The Effect of Animation Media in Discovery Learning Model on Students' Representation Ability on Chemical Equilibrium Materials

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Abstract

This study aimed to determine the effect of animation media in discovery learning model on the students' representation ability on chemical equilibrium materials. This study was an experimental study using post-test only group design. The study population consisted of 6 classes or 127 students. The sampling technique was done by using purposive random sampling, and 2 classes were chosen consisting of 53 students. Data were collected using a representation ability test which included macroscopic ability, submicroscopic ability, and symbolic ability. By using the inferential analysis of the Mann Whitney test, it was obtained that the significance value for the macroscopic ability was 0.003, the submicroscopic ability was 0,000 and the symbolic ability was 0.041. The significance value is smaller than $\alpha = 0.05$. Referring to that, it can be seen that there is an influence of animation media in discovery learning model on the students' representation ability on chemical equilibrium material.

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Keywords: animation media, discovery learning model, representation ability

1. Introduction

Curriculum 2013 is a form of integrated work between reconstruction of passing grade competence, suitability and adequacy, expansion, advancement of the materials, learning revolution and evaluation reform. On this curriculum, teachers are also introduced the suitable learning models that can be applied in the classroom during teaching and learning process. One recommended learning model is discovery learning model. This learning model allows students more active, creative, and inovative in finding and solving problem. This discovery learning model is hands-on, focuses on the process, and encourages students to look for solutions. Instead of just teaching students to memorize the concepts, this method lets them apply ideas to their lives, creating memorable lesson that will help turn them into a lifelong learner [1]. Aripin [2] further explained that the discovery learning model emphasizes how students process information, capture existing stimulus, and store it as meaningful information both in the short and long term, so that

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the information can be reused to solve problems encountered. The use of this learning model can also change passive learning conditions into active learning, and change the student centered learning into the teacher centered learning [3].

The application of discovery learning model can be integrated using animation media. According to Yudhiantoro [4], animation media is multimedia in learning that can be used as an alternative learning media whose presentation can be made more engaging by incorporating animations which consists of state images with the given effects. The combination of texts and images in the animation media will help students understand and achieve the desired learning outcomes [5]. According to Kozma & Russel [6], animation media can also enhance creativity in students and motivate them to explore complex dimensions of knowledge, because it can provide real experiences for students.

Chemical equilibrium material in chemistry is material that contains many concepts that need to be understood by students. In these materials, strengthening students' ability of representation is highly needed. The representation ability itself includes macroscopic, submicroscopic and symbolic. Chemical equilibrium material requires understanding, skill and practice. If students do not master the concepts, they will not be able to build knowledge and consequently they will experience difficulties in the learning process. Discovery learning model with the help of animation media is expected to be able to build students' knowledge by discovering their own concepts in chemical equilibrium material with the ability of multiple representations that have been built in the learning process. The use of animated media in discovery learning model will make it easier for teachers to display and explain abstract chemical material. By applying this animation media, the teacher can explain the particles contained in a material that is described in the form of atoms, molecules, ions, and compounds and is able to explain the symbols and formulas and chemical equations contained in chemical equilibrium material.

Based on the results of preliminary observations at SMK Negeri 4 Takalar, chemistry teachers in learning are still mostly using conventional learning models. Discovery learning model integrated with animation media into learning has never been done. This is the concern of researchers to conduct a study that aims to see the effect of animation media on discovery learning model on the ability of students' representation.

2. Research Methods

This study was an experimental study with a post-test only control design [7]. The variables in this study consisted of independent variable and dependent variable. The independent variable was the animation media in the discovery learning model and the dependent variable was the ability of representation. The population in this study were all XI grade students at SMK Negeri 4 Takalar consisting of 6 classes with a total of 127 students. The sampling technique was done by using purposive random sampling technique. Based on the sampling technique, two research classes were chosen. The experimental class consisted of 24 students and the control class consisted of 29 students. The research instrument was in the form of description questions consisting of 6 questions. The problem illustrated the ability of students' representation which includes macroscopic, submicroscopic, and symbolic abilities. Data analysis techniques were conducted by using descriptive and inferential analysis techniques. Descriptive analysis technique was used to determine the comparison of students' representation ability, and inferential analysis technique was used to determine any influence of animation media in discovery learning on students' representation ability. Quantitative analysis techniques were conducted by using t-test hypothesis testing.

