

Conference Paper

Development of Maquette to Promote Primary School Students' Critical Thinking Ability in Social Sciences

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Abstract

This research aimed to analyse the feasibility of the use of maquette and the effectiveness of maquette in improving students' critical thinking ability. The research model employed was the development research model developed by Borg & Gall. The research subjects were third graders. The testing was divided into preliminary field testing, main field testing, and operational field testing. The analysis of the medium feasibility was based on the assessment by media experts, the assessment by subject matter experts, students' response, and teacher's response. The analysis of maquette effectiveness was carried out using a t-test (two independent samples) to figure out the difference and gain score of the experimental class for the purpose of identifying the improvement after the use of maquette. In the feasibility analysis, a score of 88 in the category "feasible" was gained from the assessment by a media expert and a score of 85 in the category "highly feasible" was gained from the assessment by a subject matter expert. From the preliminary field testing, scores of 60.5 and 65 in the category "highly feasible" were gained for the students' response and teacher's response, respectively. Meanwhile, from the main field testing, scores of 56.1 and 66.5 in the category "highly feasible" were gained for the students' response and teacher's response to the maquette use, respectively. The t-test results show a significant value in the critical thinking, namely $0.000 < .05$, indicating a significant difference between the control class and the experimental class. The gain score was 0.5 and fell into the "moderate" category. Thus, it can be concluded that maquette is effective in improving critical thinking ability.

Keywords: maquette, critical thinking ability, social sciences learning

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Received: 2 May 2019

Accepted: 19 June 2019

Published: 3 July 2019

Publishing services provided by
Knowledge E

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Selection and Peer-review under the responsibility of the ICMEd Conference Committee.

1. Introduction

Education is a means for learning that aims to build children's character and life skills to realise Indonesian nation that is dignified and able to compete in the globalisation era. A meaningful learning process serves as a bridge to character building. Not only does it build character, meaningful learning also influence students' critical thinking ability.

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1.1. Structure

Social sciences learning is fun, with individuals being invited to get directly involved in every learning activity, making it more meaningful. Abdelraheem & Al-Rabane (2005: 2) argue that active social sciences learning involves giving opportunity to students to participate in a meaningful manner by speaking and listening, writing, reading, and reflecting the content, ideas, and academic subject problems. With active learning, an individual will have a greater responsibility for what he/she is learning and how he/she learns it (Chapin, 2011: 66). Every individual student has his/her own life experience, and to develop such experience he/she needs assistance from an educator. The educator will be able to develop the student's existing experience and indirectly train him/her into developing a critical ability.

Marin & Halpern (2011: 1) explain that developing critical ability is essential to success achievement in education, with new knowledge being created and improving rapidly. Brookfield (2012: 106) adds that students start a critical thinking process with a task that demands a direct application of critical thinking on their own ideas and experience. In the social sciences learning, students need to possess a critical thinking ability as it is necessary for assessing a thought, solving problems, and estimating values. The critical thinking ability of an individual should be based on a robust concept, so that in outlining facts, expressing opinions, and asking questions he/she will have an accountable basis.

Developing the critical thinking ability should not only be orally conducted, but also assisted by aids in the form of learning media. Media facilitate communication and learning (Smaldino et al., 2014: 14). They can be used as aids for delivering messages to achieve a learning objective (Wati, 2016: 2). Abdelraheem & Al-Rabane (2005: 3) state that learning media enable the development of specific learning abilities and improve intellectual as well as motor skills. With the use of learning media students' skills can be developed gradually.

Results of a field study conducted at a primary school show that teachers did not always use learning media in the learning process. The media frequently used by teachers were print pictures. Supporting learning media could even hardly be found in the classroom; only instructional books were found there. Electronic facilities such as projectors and computers were not available in a sufficient quantity at the school. The teachers encountered not only scarcity of classroom media, but also difficulties in developing learning media. Thus, only a limited number of materials were delivered using learning media as learning aids. The limited use of media in class led to students'

low critical thinking ability. Sufficient learning media are necessary for the development of students' critical thinking ability.

Based on the problems described above, it is necessary to develop learning media that can attract students' learning interest, are easy to use, and can help promoting students' critical thinking ability. Three-dimensional media such as maquettes can be alternative learning media. Hasnunidah's research (2012) shows that the use of maquette in learning could improve students' critical thinking ability. In developing suitable learning media, students' characteristics and needs should be taken into consideration. Children still apply thinking logic on concrete objects (Santrock, 2012: 42). Therefore, primary school students at lower grades need concrete learning media, for example, maquettes. Maquette can be used as an alternative medium should a school have limited electronic means such as projector. In light of the aforementioned, this paper aimed to analyse the maquette feasibility and effectiveness in improving primary school students' critical thinking ability.

