of messages from teacher to students, and the message is information or knowledge in the learning [27]. The media used in this study is macromedia flash. Macromedia flash is designed attractive so it can work maximally. Moreover, the abstract learning material was visualized to assist students to easily understand the learning. Visual media has important role in the learning since it can help the students understand and strengthen memories [28]. Hence, the macromedia flash in this study helps students increase their critical thinking skill.

Furthermore, macromedia flash-based guided inquiry also influences on the students’ self-regulated learning. The result of difference test for students’ self-regulated learning is shown in the Table 4.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>Self-regulated learning</td>
<td>1</td>
<td>893.508</td>
<td>6.197</td>
</tr>
</tbody>
</table>

Based on the table above, the significance level is 0.015 < 0.05. $H_0$ was rejected so it can be concluded that there is a difference of students’ self-regulated learning between using macromedia flash-based guided inquiry and using direct instruction.

The results of this study asserted that students’ self-regulated learning contributes significantly. Self-regulated learning allows someone not to continuously need assistance from others [29]. Students who have self-regulated learning belong to personality type of autonomy. Autonomous personality is a type of personality with the desire to do something independently, to act and to take initiative by themselves [30]. In this situation, the students do not continuously need the help of the teacher in the learning process because the role of the teacher is as a facilitator. Thus, it is obvious that the presence of learning media can help students have self-regulated learning or independence as a means of learning on their own [31].

4. Conclusion
Based on the results and discussion, the study concludes that there is a difference between students’ critical thinking skill and students’ self-regulated learning using macromedia flash-based guided inquiry learning model in the material of chemical equilibrium concept in the chemical learning. The students who are taught using macromedia flash-based guided inquiry learning model have higher critical thinking skill than the students who are taught using direct instruction. Guided inquiry learning enables students to have the opportunity in discovering their knowledge, to assist students in understanding the concept well, to be independent and to be active in the learning. Moreover, the media also assist students in understanding and receiving the chemical learning material. Therefore, macromedia flash-based guided inquiry learning model can be used to improve students’ critical thinking skill and students’ independent learning or self-regulated learning.
References


