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THE EFFECT OF BALLOON POWERED CAR GAMES IN LEARNING (STEAM) TO IMPROVE CREATIVE PROBLEM-SOLVING ABILITY

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ABSTRACT

Cognitive is a thinking process in the form of a child's ability to connect, assess, and consider an event or events. One of the stimulations for children's cognitive development is with games, because the characteristics of early childhood are learning while playing. This study aims to determine the effect of balloon-powered car games on learning, especially STEAM to improve creative problem solving skills in children aged 5-6 years. This research was carried out using the quantitative Single Subject Research (SSR) method. The data were obtained through the process of calculating the research results determined by the research instrument to improve creative problem-solving ability. The subjects of this study were 3 children aged 5-6 years in group B Hidayatul Islamiyah Kindergarten, Sumurugul Village. In this game, children not only play, but also participate in making the toy car according to their imagination, children are directed to choose materials to make the car frame, the materials provided are used boxes and used mineral water bottles. After the child has succeeded in assembling the toy car, the child is directed to be able to solve the problem of how to make the toy car move but not use a machine. The researchers provided knowledge about the concept of air that can push objects. In this activity, children are required to be able to solve problems creatively. The results of this study indicate that the balloon-powered car game in learning (STEAM) has an effect on creative problem-solving skills in children aged 5-6 years which is marked by an increasing tendency for the graph direction to go up from baseline 1, intervention and baseline 2. In the RMD subject, the highest score was obtained at Baseline 1, which of 60%, Intervention scores of 75%, and baseline 2 with scores of 90%. Likewise, MAPM and RKN subjects showing equally increasing results. The trend of stability at baseline 1 of 33.3%, at intervention of 66.6% and at baseline 2 of 100%. Data Traces all showed positive results (+).

Keywords: *balloon-powered car game, cognitive, early childhood*

1. INTRODUCTION

Cognitive development is a very important aspect of child development. In early childhood education, children are objects that are directly related to the educational process, so that cognitive development is very important for success in school (Utamayasa, 2021). In cognitive development in schools, teachers as educational staff who are responsible for carrying out educational interactions and cognitive development of students need very in-depth descriptions of cognitive development in their students.

Cognitive learning theory is a learning theory which states that "Learning is a mental event related to thinking, attention, assumptions, problem solving and understanding". The core thought of this theory is contrary to the thought of behaviorism. In a cognitive perspective, the learning process is not sufficiently applied to stimulus and reaction ties (S-R) or reinforcement, but is also related to logical and rational ties that link the process of obtaining or changing from within (insight), thoughts (outlook), hopes or mindset. Cognitive learning attitudes pay more attention to mental processes and perceptual relationships to get descriptions, find problem solving through thinking activities and interpret concrete things towards abstract understanding. So, the orientation of the application of this theory is intended to create understanding in students regarding significant problems (Mariyati & Rezamia, 2021) .

In early childhood, a child's way of thinking is characterized by creativity, freedom, and full of imagination/imagination. Jean Piaget divides children's cognitive development into four stages, namely the sensorimotor stage (0-2 years), the preoperational stage (2-7 years), the concrete operational stage (7-11 years), and the formal operational stage (11 years and over). Based on Piaget's stage of cognitive development, early childhood is in the pre-operational stage, because at this time the child is not ready to be involved in operations. The characteristics of the preoperational development stage are the child's illogical way of thinking, unclear causal relationships, believing in something outside himself, for example dolls have souls and can speak, besides that the next feature is that children focus on one thing that interests them and has egocentrism, namely an inability to distinguish between one's own perspective and the perspective of others (Soetjiningsih, 2018).

One approach in early childhood education is learning by playing. for a child, playing is an activity they do all day long because for a child playing is life and life is a game. Early childhood does not distinguish between play, study and work. Children generally really enjoy the game and will continue to do so wherever they have the opportunity. Play is the world of children through play activities children develop various aspects of multiple intelligences. Educational games can help optimize it. Through playing children can also know who they are and their environment, and it is equally important that children are introduced to their God through the creatures they have created. When children play in water, ask children to think about the benefits and dangers. Give children the opportunity to express what they think or what they see. Playing is an approach in carrying out early childhood education activities by using interesting strategies, methods and materials and media so that children can easily follow them. Through play, children are invited to explore (exploring) to find and use the objects around them (Sujiono, 2013). In play activities, aspects of children's cognitive development can be optimized, including 1) playing helps children build concepts and knowledge, 2) playing helps children develop abstract thinking skills, and 3) playing encourages children to think creatively (Mutiah, 2010).