2. Literature Review

Critical thinking is essential to every individual. Helpern (1999: 70) describes critical thinking as the use of cognitive skill or strategy to increase the possibility of the outcomes desired. In line with that description, Dwyer (2014: 43) describes critical thinking as a metacognitive process through reflective assessment that has objectives, increases the opportunity to make a logical inference of an argument, or solves problems.

According to Lai (2011: 42), critical thinking is a skill that is inclusive of analysing arguments, making inferences using either deductive or inductive arguments, assessment or evaluation, and making decisions or solving problems. Abrami (2008: 1121) argues that an educator must take a step to render a training service and develop learning. Students' critical thinking ability development is performed in a gradual and directed way, allowing students' critical thinking ability to develop well. Kamarulzaman & Ahmad (2014: 75) state, "Critical thinking is also found to be important to children as it enables them to indentify consequences of their behaviour and manipulation from other could be avoided as they learn to have their own opinions on information at hand."

Maquette is a miniature resembling the original form of a concrete object that is presented in a three-dimensional form. It is also called model as its form is adjusted to the original form. Sudjana & Rivai (in Prastowo, 2012: 228) referred model to a three-dimensional dummy of some concrete objects that are too big, too distant, too small, too costly, too rare, or too complicated to bring to class and to learn to students in

their original forms. Soulier (1981: 21) states, "A model is basically a man-made, three-dimensional object having many of the same obvious and recognizable characteristics as the real object." The characteristics of this three-dimensional medium is adapted to the object to be copied or the object to be manipulated according to the condition of the object.

Maquette is a simple representation of a complex device or process by highlighting important elements and eliminating disturbing details, an imitation making clear the complexity (Heinich et al., 1989: 101). Yin (2010: 420) states, "The addition of 3D visualization and modelling capability can also enable new pedagogical strategies to encourage planning students to learn more about urban systems using environments." Maquette can encourage students to learn more about something new. Directly observing something, be it the environment or an object, will stimulate students' thinking ability. Soulier (1981: 22) says that it is important for a teacher to use a model in the learning because the characteristics of the model will give contributions to the students in class.

3. Material & Methodology

3.1. Data

The data used in this research were qualitative and quantitative data. The qualitative data were analysed and explained qualitatively, while the quantitative data from the media expert validation, subject matter expert validation, students' response, and teacher's response were analysed descriptively using five-scale ordinal data reference conversion after being converted into interval.

3.2. Method

A research and development research model was applied, with findings used for designing a new product or procedure, which would later be tested in a systematic way, evaluated, and, eventually, perfected until the effectiveness and quality criteria or comparable standards were met (Gall, Gall, & Borg, 2007: 589). The subjects of this research were students of grade 3 of five primary schools. A preliminary field testing involving eight students and one teacher of SD Negeri Ngento with high, medium, and low cognitive abilities were carried out. The main field testing was conducted involving two teachers and 38 students of SD Negeri 2 Karang Sari and SD Negeri Sendang. Meanwhile, the operational field testing involved 42 students of SD Negeri

Kedungtangkil as a control class and SD Negeri 1 Karang Sari as an experimental class. The research subjects were selected using the purposive sampling technique.

The research steps were adapted from the design by Borg & Gall, namely (1) research and information collecting; (2) planning; (3) developing preliminary form of product; (4) preliminary field testing; (5) main product revision; (6) main field testing; (7) operational product revision; (8) operational field testing; and (9) final product revision. In the operational testing step, a quasi-experimental method was employed by implementing maquette in the learning to test maquette’s effectiveness in improving critical thinking ability. The different treatments given to the two classes are presented in the following table.

TABLE 1: Non-Equivalent Control Group Pretest-Posttest Design.

Class	Pre-test	Treatment	Post-test
Experiment	O ₁	X	O ₂
Control	O ₁	-	O ₂

Johnson
(2014: 463)

O1: *Pretest*

O2: *Posttest*

X: *Treatment*

The pretest and posttest results from the operational field testing were subjected to a t-test. An analysis was carried out to determine whether there was a difference in the critical thinking ability between students taught using maquette (experimental class) and those taught conventionally (control class). The arising difference would show that maquette was an effective learning medium.

