



The Effectiveness of Manipulative Scales Media in Children's Group B Measurement Concept Ability at Tk Negeri Pembina Sragen

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Abstract

The using of manipulative scales is a learning media that is expected to increase the development of measurement concept ability accordance with the development level of children in group B. The use of manipulative scales media can be used effectively if teachers are creative in using supporting materials that can be found in surrounding environment to be used in developing measurement concept. The purpose of this research is to determine the effectiveness of using manipulative scales media toward measurement concept ability in measuring the length, volume, and weight for children's Group B at TK Negeri Pembina Sragen. This research uses experimental methods with design One Group Pretest-Posttest Design. Sampling technique used in this research was purposive sampling with 43 children as sample. Hypothesis test obtain that based on statistical calculations which conducted, it obtained a t-test data through differences test Paired Sample t-Test on SPSS 18.0 program for windows t value is -38,083 with value sig(2-tailed) amounted to 0,000 < 0.05. This results show if the posttest result experienced an increase measurement concept ability that is higher than the pretest results. Viewed from the diagram picture 4.1 show an improvement achievement of mean value occurred in each measurement concepts that given, for the concept of length measurement from originally 34,67 into 43,88, for the concept of volume from 32,67 into 42,14, and the concept of weight from 33,42 into 42,02 and overall there is an increase mean value of measurement concept ability levels from group B from 100,77 into 128,05, resulting in increased score amounted to 27,28. The conclusion of this research is the use manipulative scales media can increase measurement concept ability in children's group B, so that manipulative scales can be used by teacher as media in defining measuring concept of length, volume, and mass for student group B.

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INTRODUCTION

Childhood is the beginning of human growth process, in this period basic character is formed well which comes from the brain, emotional and spiritual. According to article 1 Law of the Republic of Indonesia number 2003 about national education system, Section 1 article 14 (Santi, 2009), early childhood education is a development effort for children from birth to six years old which is given through education stimulation to help their physical and mental growth and development in order to make them ready in having further education.

One of the aspects that should be developed is cognitive aspect. According to Santrock (Luckrista and Komalasari, 2015:2) cognitive aspect is a development aspect aims to develop children's thinking skill to develop logical mathematic skill and knowledge of space and time, as well as skill to classify, to make a group and to prepare thinking skill. Cognitive aspect that can be developed is measurement concept. Measurement concept is the act of giving number toward an object either with standard or non-standard measurement unit (Fatdianti and Rianto, 2016:160) including children can show interest in sense and difference motoric sensory activity (color, size and shape, sound, scent, mass) and show the increasing of interest in simple number and quantity of action (calculating, measuring, examining, less than and small large).

Measurement is a part of mathematics. Knowledge of concept about measurement will make children easier to know various concepts in their daily lives. Basic skill development related to measurement according to Jamaris (Fatdianti and Rianto, 2016: 2) gained by children's experiences when they interact with comparing, classifying, and arranging or ordering things. In line with that Lestari (2011: 20) states that knowing the concept of initial measurement children do not use tool, but by introducing them about the concept of longer, shorter, lighter, faster, and slower. The next higher step, children are invited to use clock, ruler, scale, and thermometer. The main purpose of knowing the measurement is to define the use of either standard or non-standard measuring tool in children's daily life (Harjanto, 2011: 79-82).

Defining standard and non-standard measuring tool in children's play activity can support their measuring concept. Several measuring concepts needed to be defined since early childhoods are length, volume, and mass. According to Koes and Prabowo (1998: 4) length is a base

quantity with international unit in meter (m). Measuring length according to Herowati (2014: 9) is a process of comparing an object's length with a measuring tool. Defining the concept of length can be started by comparing the length of a thing in classroom by using non-standard measuring tool then followed by standard measuring tool. The definition measuring length in this present research is an effort to measure the length of an object comparing objects' length by using standard measuring tool (ruler) and non-standard (stick, span, felt tip marker).

Volume is the amount of space needed by an object (Oxclade and Ganeri, 2003: 65). According to Smith and Price (2012: 153-156) volume is an expression to express something great, few, wide, small and tiny from a container they made. Volume is related to pouring and measuring activity. The definition of volume in this present research is an effort to measure capacity (content) of an object by pouring or measuring it to a standard measuring tool (measuring glass, measuring spoon, measuring cups) and non-standard measuring tool (spoon, spade, plastic glass) with international unit m^3 ($1 dm^3 = 1 liter$).

Mass is a base quantity with international unit in kilogram (kg) (Koes and Prabowo, 1998:4). The definition of measuring mass according to Yuliana (2104: 15) is an effort to compare the amount of substance in an object in kilogram (kg) unit, and scale as the standard measuring tool. According to Prasetyono (2008: 95) measuring weigh concept should be taught by using scale with weights, because if using scale with pointer as the weigh indicator it often moves so it will be difficult for children to read it. The definition of measuring weigh in this present research is an effort to compare the amount of substance in an object with standard unit (kg) and non-standard unit (spoon) by using equal-arm beam scale as the measuring tool.