3. Results and Discussion

3.1. Descriptive Analysis

3.1.1. Macroscopic representation

The results of statistical analysis of students' macroscopic ability can be seen in table 1. Based on the table, it shows that the average value of the macroscopic ability of the experimental class was 75.67 and the average value of the control class was 59.27. Based on these values, it was found that the ability of microscopic representation ability of the experimental class was higher than the control class.

Based on Table 2, it was found that for the very high category, the frequency of students in the control class was 7 people and in the experimental class was 13 people. For the high category, the frequency of students in the control class was 10 people and in the experimental class was 8 people. For satisfactory category, the frequency of students in the control class was 5 people and in the experimental class was 3 people. For the low category, the frequency of students in the the control class was 7 and there was none in the experimental class. Comparison of the frequency of students in the control class and the experimental class can be seen in Figure 1.

Table 1 Descriptive Analysis of Students' Macroscopic Representation Ability

Statistics	Control class	Experimental class
Size	29	24
Mean	59.72	75.67
Maximum	83	100
Minimum	33	50

Table 2 Frequency Distribution of Students' Macroscopic Representation Ability

Score	Category	Frekuensi	
		Control class	Experimental class
81-100	Very high	7	13
61-80	High	10	8
41-60	Enough	5	3
21-40	Low	7	0
0-20	Very low	0	0
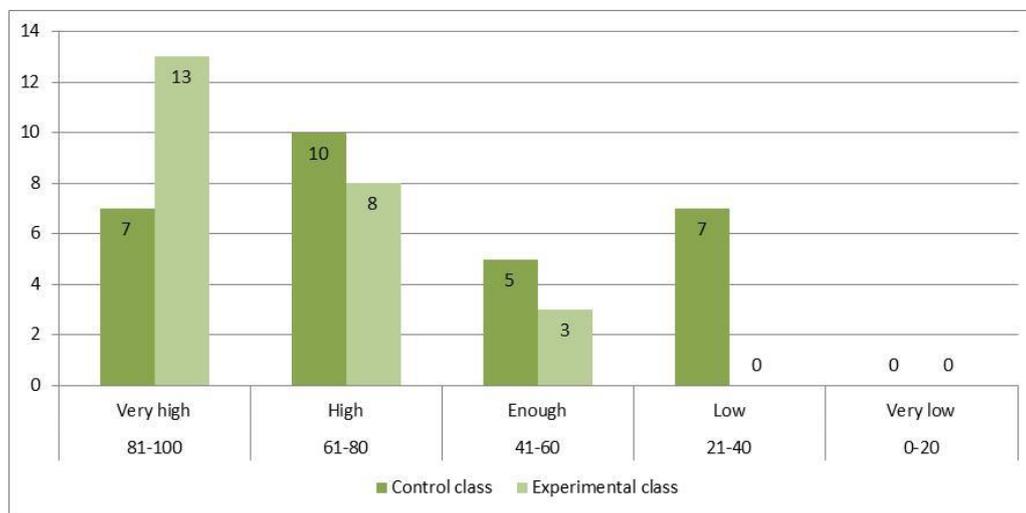
Figure 1. Histogram of Macroscopic Ability

3.1.2. Submicroscopic representation

The ability of submicroscopic representation is basically the ability to measure students' observations of the images presentation of structures and processes at the particle level to the observed macroscopic phenomenon. At the submicroscopic level, it can be seen that in the learning process, students who were taught using animation media were more enthusiastic about the material they see directly. The results of descriptive statistical analysis for submicroscopic representation can be seen in Table 3.