In the 21st century, it focuses more on the learning process than on learning outcomes. For early childhood skills, the 21st century is needed because they are skills related to knowledge, attitudes, skills and character that experts believe are very important for an individual to have in supporting career success in the current era. These 21st century skills include critical thinking, collaborative, communication and creativity skills (Putri, 2019). In addition to these four skills, children are also stimulated to be able to search, process and convey information through technology. Various models, methods and learning strategies have developed following the dynamics of the industrial revolution, this is because education is the spearhead of preparing the required human resources. The STEAM learning model is one of the learning model solutions that can prepare students to have 21st century skills (Puspitasari et al., 2022).

The STEAM approach bases the development of learning on the existence and relationship between components of science, technology, engineering, art and math. Children are invited to create something based on their own thinking and imagination so that it is possible for children to form good mindsets. The introduction of STEAM for early childhood can be done by creating a safe and fun learning environment. Providing opportunities for children to explore, discover, build, conduct experiments, predict, seek temporary answers and relate knowledge to real life are key activities that can be carried out in implementing STEAM. These activities can be designed through play activities so that children feel comfortable and enthusiastic about being involved in them. There are several aspects that need to be considered in implementing STEAM for early childhood. These aspects consist of: 1) asking questions (questioning), 2) exploring and observing, 3) developing skills and processes, 4) communicating, and 5) playing (Putri, 2019).

Providing the right media will direct learning to STEAM. The provision of media and learning activities depends on the creativity of the teacher. To support children's skills and creativity in using the STEAM model, the researchers designed a balloon-powered car for STEAM learning activities at Hidayatul Islamiyah Kindergarten. In this activity, children are invited to create their own toys by choosing materials to make toy cars. In this activity the researchers provided tools and materials such as used small boxes, used mineral water bottles, mineral water bottle caps, straws, balloons, toothpicks and also double tips. After that the child is directed to assemble his own toy car, this is a stimulation of creative problem solving. In addition, children can explore and observe how to make the toy car they have made run without using an engine or battery, but using a balloon that is blown up and the air in the balloon can push the car to move. In this activity children get new experiences and new knowledge by active learning, exploring and also observing a game. Therefore, the title of this study is "The effect of Balloon Powered Car Games in Learning (STEAM) to Improve Creative Problem-Solving Ability (Single Subject Research at Hidayatul Islamiyah Kindergarten 2023)".

2. LITERATURE REVIEW

2.1 Cognitive Theory of Science and Mathematics for Early Childhood

Science is a scientific study related to natural phenomena that is carried out through scientific processes. Not only that, science is also related to ways of thinking, how to obtain facts through a series of scientific steps to obtain various information so as to produce an explanation or theory based on the principles of objective truth. Science for early childhood is a form of learning about problems that come up and according to their thoughts and curiosity. Early childhood has unique characteristics because they are always curious about what is around their environment. Adults can take advantage of children's curiosity in directing them to be able to search for information in finding answers to questions they ask themselves. In science learning, teachers can direct children into investigative learning activities. Science for early childhood is not just a collection of facts, but involves observing what is happening, classifying information, predicting what will happen, testing predictions through guided activities and formulating conclusions (Putri, 2019).

Apart from learning science trough playing math games can be introduced in early childhood so that the development of science and mathematics can help optimize the early childhood development. Mathematics is very important in everyday life. Throughout everyday life. We always use mathematics in daily life. Shopping, counting objects, time, place, distance and speed are all mathematical functions. Understanding graphs, tables, diagrams is also a function of mathematics. Measuring length, weight and volume are also mathematical functions. Mathematics has a much broader meaning than the calculation of numbers because mathematics functions as a way and tool for thinking. It can be defined as a scientific discipline that is not just arithmetic/counting. Mathematics is a tool for solving problems. Mathematics is an activity to find and study patterns and relationships (Sriningsih, 2009).

Science and mathematics in early childhood are interpreted as good development for children's cognitive or other aspects of development. Both play activities must start from simple things in the environment around the child and carried out through fun games. So that the basic concepts of science and mathematics can be optimally implanted.

2.2 Creative Problem Solving

The process of creative thinking is mainly used by someone to solve problems. Problem solving is a process that occurs in 4 (four) phases, namely: (1) the preparatory phase, in the form of gathering information relating to the problem being solved; (2) the information maturation phase that has been collected, in the form of activities related to efforts to understand the linkage of one information with other information in the context of solving problems; (3) the illumination phase, in the form of finding ways to solve problems; and (4) the verification phase, in the form of activities related to efforts to evaluate whether the steps to be used in solving the problem will produce appropriate results (Nuraini et al., 2020).

