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THE EFFECT OF VARIOUS MEDIA SCAFFOLDING ON INCREASING UNDERSTANDING OF STUDENTS' GEOMETRY CONCEPTS

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Abstract

This study is a quasi-experimental research with pretest-posttest control group design, which aims to determine (1) the tendency of students in using various media scaffolding based on gender, and (2) effect of media scaffolding on increasing understanding of students' geometry concepts. Media scaffolding used this study is chart, props, and visual. The population was the fifth grade students of State Elementary School I Gunung Terang (total 40 students), Bandar Lampung, Indonesia of the academic year 2015-2016. The sample was total sampling, respectively 20 students in the experimental class (with media scaffolding) and control class (without media scaffolding). Data were collected through observation, interview and test. Analysis of the observation and interviews data with descriptive statistics (percentage). and the test data was analyzed by (a) measuring the level of effectiveness on increasing understanding of students' geometry concepts with formula of Hake's Normalized Gain (g) and its interpretation, and (b) examine of hypotesis on level of effectiveness with t-test. The results of research showed that (1) the tendency of male students using the media scaffolding props, and female students using scaffolding media chart, and (2) effect of media scaffolding on increasing understanding of students' geometry concepts is effective enough.

Keywords: Media Scaffolding, Chart, Props, Visual, Understanding of Students' Geometry Concept

Abstrak

Penelitian ini merupakan penelitian eksperimen semu dengan desain kelompok kontrol pretes-postes, yang bertujuan untuk menentukan (1) kecenderungan siswa dalam menggunakan media *scaffolding* berdasarkan jenis kelamin, dan (2) pengaruh media *scaffolding* terhadap peningkatan pemahaman konsep geometri siswa. Media *scaffolding* yang digunakan dalam penelitian adalah media chart, alat peraga, dan visual. Populasi penelitian adalah siswa kelas 5 SDN 1 Gunung Terang Bandar Lampung (jumlah seluruhnya 40 siswa). Sampel penelitian diambil dengan teknik sampling jenuh, terdiri dari 20 siswa sebagai kelas eksperimen (dengan media *scaffolding*) dan 20 siswa sebagai kelas kontrol (tanpa media *scaffolding*). Data penelitian dikumpulkan melalui pengamatan, wawancara, dan tes. Analisis data pengamatan dan wawancara dilakukan dengan statitika deskripstif (persentase), dan data tes dianalisis melalui cara (a) mengukur tingkat efektivitas peningkatan pemahaman konsep geometri siswa dengan rumus gain ternormalisasi Hake serta interpretasinya, dan (b) uji hipotesis tingkat efektivitas dengan uji-t. Hasil penelitian menunjukkan bahwa (1) kecenderungan siswa laki-laki menggunakan media *scaffolding* alat peraga, dan siswa perempuan menggunakan media chart, dan (2) pengaruh media *scaffolding* terhadap pemahaman konsepgeometri siswa adalah cukup efektif.

Kata kunci: *Media Scaffolding*, *Chart*, Alat Peraga, Visual, Pemahaman Konsep Geometri Siswa

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Mathematics is a basic science that consists of several parts, such as algebra, geometry, statistics, and others; and each part has a different character. Algebra emphasis on students' ability to manipulate symbols and analytical skills in problem solving, geometry focuses on students' ability to imagine waking up flat and space, and statistics focuses on students' ability to collect data, analyze and summarize. The results of study showed that the geometry is more difficult for students than algebra and statistics. Sutiarso, et al (2008) said that more than 40% of the material difficult math is geometry.

The results of the analysis about the UN (National Examination) in Indonesia is obtained that geometry has the lowest absorption capacity compared with algebra and statistics (Balitbang Kemdikbud, 2013).

The main cause of the difficulties students on geometry are misconceptions of geometry (Ada & Kurtulus, 2010; Kabaca, et al, 2011; Ozerem, 2012). According to Sutiarso & Coesamin (2012) that misconceptions of geometry misconceptions of geometry covers two aspects, those are conceptual and procedural misconceptions. The conceptual misconception a mistake in identifying objects and linking the mathematical relationships among objects, while procedural misconception is an error in using symbols, rules, and an algorithms to solve problems.

Teachers have a very important role to reduce these misconceptions. The teacher's role is done by providing scaffolding to students who have learning difficulties. The notion of scaffolding is an adult or expert (teacher) helps somebody who is less adult or fewer experts (student). This scaffolding consists essentially of the adult controlling those elements of the task that are initially beyond the learner's capacity, thus permitting him to concentrate upon and complete only those elements that are within his range of competence (Wood, et al, 1976).