Defining measurement concept can be done by changing the way of learning based on children's interests so that they consider their learning activity is like playing, even it is actually a game. Besides, interesting media is needed so it will make children easy to define beginning measuring concept without burden their brains. A good learning media must have these criteria: clear and neat, clean and interesting, appropriate with the target, relevant with the given topic, appropriate with the purpose of learning, practical, flexible, durable, has good quality, and the measurement is suitable with the learning environment (Asyar, 2012: 81-82).

The fact is there is Kindergarten institu-

te which still apply worksheet as media in learning process particularly in defining calculation. The use of worksheet in defining the concept of measuring length, volume, and mass will make children feel difficult in understanding the concept of actual measuring. By worksheet, children are demanded to memorize numbers, sum, geometry shapes, various symbols and mathematics language, without knowing the basic principle. While children in their preoperational age according to Piaget (Santi, 2009) need to be actively engage and know their environments. Therefore children can actively participate and become active learners.

Based on the result of observation done at TK Negeri Pembina Sragen on 22-26th of January 2016, defining initial measuring concept for children was simple concept. The concept was defining the concept of length. Defining length concept was taught by teacher who brought two beams in different lengths, and then teacher compared them by made them one and invited children to see which beam was short and which one was long without using any tool. After teacher gave the simple length concept, she gave worksheet to define further concept.

Defining measurement concept could not be done only by seeing, for example, not all objects that have great amount were heavier (cottons and apples), and the liquid in a higher container was liquid which had more volume but actually the container had different shape (glass and bowl). Teacher did not define measuring with standard measuring tool, even though there was no demand from children about standard measuring tool. But there was no harm to define various standard and non-standard measuring tools for children to give them the right measuring concepts.

Based on the result of the observation not all of the children were able to mention the right measurements when 2 kinds of liquid that had the same amount poured into different containers, it was because they were not given the definition about standard measuring tool. The lack of supportive media and teacher still used worksheet as a supportive media for learning caused children felt difficult to understand the right measuring concept because they did not directly practice in measuring. Learning process had the obstacles if it did not include direct practice with actual media.

Edgar Dale (Mauladin, 2013: 80) also states that by using learning model method, and direct practice will give more experience for learning. By direct practice, children not only learn to

find something, but also have the skill to analyze what they found and this skill can be gained only when they interact with their environments. Then according to Ardini (2013; 42) in investigating and finding principle children are expected to be able to actively engage in solving problems when they are investigating and finding. Tension needed to be noticed when arranging the materials, which are phased from simple and basic to hard and complex. When children have actively engaged then teacher can notice their understanding level deeper before they go to the next material.

Giving worksheet to children will give boring effect in learning something, because it can be denied that children are not young adult, but children's world is the world of playing. Playing media which is easy, cheap and exciting is needed to facilitate the development of measuring concept by children. By using materials which are easy to be found around them, manipulative scale is expected to help children in developing measuring concept skill.

Manipulative scales is a media which has three functions in defining measuring concept for children; they are length, volume and mass. This media is made by combining things which are easy to be found around them, can be seen, touched, heard, felt and manipulated. Media made by wood, ruler, and measuring glass are useful in differentiating and mentioning object's size, children can learn how to measure length-short, great-few volume, and heavy-light of an object.

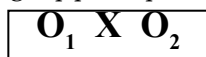
Manipulative scales media is also completed by a box contained standard and non-standard measuring tools such as ice cream stick, cloth gauge, plastic glass, tablespoon, measuring spoon, funnel, and beam weights that can be used to measure length, volume, and mass. This media can be overhauled according to what teacher wants will define which concept form the three concepts that will be taught first. This media is an effort to decrease the use of worksheet especially in defining measurement concept activity for children. Based on the background, the research entitled "The Effectiveness of Manipulative Scales Media in Children's Group B Measurement Concept Ability at TK Negeri Pembina Sragen" is needed to be conducted.

METHOD

This research about the effectiveness of manipulative scales media in children's group B measurement concept ability at TK Negeri Pembina Sragen was a research that used quantitati-

ve approach with pre-experimental design and one-group pretest-posttest type. The measuring in this research was done twice, that were before and after experiment. The pattern of this design as follows:

Table 1. *One group pretest-posttest design*



Explanation:

O_1 : Pretest results (before treatment)

X : Treatment

O_2 : Posttest results (after treatment)

Free variable in this research was manipulative scales media, while bond variable was student group B's measuring concept. Population of the present research was all of the children in student group at TK Negeri Pembina Kabupaten Sragen. Sampling technique used in this research was purposive sampling. Purposive technique was sampling method used by collecting subject not based on strata, random or area but based on certain purpose (Arikunto, 2010: 183). The researcher took sample from children in students group B1 and B2 of TK Negeri Pembina Sragen the amount of samples were 43 children.

Instrument used to measure variable of measurement concept ability of student group B in this research was by using likert scale. The use of liker scale made in checklist mode. The scale was arranged based on cognitive and mathematics learning manual Depdiknas, Permendiknas No. 58 Year 2009, Permendikbud No. 137 and 146 Year 2014. The good instrument should fulfill two main requirements; valid and reliable. An instrument was valid if it could be used to measure what must be measured (Sugiyono, 2010: 173).