The process of creative thinking through the phases of preparation, maturation, illumination and verification can also occur in early

childhood. That means that in order for children to be stimulated to always think creatively, parents and educators and other adults need to create situations, conditions and environments that can challenge curiosity through observing, asking questions, gathering information and trying. Associating and communicating to friends, teachers and parents.

3. METHODS

This study used the SSR research method, which is a quantitative research method with a single subject experimental type. Single subject research was conducted to find out how much influence a treatment was given to the target behavior repeatedly in a certain time. The purpose of SSR research was to focus on individual data as a research sample in the research that would be examined on the problems determined by the researchers. SSR research is used for single subjects in its implementation can be carried out on a single subject or group of subjects (Zulmiyetri et al., 2020).

In this study, the subjects were 3 children aged 5-6 years with the initials RMD, MAPM, RKN who are now in Group B of TK Hidayatul Islamiyah. These 3 children were given a treatment of balloon-powered car games in learning (STEAM) to improve creative problem solving skills. Data collection is a very important thing in a research, intended to obtain reliable materials, information, facts, and information. Data collection techniques used by researchers in this study were observation, discussion, and documentation.

The technique of collecting data through observation is a way for researchers to observe objects directly using research instruments according to the criteria set by the researcher. Furthermore, the data collection technique through discussion is a dialogue used in collecting data between researchers and subjects by way of systematic question and answer and based on research objectives. In addition to observations and discussions in this study, the researchers also used a documentation study in the form of photos when the child successfully completed the task of making this balloon-powered car game.

The data collection tool used in this study was in the form of an action test instrument, namely: 1) children were able to recognize geometric shapes from car-making materials, 2) children were able to count objects (counting car wheels), 3) children were able to use objects as symbolic games, 4) children were able to know the concept of air, 5) children were able to show explorative activities, 6) children were able to show probing activities, 7) children were able to show creative attitudes in solving problems, 8) children were able to recognize the reasons for their environment, 9) children were able to apply knowledge or experience in new contexts, and 10) children were able to show initiative in choosing game materials.

Table 1. Score Assessment Criteria

Assessment criteria	Score
BB (Undeveloped)	1
MB (Start Developing)	2
BSH (Thriving As Expected)	3
BSB (Very Well Developed)	4

The design used in this study was the A-B-A reversal design. This A-B-A design is one of the developments on the basic A-B design. This A-B-A design has demonstrated a causal relationship between the dependent viable and independent variables. The basic procedure is not much different from the A-B design; it is just that there has been a repeat of the baseline phase. Initially, the target behavior is measured continuously in baseline conditions (A1) for a certain period of time, then in intervention conditions (B). different from the A-B design in the A-B-A design after the measurement in the intervention condition (B) the measurement in the second baseline condition (A2) is given. The addition of the second baseline condition (A2) is intended as a control for the intervention phase so that it is possible to draw conclusions that there is a functional relationship between the independent variable and the dependent variable. The basic structure of the A-B-A design on the influence of balloon-powered car games on learning (STEAM) to improve creative problem-solving abilities in children aged 5-6 years.

Data analysis was the last stage before drawing conclusions. Data analysis in group research as in this experimental study involved combining data between research subjects, which were then described using statistics, such as mean, standard deviation or variance, finally using inferential statistics to help decide whether the proposed hypothesis is accepted or not (Widodo et al., 2021). In this study, internal statistics were used to help decide whether there was an effect of balloon-powered car games on learning (STEAM) to improve creative problem-solving skills for children aged 5-6 years in Hidayatul Islamiyah Kindergarten.

4. RESULTS & DISCUSSION

The results of the initial observations showed that there were 23 students aged 5-6 years who attended Kindergarten Hidayatul Islamiyah. The researchers also found that in global conditions, the children at Hidayatul Islamiyah Kindergarten were still under-stimulated in terms of cognitive development, especially in problem solving. For more effective results, researchers conducted research on only 3 children. The researcher made observations, gave examples of similar questions related to problem solving, and thoroughly observed the 3 children. An explanation of the research results will be explained below.

4.1 Data Description

The results of calculating the score of creative problem solving abilities in children aged 5-6 years in terms of the research instrument (result score: maximum score x 100%) in the three subjects.