Scaffolding has been implemented in the learning of mathematics, such as algebra with computer-based learning environments (Azevedo & Hadwin, 2005), numeracy and develop multiplicative thinking (Siemon & Izard, 2006), geometry with using a dynamic geometry program (Dove & Hollenbrands, 2013), and percentages (Pohler, & Prediger, 2015). The form of scaffolding can be done in various ways, such as cue cards, handouts, prompts, hints, examples, question, stories, explanations, and visual (Alibali, 2006), telling (Baxter, & Williams, 2010), inquiry dan problem-based learning (Hmelo-Silver, et al, 2007; Fajarini, et al, 2016), effects of three scaffolding types, such as providing explanation scaffolding, providing cue scaffolding, inviting student participation scaffolding on problem solving phase in web-based learning (Jang & Lim, 2008) , scaffolding on real problems (Amiripour, et al, 2012), scaffolding with learning approach (Hryciw & Dantas, 2016), and the patterns of scaffolding contingency in teaching and learning mathematics (Anwar, et al., 2017).
With regarding to the misconception geometry, hence the need for scaffolding teachers to bridge geometry abstract concepts into concrete. Form of scaffolding which may be used by teachers is the use of instructional media (Coesamin & Sutiarso, 2013). The aim of this research is to answer the following research questions: (1) how is the tendency of students in using various media scaffolding (chart, props, visual) based on gender?, and (2) how is effect of various media scaffolding on increasing understanding of students' geometrical concepts?.

METHOD

This study is a quasi-experimental research with pretest-posttest control group design. The population was the fifth grade students of State Elementary School I Gunung Terang (total 40 students), Bandar Lampung, Indonesia of the academic year 2015-2016. The sample was total

sampling, respectively 20 students in the experimental class (with media scaffolding) and control class (without media scaffolding). The media scaffolding provided teacher are charts, props, and visual. Data were collected through observation, interview and test. Observation and interview are used to determine the tendency of students (male and female) using all three media scaffolding, and test are used to determine the effect of media scaffolding on increasing understanding of geometry concepts. This test consists of six items essay; those are redefining the concept, providing examples and non-examples of concept, and application of concepts to determine the area of a trapezoid and kite. Before the test used, the first conducted trials test, and the results of the analysis of reliability tests with Cronbach's Alpha Value obtained 0.76 (n = 29). Analysis of the observation and interviews data with descriptive statistics (percentage). and the test data was analyzed by (a) measuring the level of effectiveness increasing on increasing understanding of geometry concepts with formula of Hake's Normalized Gain (g) and interpret it according to Table 1 (Loranz, 2014), and (b) examine that level of effectiveness with t-test.

Table 1. Interpretation on the value of g

Range of value g	Description
$0.7 < g \leq 1$	Effective
$0.3 < g \leq 0.7$	Effective Enough
$0.0 < g \leq 0.3$	Less Effective

RESULT AND DISCUSSION

Using Media Scaffolding

Media scaffoliding provided by the teacher has a role as a learning aid for students who have difficulty learning geometry Teachers provide scaffolding three media that can be used by students, namely charts, props and visual. Based on observations obtained the following results (Table 2).

Table 2. Percentage of students (male and female) in using media scaffolding

Media Scaffolding	Male Students (n = 10)	Female Students (n = 10)
Charts	20 %	60 %
Props	70 %	30 %
Visual	10 %	10 %
Total	100%	!00%

Based on Table 2, it seems that the charts and props as media scaffolding that is widely used student than visual, with details of many male students using charts and many female students using props. These results indicate that male students prefer media that enable themselves, and women students prefer media that does not complicate them. These results are consistent opinion of Hurst (2015) that "Boys are generally more active than girls. Boys tend to have trouble sitting still for

lengthy periods and therefore do not enjoy activities that are sedentary in nature. Reading, coloring and activities that require sitting still are more difficult for boys. Boys are typically more physically aggressive than girls, especially in elementary and middle school years. Girls can be equally aggressive, but they demonstrate their aggressiveness in nonphysical ways".

Results of interviews with students found other reasons why students prefer a chart rather than visual, that is because charts and props more help in understanding the concepts of geometry and more practical than the visual. The results of this study are consistent with Kidwai, et al (2001) which states that visual scaffolding strategies did not have a significant impact on students' performance. Here are some interview the teacher to the student representative.

Interview to students 1:

Teacher: *"Which media do you use?"*

Student: *"Chart"*

Teacher: *"Why do you use the chart, not the other?"*

Student: *"Because the chart easier to use"*

Teacher: *"Why do not use props or visual?"*

Student: *"If props I am also happy, but I am confused using visual"*

Interview to students 2:

Teacher: *"Which media do you use?"*

Student: *"I use props"*

Teacher: *"Why did you choose props?"*

Student: *"Because props more easily removed and installed again"*

Teacher: *"Why do not you use charts or visual?"*

Student: *"If charts or visual could not be removed again"*.

Increasing Understanding of Geometry Concepts Students

The results of data analysis on increasing understanding of the concept of geometry students in two classes (with media scaffolding and without media scaffolding) are presented in Table 3.