Based on the data in table 3, it can be seen that the comparison of the average value of representation ability at the submicroscopic level for the control class was 20.69, while for the experimental class was 79.17. The minimum value for the control class was 0, while the experimental class was 50. From the data, it shows that in the control class, there

were still many students who have difficulty in answering submicroscopic questions, while for the experimental class, most of the students had been able to describe presentations at the particular level.

Table 3 Descriptive Analysis of Students' Submicroscopic Representation Ability

Statistics	Control class	Experimental class
Size	29	24
Mean	20.69	79.17
Maximum	100	100
Minimum	0	50

Table 4 Frequency Distribution of Students' Submicroscopic Representation Ability

Score	Category	Frekuensi	
		Control class	Experimental class
81-100	Very high	3	14
61-80	High	0	0
41-60	Enough	6	10
21-40	Low	0	0
0-20	Very low	20	0

Based on Table 4, it was found that for the very high category, the frequency of students in the control class was 3 people and in the experimental class was 14 people. For the high category, it was not achieved by students both in the control class and in the experimental class. For satisfactory category, the frequency of students in the control class was 6 people and in the experimental class was 10 people. For the low category, it was not achieved by students both in the control class and in the experimental class. But in the very low category, the frequency of students in the control class was 20 and there was none in the experimental class. Comparison of frequency of submicroscopic representation of control class and experimental class can be seen in Figure 2.
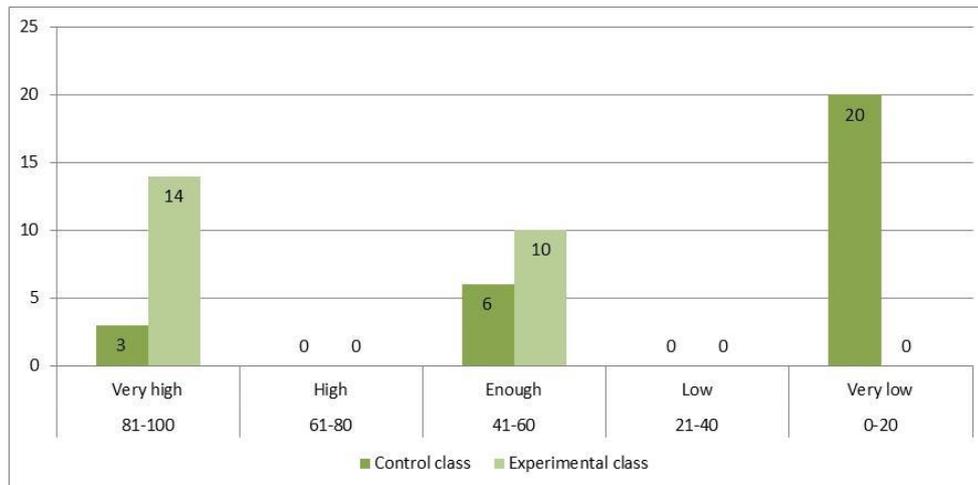
Figure 2. Histogram of Submicroscopic Ability

3.1.3. Symbolic representation

Symbolic representation ability relating to the use of symbols, formulas, and chemical equations. The results of descriptive statistical analysis for symbolic representation can be seen in Table 5. Based on the data in table 5, it can be seen a comparison of the average value of the symbolic representation ability of students. The data in Table 5 shows that the average value for the control class was 54.00, while for the experimental class was 72.58. The minimum value of the control class was 0, while for the experimental class was 17. This shows that the experimental

class learned using animation media in the discovery learning model is better than those that did not use animated media (control class).