Validity test of this instrument was done by using product moment correlation formula by Pearson and analyzed by using analysis program form SPSS 18.0 for windows with significant rate 5% = 0.30, with testing criteria if $r_{xy \text{ calculate}} > r_{\text{critical}}$ then the instrument was valid and if $r_{xy \text{ calculate}} < r_{\text{critical}}$ then it was not valid. Based on the result of validity test on the instrument, it could be found that for 50 items which were proposed there were 42 items that were valid.

The reliability of instrument in this research was calculated by Alpha formula. To calculate the reliability the researcher used analysis program SPSS 18.0 for windows with testing criteria if Cronbach's Alpha value was nearer to 1, then the instrument was reliable.

Table 2. The Result of Reliability Test of Initial Data.

Cronbach's Alpha	N of Items
.938	50

Based on the table above it can be seen that Cronbach's Alpha value was 0.938. in significant rate 0.05 with N = 30 (the amount of sample = 30 children), then r_{critical} was gained 0.30. The conclusion was, Cronbach's Alpha > r_{critical} or nearer to 1, which was 0,938 > 0,30, meant that the instrument was reliable and could be used as measuring tool in order to collect data.

RESULTS AND DISCUSSION

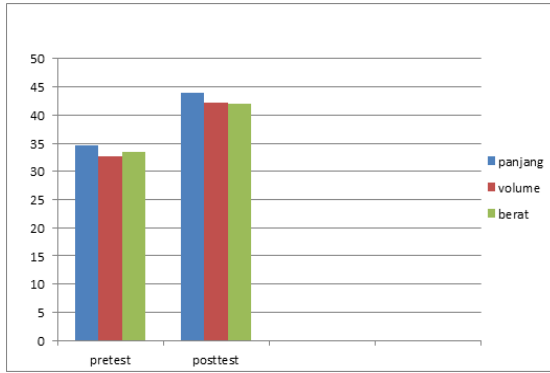
The research about the effectiveness of manipulative scales media in children's group B measurement concept ability at TK Negeri Pembina Sragen was held in August and October 2016. Pretest was conducted before giving treatment this aimed to find out initial measurement concept ability level for student group B, after that treatment was given by using manipulative scales for 12 times treatment, and conducted posttest aimed to find measurement concept ability of student group B after giving treatment.

After pretest and posttest data were gained, and then data was analyzed by using Paired Sample T-test, with analysis program SPSS 18.0 for windows. Based on hypothesis test result by using paired sample t-test at experimental group, it showed that there was difference between pretest and posttest result before and after giving treatment. It can be proved by the increasing score seen from average (mean) score of measurement concept ability before and after giving treatment by using manipulative scales.

Table 3. The Result of Mean Score

Data	N	Min	Max	Mean
Pretest	43	81	117	100,77
Posttest	43	111	138	128,05

Based on the score gained by mean score showed that there was increasing score 27.28 which the initial score average was 100.77 and increased to be 128.05. While average (mean) the achievement of development for each concept aspect of measuring length, volume, and mass would be explained in bar chart as follows:



Picture Diagram 1. The achievement of pretest and posttest mean of length, volume, and mass.

From the diagram above the number of left side average value (mean) from each achievement of measurement concept development with blue chart showed that mean value of length, red bar showed mean value of volume and green bar. From the table above it can be read that mean value before treatment of measurement concept including 34.67 for length concept, 32.67 for volume concept, and 33.42 for mass concept. While the result of mean after giving treatment of manipulative scales media was 43.88 for length, 42.14 for volume and 42.02 for mass measuring concept. Based on the comparison of pretest and posttest it was gained than the increasing score after using manipulative scales it was 9.21 for measuring length, 9.47 for measuring volume, and 8.6 for measuring mass.

It meant that average value of measurement ability in children's group B after treatment by using manipulative scales media was higher

than the average of measurement concept ability average of children's group B before treatment.

From the table above $t_{\text{calculate}} = 8.856$, with t value $t = -38.083$, with sig value sig.(2-tailed) $0,000 < 0,05$ meant that there was difference between the result of pretest and posttest score. By mean value 27.279 minus value in mean score showed that mean or first group (pretest) data was smaller.

The conclusion which could be gotten was H_0 was rejected and H_a was accepted, meant that there was significant difference on measurement concept ability in children's group B it was before and after treatment was given by using manipulative scales media.

CONCLUSION

Based on the result of experimental research entitled "The Effectiveness of Manipulative Scales Media in Children's Group B Measurement Concept Ability at TK Negeri Pembina Sragen", it can be concluded that the use of manipulative scales media was effective to develop measurement concept ability in children's group B at TK Negeri Pembina Sragen. It can be seen based on measurement concept ability result of group B after treatment was given (posttest) the manipulative scales was higher than before treatment (pretest). It meant that there was significant difference in measurement concept ability in children's group B after using manipulative scales media.

Table 4. The Result of Paired Sample t-Test Hypothesis Test

	Paired Differences							
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference		T	Df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 pretest(x)- posttest(y)	-27.279	4.697	.716	-28.725	-25.834	-38.083	42	.000

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