Table 3. Increasing understanding of geometry concepts students

Group	N	Mean of Pretest	SD	Mean of Posttest	SD	g	Description
With media *scaffolding*	20	35,90	6,34	74,77	15,59	0,65	Effective Enough
Without Media Scaffolding	20	34,29	11,62	42,76	14,52	0,14	Less Effective

Note, Maximum Value: 100

Based on Table 3, it appears that increasing understanding of the concept of geometry students in the class with media scaffolding is higher than the class without scaffolding media. These results also indicate that SD on the class with media scaffloding have relatively large spread of data than ever before (SD = 6.34 into SD = 15.59), while SD on the class without scaffolding media have small spread of data (SD = 11, 62 into SD = 14.52). Then, in the class using media scaffolding have the value of g greater than class without media scaffolding; These results indicate that increasing understanding of the concept of geometry students in class with media scaffolding media more effective than class without media scaffolding. With interpretation the formula of Hake's Gain Normalized was obtained effective enough. Although including effective enough, it does not mean that media scaffolding is not helpful.

Before the t-test was done, the first normality test on the value of g (the value of increasing understanding of geometry concepts)for both classes. The test results of normality with the Kolmogorov-Smirnov test showed that the distribution of data in both classes was normally distributed. and the t-test results are presented in Table 4.

Table 4. T-Test on the value of g

	t-test for Equality of Means		
	T	df	Sig. (2-tailed)
Equal variances assumed	-8.620*	38	.000

Note, p* < 0.05

Based on t test in Table 5 above, because asymp. sig. 0.000 < 0.05 then it can be concluded that there is a significant difference on increasing Understanding of Geometry Concepts Students between classes with scaffolding media than without scaffolding. The results of this study prove that media scaffolding has been helping students in understanding the concept of geometry. The findings of this study that the media scaffolding has been helping students in (a) investigation of the properties, (b) make concrete shape of geometry mentally, and (c) completion of a task or problem geometry.

Investigation on the properties of geometry and concretize the form of wake up is an important part in understanding the geometry. Difficulties students understand geometry properties because they are not able to identify a wake geometry geometry on the other. This is according to Van Hiele Scheme (Cited in Schwartz, 2014) which states that ".. at the PreRecognition Stage, children perceive geometric shapes but they are generally unable to identify them. They can recognize broad categories of shapes, such as straight-sided shapes as compared to curved-sided shapes. They do not construct mental images of shapes or hold shapes in their minds for any length of time. At the next higher level in the van Hiele scheme, children do hold mental images of shapes". In this study, investigation of the properties and make concrete shape of geometry mentally more do students through charts and props

than visual. Students use the chart to see a picture of a geometry and its properties, and the use of props to try and modify geometry.

Media scaffolding also assist students in completing a task or problem geometry. For example, when the teacher asked the students "How to determine the area of kite?". To answer these problems, students use props kite by modifying the kite into a rectangle. Then the students calculate the area of a rectangle and split second, then gained the area of kite. Then, students try other kites of different sizes. In the same way the students can calculate the area of a second kite. Based on the modification of the props, the students can conclude that the area of kite is half the area of rectangle.

Chart has helped shorten the learning time of students. Because students do not need to read a detailed description on textbooks that generally sentences in books confuse students. Students feel practically see the image geometry, a brief explanation on the chart, as well as examples of problem solving. For example, the material trapezoid shown in the chart with examples, shapes and attractive colors has been helping students in understanding the concept of trapezoid and its properties. On the chart also show the example problems and solutions with a variety of images and attractive colors has also helped students in problem solving. Meanwhile, the students while using props have cultivated the attitude of cooperation among students. This attitude was demonstrated when a student making modifications props. Attitude to help each other have been growing mutual sharing of the knowledge among students, and mutual knowledge between the students is more effective than knowledge by teachers.

Other research findings is the attitude to dare to ask the teacher when students face problems, attitude like interacting and communicating with teachers, and attitude self confident in the opinion of the idea or problem. This attitudes to dared to ask impact to keep learning and curiosity about new something. Attitudes like to interact and communicate with teachers bring comfortable feeling students in learning and unencumbered while studying. Attitude self confident foster the spirit to fight, resilient, and tireless in solving new problems. This means that this media scaffolding has given a strong impetus to understand the concept. According to Mohd & Mahmood (2011) that there is significant contribution between overall attitude in problem solving and mathematics achievement.

CONCLUSION

Media scaffolding prepared by teachers is very important for students, especially students who have learning difficulties. Teachers should be able to prepare various media scaffolding with attention level of ability and gender, such as charts, props and visual. Based on data analysis and discussion can be concluded the tendency of male students using the media scaffolding props, and female students using scaffolding media chart, and effect of media scaffolding on increasing understanding of geometry concepts is effective enough.

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