4. Results and Discussion

4.1. Maquette’s feasibility according to material and media experts

The maquette was validated by media and subject matter experts based on the feasibility components of content, presentation, graphics, content quality and objectives, and instructional and technical quality. The assessment results by media and subject matter experts having been converted into five scales are presented in the following table.

TABLE 2: Results of Expert Assessments.

Validator	Score Obtained	Kategori
Media Expert	88	Feasible
Material Expert	85	Highly Feasible

Based on the table above, the maquette developed was categorised as “feasible” by the media expert and “highly feasible” by the subject matter expert. Therefore, it can be said that the maquette was feasible according to experts.

4.2. Maquette’s feasibility according to students’ and teachers’ response

The medium whose feasibility had been validated by the media and subject matter experts was subsequently subjected to preliminary field testing and main testing to gain students’ and teachers’ response. The two kinds of testing were aimed to provide a support to the results of the feasibility testing by the media and subject matter experts to see whether the maquette were truly feasible to use as a learning medium and whether it was ready to be subjected to the operational field testing. The students’ and teachers’ response is presented in the following table.

TABLE 3: Students’ and Teachers’ Response.

	Preliminary Testing		Main Field Testing	
	Teacher	Student	Teacher	Student
Score Obtained	65	60,5	66,5	56,1
Category	Very good	Very good	Very good	Very good

The teachers’ and students’ response in the preliminary field testing was categorised as “very good”, so the medium was fit to be subjected to the main field testing. In the main field testing, the teachers’ and students’ response fell into the “very good” category. This shows that the medium was fit for the operational field testing during the learning process.

4.3. Results of the Maquette effectiveness testing

A t-test was conducted to determine whether there was a difference in the critical thinking ability between the control class and the experimental class. The data were analysed using the Mann-Whitney U t-test. This type of t-test was used because the data were not normally distributed, with the operational testing subject number being

greater than 30, necessitating prerequisite testing to meet the t-test requirements. The t-test results are presented in the table below.

TABLE 4: The t-test Results of Critical Thinking Ability.

Group	Significance	Condition	Remark
Control	.509	Sig. > 0,05	Ho accepted
Experiment	.000	Sig. < 0,05	Ho rejected

Based on the t-test results, the experimental group obtained a value of.000, whereas the control group gained a significant value of.509, greater than the significance level of.05. When compared to the 5% ($\alpha = 0.05$) significance level, the significance of the experimental class was lower than 0.05 (.000 <.05). This proves that there was a significant difference between the control class and the experimental class, with the thinking ability being more pronounced and developed in the class applying maquette six times in the learning than in the class where maquette was not applied.

To support the t-test results, gain score testing was performed. The results of the gain score testing are presented in the following table.

TABLE 5: Gain Score of Critical Thinking Ability.

	\bar{X} Pretest	\bar{X} Posttest	Gain Score	Criteria
Critical Thinking Ability	63,33	80,00	0,5	Moderatte

Based on the table above, the gain score of the critical thinking ability obtained by the experimental class was 0.5, which fell into the medium category. This shows that there was an improvement in the students' critical thinking ability after the application of the maquette in the learning by 0.5. Hence, it can be concluded that maquette was effective in improving students' critical thinking ability by 0.5 and was under the medium category.

Every student basically had the ability to think critically, yet the development of the critical thinking ability differs between one student and another. The use of learning media become an alternative for developing students' critical thinking ability.

Munadi (2013: 39) states that media can increase vocabulary (verbal symbol) with meanings truly understood by students. With the use of media in the learning process, students will gradually gain the ability to develop their critical thinking ability as media use will stimulate the generation of questions in students' minds. November (2015: 511) also states that students' critical thinking may encompass students' experience in relation to knowledge of themselves and the world.

That being the case, maquette was, therefore, declared “effective” in improving critical thinking ability. The maquette was effective as it met the effectiveness criteria according to the results of t-test and gain score of critical thinking ability. With that said, it can be stated that maquettes about professions can be used as learning media that can attract students’ interest in learning and have met the validity and effectiveness criteria in terms of critical thinking ability, making students more motivated to learn.

5. Conclusion

In this research, maquette feasibility was determined based on the results of the assessment by a media expert, the assessment by a subject matter expert, students’ response, and teachers’ response in the media testing. The feasibility testing results show that maquette was feasible to use as a learning medium. This testing was followed by testing of maquette effectiveness in the learning process. This research was limited to third graders. Hence, it can be concluded that maquettes are feasible and effective in improving primary school students’ critical thinking ability.

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