Table 5 Descriptive Analysis of Students' Symbolic Representation Ability

Statistics	Control class	Experimental class
Size	29	24
Mean	54.00	72.58
Maximum	100	100
Minimum	0	17

Table 6 Frequency Distribution of Students' Symbolic Representation Ability

Score	Category	Frekuensi	
		Control class	Experimental class
81-100	Very high	7	13
61-80	High	7	4
41-60	Enough	8	1
21-40	Low	1	0
0-20	Very low	6	6

Based on Table 6, it was obtained that for the very high category, the frequency of students in in the control class was 7 people and in the experimental class was 13 people. For the high category, the frequency of students in the control class was 7 people and in the experimental class was 4 people. For satisfactory category, the frequency of students in the control class was 8 people and in the experimental class was 1 person. For the low category, the frequency of students in the control class was 1 person and there was none in the experimental class. But in the very low category, the frequency of students in the control class and the experimental class was the same, namely 6 people.

3.2. Inferential statistical analysis

Inferential statistical analysis in this study was used to test the hypothesis. Hypothesis testing analysis consists of parametric and non-parametric analysis. Parametric analysis is carried out if the data are normally distributed and are homogeneous. Meanwhile, non-parametric analysis is carried out if the data are not normally distributed or not homogeneous. The results of inferential statistical analysis for each level of representation ability are as follow.

3.2.1. Macroscopic representation

The results of inferential statistical analysis for the ability of macroscopic representation can be seen in table 7. In the table, it shows that the data obtained were not normally distributed, but came from homogeneous samples, so that the hypothesis testing used the non-parametric statistical test, namely the Mann-Whitney test.

Table 7 Inferential analysis of representation ability at the macroscopic level

No.	**Inferential statistical analysis**	**Result (Sig.)**	**Conclusion**
1.	Normality test	< 0.001	not normally distributed
2.	Homogeneity test	0.080	homogeneous
3.	Mann-Whitney test	0.003	H_0 reject or H_1 accepted

Hypothesis testing results indicated that the significance value was 0.003. This value is smaller than the significance level used, which is $\alpha = 0.05$, so it can be seen that there is an influence of the use of animation media in discovery learning model on the students' ability of macroscopic representation.

3.2.2. Submicroscopic representation

The results of inferential statistical analysis for the ability of submicroscopic representation can be seen in Table 8. Similar to testing on macroscopic representation ability, it turns out that the data obtained for students' submicroscopic ability based on the results of data analysis were the data that were not normally distributed, but came

from homogeneous samples. Therefore, hypothesis testing was also performed with non-parametric statistical test, namely the Mann-Whitney test.

Table 8 also shows that the Mann-Whitney test results obtained a significance value < 0,001. The significance value is smaller than the significance value used, which is $\alpha = 0.05$. In accordance with the prerequisites for submitting a hypothesis, that if the significance value obtained is smaller than the significance value used, then it can be concluded that Ho is rejected and H1 is accepted. Thus, it can be said that there is an influence of the use of animation media in discovery learning model on the ability of students' submicroscopic representation.

Table 8 Inferential analysis of representation ability at the submicroscopic level

No.	Inferential statistical analysis	Result (Sig.)	Conclusion
1.	Normality test	< 0.001	not normally distributed
2.	Homogeneity test	0.263	homogeneous
3.	Mann-Whitney test	< 0.001	H_0 reject or H_1 accepted

3.2.3. Symbolic representation

The results of the inferential statistical analysis in Table 9 also show that the data on symbolic representation ability of students came from the data that were not normally distributed and came from homogeneous samples. Therefore, the hypothesis testing was performed by using the Mann-Whitney test. The significance value obtained in the Mann-Whitney test was 0.041. Based on the significance value, it can be said that there is an influence of the use of animation media in discovery learning on the ability of students' symbolic representation.

Table 8 Inferential analysis of representation ability at the symbolic level

No.	Inferential statistical analysis	Result (Sig.)	Conclusion
1.	Normality test	< 0.001	not normally distributed
2.	Homogeneity test	0.657	homogeneous
3.	Mann-Whitney test	< 0.041	H_0 reject or H_1 accepted

4. Conclusion

Based on result and discussion, we could conclude that:
(1) There is an influence of the use of animation media in discovery learning model on the ability of students' representation.
(2) Students' representation abilities include macroscopic representation, submicroscopic representation, and symbolic representation.

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