

Developing Science and Creativity Through the Water Playing Exploratory Game

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Abstract—This research aims to review (1) the influence of water-playing exploratory game to the children's science ability, (2) the influence of water-playing exploratory game to the children's creativity. The researcher is choosing an exploratory game to develop children's science and creativity between 5 to 6 years old in order to have an ability in solving a simple problem, understanding the concept of nature, generating ideas or new work product. The method of this research is quasi-experimental with experimental and control group design. The samples of this research are 125 students in Sukolilo Surabaya. In this research, observation and documentation are used for data collection technique. The result shows that the experimental group's science and creativity is greater than the control one. The researcher recommends to every institution in kindergarten to develop the exploratory game by taking advantage of a natural environment that is water as the source of learning, because water-playing exploratory game is proven effective to develop children's science and creativity.

Keywords—*exploratory game; science ability; creativity*

I. INTRODUCTION

Golden Age is the period of children in early childhood, which is the most important period in a human life because in those periods of time there is some process in the physical formation that develop children's potential in terms of motoric development, skills, character, thinking skill and creativity, in which it is growing so fast in this period. In early childhood, children brain will have golden experience on the progress, that is why children need proper referral and stimulation in order all cognitive and creativity aspect could grow better during the process.

Basically, every child has higher curiosity, having fun in experiment and science spirit to grow. Therefore, developing science in early childhood need to be done to bring every stimulation that makes children observing any information, digging information and building knowledge about nature around them [1]. Science learning in children covers exploratory activity, observation, experiment, that aims to make them be able to absorb any knowledge about the process and science knowledge.

According to Wenham in Gross [2]: *Science is "a way of exploring and investigating the world around us... not only a way of knowing; it is...a way of doing". Science involves the discovery of factual knowledge (that something is true), causes*

for what is observed (why something occurs), and procedures (how something is investigated). This opinion mentions that science is a way to explore and investigate the environment around children.

Developing science in early childhood has an important role in stimulating some aspects of children progress, some experts reveal the importance of starting science development during the process of the early childhood period. According to Eshach research in Trundle (2015: 1-2), science experience can be implanted to the children as early as possible. It can enrich children's experience and build a knowledge foundation that could be useful in the future.

According to Coughlin in Kharningsih [3], skill of scientific process that can be done by the children in early childhood as follows: observing, comparing, explaining, estimating, communicating, classifying and measuring. The skill of scientific process can be done in a simple way to the children in the time the play a game by introducing nature that involving environment to enrich children experience. By exploratory activity, doing some simple experiment on nature around them will help children connecting causes and effects. It will help them grow logical and rational thinking skill so that their cognitive development can be supported by their science activity.

Science also creates a fun environment which stimulates children's imaginations. From every imagination will create creativity and enlarge their knowledge about their environment that has been designed for science activity. This environment will stimulate them to ask many questions bravely as a form of creative thinking that will show their creativity.

Santrock in Sujiono [4] stated that creativity is a skill to think in a new way and very uncommon, and also bring out a unique solution to every problem that they will face in the future. It is very important to develop creativity skill on children because it will effect their ideas, problem-solving to every matter and will give an effect to their academic achievement [5]. If we do not stimulate their creativity since childhood, then their intelligence and thinking skill will not be evolved. On this thing, a teacher has an important role to develop those skills.

According to Erikson in Mariyana [6], Attitude formation period of children will occur at the age between 3 and a half to

6 years old, so that is the most important period to develop children's creativity skill. Erikson said that children who gained a good education and parenting environment will develop their creative attitude, they will like exploratory activities, try new things, imagine and have the courage to take a risk. That matter showed that the children's creativity needs some support from a good environment and learning design.

We can observe the creative potential in the children while they playing. Montessori in Suyadi [7] said:

“For the child, a play is an enjoyable, voluntary, purposeful, and spontaneously chosen activity. It is often created as well, involving problem-solving, learning, new social skill, new language, and new physical skills”

For the child, games are something fun, ungrudging, meaningful and spontaneous activity. Games are also considered creative, that involve problem-solving, learn a new social skill, new language, and new physical skill. This concept of playing is also known as learning while playing.

The exploratory game is the kind of game which make children develop their science and creativity skill. According to Mulyasa (2014: 106), the main activity of exploratory game is doing some adventurous activity that will give them happiness and new experience for children. The exploratory game will give them some opportunity to find out new things, develop their skill, stimulate their curiosity and encourage them to learn new skills.

The exploratory game can be done by playing water. According to Dodge in Saleh [8], playing water is very important to grow and develop children skills. By playing water, children can develop their skill of identifying the relation between cause and effect, and build their science knowledge. Problem solving also can be done by the children while and after they play water. According to [4] playing water also can build their scientific science concept, encourage their curiosity and positive attitude which leads them to be a problem solver and scientist in the future. Creative ideas are often appearing from exploration while playing water.