Table 2. Baseline 1 Gain Score (Session 1-3)

Name	Session To Test Achievement (%)		
	1	2	3
RMD	47,5%	52,5%	60%
MAPM	37,5 %	42,5%	50%
RKN	47,5%	50%	57,5%

Table 3. Intervensi Gain Score (Session 1-3)

Name	Session To Test Achievement (%)		
	1	2	3
RMD	65%	67,5%	75%
MAPM	52,5%	57,5%	62,5%

RKN	60%	65%	70%

Table 4. Baseline 2 Gain Score (Session 1-3)

Name	Session To Test Achievement (%)		
	1	2	3
RMD	82,5%	87,5%	90%
MAPM	67,5%	75%	82,5%
RKN	75%	80%	82,5%

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4.2 Data Analysis

4.2.1 Under Condition Analysis

Analysis in conditions according to the data reviewed from the first subject, namely RMD, the length of conditions from Baseline 1, Intervention and Baseline 2 all have 3 sessions. The trend of all graph directions is up. The trend of stability at baseline 1 of 33.3%, at intervention of 66.6% and at baseline 2 of 100%. Data Traces all showed positive results (+). The stability level at baseline 1 of 33.3% and ranged (48.75 - 57.75), at the intervention the stability level of 66.6% and ranged (63.375 - 74.625), then at baseline 2 the stability level of 100% and ranged (79.75 – 93.75).

The second subject is MAPM, analysis in conditions according to the following data, the length of conditions from Baseline 1, Intervention and Baseline 2 all have 3 sessions. The trend of all graph directions is up. The trend of stability at baseline 1 of 33.3%, at intervention of 66.6% and at baseline 2 of 100%. Data Traces all showed positive results (+). The stability level at baseline 1 of 33.3% and ranged (39.55 – 47.05), at the intervention the stability level of 66.6% and ranged (52.815 – 62.185), then at baseline 2 the stability level of 100% and ranged (68.815 - 81.185).

Analysis in conditions according to the data reviewed from the third subject, namely RKN, the length of conditions from both Baseline 1, Intervention and Baseline 2 all have 3 sessions. The trend of all graph directions is up. The trend of stability at baseline 1 of 33.3%, at intervention of 66.6% and at baseline 2 of 100%. Data Traces all showed positive results (+). The stability level at baseline 1 of 33.3% and ranged (32.375 – 40.625), at the intervention the stability level of 66.6% and ranged (59.75 – 70.25), then at baseline 2 the stability level of 100% and ranged (72.815 – 85.185).

4.2.2 Inter-condition Analysis

The components of analysis between baseline conditions (A1), Intervention (B) and Baseline 2 (A2) in **improving** problem solving abilities are as follows:

Table 5. Inter-Condition Analysis

Condition Analysis	Baseline 1 (A1) / Intervention (B)	Intervention (B) / Baseline 2 (A2)
Number of Variables • RMD • MAPM • RKN	1 1 1	1 1 1
Directional Trends and Their Effects		
• RMD • MAPM • RKN	(+) (+) (+)	(+) (+) (+)
Stability Change • RMD • MAPM • RKN	Unstable/Unstable Unstable/Unstable Unstable/Unstable	Unstable / Stable Unstable / Stable Unstable / Stable
Data Overlap	$\frac{0}{3}$ x 100% = 0%	$\frac{0}{3}$ x 100% = 0%

Based on the data analysis described above, it can be proven that balloon-powered car games are effective in increasing creative problem-solving abilities in children aged 5-6 years in Hidayatul Islamiyah Kindergarten. In line with the explanation above, that the use of media in learning is one way to improve the learning process. The benefits of learning media include, namely, learning is more interesting and clearer, the learning process becomes more interactive, and improves the quality of children's learning outcomes (Irmade, 2022).

Figure 1. Balloon Powered Car Game Image

5. CONCLUSION

By using this balloon-powered car game media, it is easier for children to understand the material provided by researchers. Based on the results of this study, it shows that the balloon-powered car game in learning (STEAM) has an effect on creative problem-solving abilities in children aged 5-6 years which is marked by an increase in the tendency for the graph direction to go up from baseline 1, intervention and baseline 2. On the subject RMD acquisition score on Baseline 1 session 1 (47.5%), session 2 (52.5%) and session 3 (60%). Intervention scores for session 1 (65%), session 2 (67.5%) and session 3 (75%). Gain scores at baseline 2 1st session (82.5%), 2nd session (87.5%) and 3rd session (90%). Likewise, MAPM and RKN subjects showing equally increasing results. The trend of stability at baseline 1 was 33.3%, at intervention was 66.6% and at baseline 2 was 100%. Data Traces all showed positive results (+). The stability level at baseline 1 was 33.3% and ranged (48.75 - 57.75), at the intervention the stability level was 66.6% and ranged (63.375 - 74.625), then at baseline 2 the stability level was 100% and ranged (79.75 – 93.75). Analysis between baseline 1-intervention-baseline 2 conditions, the number of variables is 1, the trend of direction and the effect is (+), changes in stability are unstable – unstable – stable, and the data overlap is 0%. Besides being able to make their own toys, children can also play with the car and know that a balloon filled with air can make the car move. In this activity children get new experiences and new knowledge by active learning, exploring and also observing a game.

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