In the water playing game, children move through the stages as follows:

- 1) Stage 1 is a functional play which is children ability to sensing through the five senses. Children are introduced to the nature of water, to find the sound of a waterspout, to feel the sensation through the sideline of finger sand to watch the water disappear soaked into the ground.
- 2) Stage 2 is constructive playing, they are using experiences while they played water for specific purposes by planning and experimentation.
- 3) Stage 3, children do their own activities according to their experiences after playing water.

An activity of playing water allows the children to develop their cognitive aspect around the scope of science development, such as measuring, filling in, having an experiment, exploration, and solving problem. According to Gross [2], playing water give the children an opportunity to learn about the simple science concepts, such as floating concept and drowning by putting in few things into the water, making a solution by mixing some ingredients into the water, observing the differences by using color exploration game which is able to increase the children's science ability.

Theuma[9] explained that children build the understanding of science concept through playing water. Floating and drowning experiment are designed by the teacher when they play with water, manipulate the floating objects is the kind of activity that can develop children's science and creativity skills. Playing water is one of the varieties of games that can push their cognitive development and lead to science and creativity development, therefore this research chose an exploratory game by playing water.

II. RESEARCH METHODS

This research is using a quantitative research approach which done by describing the data in the form of numbers. Experimental research is the type of this experiment because it aims to test the hypothesis of the relationship between variable and research.

Quasi-Experimental Design is used for the design of this research. According to Arikunto [8], *pre queasy experimental design* research actually is a quasi-experiment because the researcher only gives the treatment to one group while other is not given the treatment.

In this research, quasi-experimental is using *Non-Equivalent Pretest-Posttest Control Group Design* which uses both the experimental group and control group. This design is using *pretest* and *posttest* for both groups to measure the contribution of water playing as an exploratory game for both two group. The quasi-experimental design is described in the following table [10] :

TABLE 2.1 *QUASYEXPERIMENTAL DESIGN*

<i>Time</i>	<i>Pre-</i>	<i>and</i>	<i>Posttest</i>	<i>Design</i>
<i>Select Control Group</i>	<i>Pretest</i>		<i>No Treatment</i>	<i>Posttest</i>
<i>Select Experimental Group</i>	<i>Pretest</i>		<i>Experimental Treatment</i>	<i>Posttest</i>

The pretest will be held by doing an observation for both groups. The observation aims to measure children's science and creativity ability. Next, for the experimental group, the teacher will give learning activity by doing a water-playing exploratory game, while the control group teachers are using story-telling method and tasks. *Posttest* will be held by doing observation and re-observation after the treatment, it will be obtained the differences score between *posttest* and *pretest* or called as *the gain score*. Next, the researcher will compare *the gain score* between control and experimental group to notice how far the treatment influence their ability.

The research design of *control group pretest* and *posttest* design is using one treatment, that will be described as follows [8]:

TABLE 2.2 *CONTROL GROUP PRETEST DAN POSTTEST DESIGN*

O₁	X	O₂
O₃	-	O₄

Explanation:

- O₁: Measurement of the first capability for the experimental group.
 O₂: Measurement of close capability for the experimental group.
 X: Giving the treatment / water-playing exploratory game activity to the experimental group.
 - : Not treated.
 O₃: Measurement of the first capability for the control group.
 O₄: Measurement of end capability for the control group.

The population of this research is all children in group B Gugus I dan Gugus V Sukolilo Surabaya Kindergarten which covers 16th kindergarten with amount total of research population 563 children.

Sample

The subgroup is the sample of the target population which will be researched by the researcher in order to take generalizations upon that target population. [10]

Purposive Sampling is the sampling technique that will be used in this research, to decide someone to become a sample need to consider the interest of the subject who will be inspected in order to earn the relevant information with the purpose of this research [11]. Details of this research sample as follows:

TABLE 2.3 AMOUNT OF SAMPLE

No	Name of Institution	Class	Number of Students	Group
1	TK Yapita	B1	32	Experiment
		B2	31	Control
2	Alam Insan Mulia	B1	32	Experiment
3	Sepuluh Nopember	B	30	Control
Total Students			125	

Children of group B (age 5-6 years) is the sample of this research at Yapita Kindergarten, Alam Insan Mulia Kindergarten, Sepuluh Nopember Kindergarten Surabaya which has homogeneity character and the same characteristic. Having a characteristic area and facility which support learning proses and playing activity. The student will be divided into 2 classes (experimental and control) amount total 125 children.

Yapita Kindergarten school has been set up as a research sample on group B1 that contain 32 children as an experimental group and group B2 with amount total 31 children as a control group.

Alam Insan Mulia Kindergarten has been set up as research sample is group B1 which contain 32 students as an experimental group and in group B of Sepuluh Nopember Kindergarten has been set up as research sample which contains 30 students as a control group. The research was conducted in the second semester, 2017-2018.

The instrument that will be used is observation guideline, documentation and research instrument which develop upon each variable indicator. The observation guideline of this research consists of an instrument to observe the learning by using the water-playing exploratory game.

In order the instrument can be used properly, the researcher needs to develop instruments draft that is known as "latticework". The latticework is an elementary plan for making research instrument.

Latticework Guideline for developing children's science skill can be seen as follows:

TABLE 2.4 GUIDANCE GRILLRESEARCH INSTRUMENT DEVELOPING SCIENCE SKILL OF CHILDREN

Level of Child Development Achievement	Indicator	No Item	Items
Demonstrating activities that are explorative and probing	Observe what happens if water is mixed with the ingredients (solved/dissolved)	1,2,3,4	4
	Try and tell what happens if the colors are mixed (color mixing)		
	Try and tell what happens if things are put in water (floating- drowning)		
	Conduct an experiment of loading ingredients into water (materials that can absorb water and do not absorb water)		
Identifying the cause and effect of the environment	Reveals causes things that can float and drown	5,6	2
	Mention the soluble material and the insoluble material in water		
Classifying objects into similar groups	Group the floating objects and submerged objects in the air	7	1
Solving simple problems in daily life	Make a project by blowing colored water on paper	8	1

(Source: Permendikbud Nomor 137 Tahun 2014)

TABLE 2.5 INSTRUMENT GRILLE ON CREATIVITY PROCESSOBSERVATION OF CHILDREN

Level of Child Development Achievement	Indicator	No Item	Items
Showing the initiative in choosing a game theme	Have the initiative to choose objects or materials for water-play activities	1,2	2
	Using objects or materials that have been selected for water-play activities		
Demonstrating creative attitude in solving problems (ideas, ideas out of the ordinary habit)	Finding alternatives way to make a drowning object (plastic) becomes floating	3,4	2
	Create new combinations in color mixing		
Exploring various media and activities	Make different shapes by blowing colored water on paper according to the child's idea	5	1

(Source: Permendikbud Nomor 137 Tahun 2014)

Based on observation method that has been used, assessment rubric are used for the measurement of this research.

III. RESEARCH RESULT

Data analysis techniques in this experimental research have been done inferentially by using parametric statistics. On parametric statistics, test prerequisite analyst has to be done before conducting the hypothesis test to find out normality and homogeneity of the research. Next, hypothesis test should be conducted to determine whether the hypothesis has been accepted or rejected.

To test the first hypothesis and the second hypothesis, the ANOVA data analysis techniques (*analysis of variants*) is used by using SPSS program for Windows version 22.

The following is the result of the analysis of the first hypothesis by using ANOVA with SPSS program for Windows version 22.

TABLE 3.1 TEST TABLE ANOVA SCIENCE ABILITY

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	226.800	1	226.800	69.794	.000
Groups	220.971	68	3.250		
Total	447.771	69			

The test criteria used to determine the influence of each variable in this study is:

H_0 accepted if the value sig > 0.05

H_0 rejected if the value sig < 0.05

Based on the calculation results above, the result obtained a significance effect *Between Groups* with amount of 0.000 that is less than 0,05 so that H_0 rejected. Based on these calculations it can be concluded that there is the influence of water-playing exploratory game on the children's development of science ability.

The following is the result of the analysis of the second hypothesis by using ANOVA with SPSS program for Windows version 22.

TABLE 3.2 TEST TABLE ANOVA CREATIVITY

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	24.722	1	24.722	14.157	.000
Groups	118.749	68	1.746		
Total	143.471	69			

The test criteria used to determine the influence of each variable in this study is:

H_0 accepted if the value sig > 0,05

H_0 rejected if the value sig < 0.05

Based on the calculation results above, the result obtained a significance effect *Between Groups* with amount of 0.000 that is less than 0,05 so that H_0 rejected. Based on these calculations it can be concluded that there is the influence of

water-playing exploratory game on the children's development of science ability.

The results of this study are similar with research conducted by Karin H. Spencer et al. The results show that outdoor game by using nature media (water-playing area and sandbox) develop children's creativity and expand their imagination more than before. Some research journals that are relevant to this research are research conducted by [4], that explains the children in the United States who perform an water-playing exploratory game designed by the teacher support children's understanding of the science concept, water flows, moves and floating and drowning experiment. Research conducted by Theuma [9], found that from the age 5 to 6 years old children could build the understanding of science concept through playing water.

IV. CONCLUSION

Based on the discussion above, it can be concluded that the water-playing exploratory game is able to develop children's science and creativity skill. The application of water-playing exploratory game has infected significantly to the development of children's science and creativity skill. This is indicated by the significant difference in children's ability in science and creativity between the control group and the experimental group, that the experimental group's understanding is better than the control group.

Suggestion

Early childhood educators are encouraged to apply the water-playing exploratory game as one of the games in developing children's science and creativity, since this type of game is significantly able to improve their ability.

For other researchers who interested in similar research, it is recommended that this research as a reference to do more comprehensive study of other explorative game activities in early childhood.

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