

To cite this article: Siti Umroh\*, Mustaji, Rachma Hasibuan (2021). EFFECTIVENESS OF USING STEAM LEARNING APPROACH TO IMPROVE LANGUAGE AND COGNITIVE DEVELOPMENT OF GROUP B KINDERGARDEN CHILDREN IN WARU DISTRICT SIDOARJO REGENCY, International Journal of Education and Social Science Research (IJESSR) 4 (6): 210-230

**EFFECTIVENESS OF USING STEAM LEARNING APPROACH TO IMPROVE LANGUAGE AND COGNITIVE DEVELOPMENT OF GROUP B KINDERGARDEN CHILDREN IN WARU DISTRICT SIDOARJO REGENCY**

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DOI: <http://dx.doi.org/10.37500/IJESSR.2021.4617>

**ABSTRACT**

The purpose of this research was to test the effectiveness of the STEAM approach to improve language and cognitive development in group B children at Al Muslim Kindergarten, Waru Sidoarjo District. The research was carried out through a quantitative approach with an experimental design. The experimental design used is a nonequivalent control group design. The subjects of the study were group B children of Al Muslim Kindergarten, Waru Sidoarjo District, with class B1 as the experimental group and class B2 as the control group. The research data were collected through observation techniques with oral interview sheet instruments related to language development and cognitive development observation sheets. The research data were analyzed statistically through the t test technique. Hypothesis testing uses a significance level of 5%. The results of data analysis show that: 1) the STEAM approach is effectively used in learning to improve language development in children in Group B of Al Muslim Kindergarten, Waru Sidoarjo District; 2) the STEAM approach is effectively used in learning to improve cognitive development in children in Group B of Al Muslim Kindergarten, Waru Sidoarjo District. The implication of this research is that teachers are advised to use the STEAM approach in learning because it can attract children's interest and enthusiasm in participating in the learning process. In addition, the STEAM approach can be a solution in improving the language and cognitive development of children in group B Kindergarten.

**KEYWORDS:** STEAM approach, language development, cognitive development

**INTRODUCTION**

The quality of a child can be seen from the process of growth and development. Early childhood is an individual who is undergoing a process of rapid and fundamental growth and development for the next life. Experts argue that the age range of 0-6 years is the Golden Age, namely the golden age, because at this time various physical, cognitive, language, social emotional, spiritual and artistic abilities are

developing rapidly and require appropriate stimulation so that all potential, children's interests, talents, and abilities can develop to the fullest. One of the efforts that can be done is through Early Childhood Education.

Healthy, intelligent, cheerful and noble children are the dreams of every parent. Various efforts have been made by parents to optimize the development of their children, but to realize it is not something that is directed according to the stages of age, and a supportive environment must receive special attention.

Basically, early education includes all efforts and actions taken in the process of caring for, nurturing and educating children by creating an environment where children can explore their learning experiences. This environment gives him the opportunity to know and understand things through observing, imitating, and experimenting which takes place repeatedly and involves all his potential intelligence. Through Early Childhood Education which focuses on laying the foundation for physical growth and development (fine and gross motor coordination), cognitive development, development of moral and religious values, social emotional development, language development and artistic development in accordance with the uniqueness and stages of development through which young children go,

The above is in line with Law no. 20 of 2003 concerning the National Education System Chapter 1, article 1, point 14 which states that, "Early Childhood Education is a coaching effort aimed at children from birth to the age of six which is carried out through the provision of educational stimuli to help growth and development. physically and spiritually so that children have readiness to enter further education.

In general, the purpose of early childhood education is to develop the full potential of children from an early age as a provision for children's lives so that they can be independent and adapt to their environment. The task of educators, parents, and the community around the environment is to help foster and hone the abilities they have, as well as those that have not yet appeared in early childhood through integrated and directed guidance. Good communication between parents, teachers and the community is needed in the early childhood learning process.

The learning process in early childhood should be done by providing basic concepts that have meaning for children through real experience. Experiences that allow children to do activities that can develop all their potential, including language development and cognitive development. Children express needs, thoughts, and feelings through language with words that have unique meanings. Children's development of understanding language is mostly limited to their own views, in other words, children have limitations in understanding language from the point of view of others. Increased child language development occurs as a result of the development of symbolic functions

Many young children can read books from beginning to end by interpreting the pictures on each page, can understand the storyline and can predict what will happen next in simple stories, and can read certain symbols. The results of research from Aisyah Isna (2019) with the title of early childhood language development, it can be concluded that language is essentially used for communication interactions such as the communicative function of language and to analyze language well, so that children will better understand how to communicate using certain symbols.

Understanding the story line and reading certain symbols are closely related to the thought process. The thought process is an individual's ability to combine, assess, and consider an event or events, so that the thinking process is a cognitive development related to the level of intelligence that is adequate for children with various interests and potentials. So it can be concluded that cognitive development also affects one's language development. This is in line with Piaget's opinion (Ormrod, 2009) which in his observations revealed that children's cognitive development will affect the language they use.

Cognitive development is directly related to the development of thinking. The development of children's thinking that must be achieved, one of which is in terms of problem solving, namely solving simple problems in everyday life. While in the development of symbolic thinking, what happens is that children begin to use symbols when children use an object or action to represent something that is not in front of them.

Specifically, the ability to think symbolic is the ability to represent and think about objects and events within the framework of internal mental entities, or symbols of everyday experiences or events they experience. According to Piaget (Ormrod, 2009), often these symbols are in the form of words that children hear from the world around them, and which are used in one-word "sentences". In line with Piaget's opinion, (Runtukahu, 2014) that in the symbolic stage, children manipulate symbols or symbols of certain objects. Children are able to use notation without depending on real objects. The opinion of these experts can be drawn as a red thread, meaning that children interpret certain symbols or objects according to their previous experiences.

Early childhood education has a function, namely to develop all the potential of children, inculcate values and norms of life, formation and habituation of expected behavior, development of basic knowledge and skills, development of motivation and positive learning attitudes (Sujiono, 2013:83). Education for early childhood has stages of development with the learning process or learning approach used differently according to the age and ability of the child. Educators are required to be professional in the implementation of the learning process, educators must be able to collaborate with children, of course with an interesting and fun learning approach.

The development of different learning approaches is very interesting to discuss, one of which is the application of the STEAM approach (science, technology, engineering, art, mathematics). The

STEAM approach in learning can develop the reasoning power of early childhood naturally, where children will observe, ask questions, collect information and communicate (language and cognitive development). Learning with a STEAM approach (science, technology, engineering, art, mathematics) allows children to learn while playing with meaningful games. Children are invited to tell stories and retell after what children do and children are invited to count with objects through fun learning concepts. Educators provide rules in learning activities by giving freedom to choose a variety of learning activities, so that children will enjoy learning very happily and enthusiastically.

The learning process must be able to equip children with life skills or life skills that are adapted to the child's environment and the needs of the times individually for students, so that the learning process should provide benefits for children and educational goals can be achieved effectively and efficiently, this was conveyed by Setyowati (in Artobatama, 2018:41). The main concept is when the content of the 2013 Curriculum applied in PAUD using an integrated scientific and thematic approach can be combined with STEAM-based learning, because basically the 2013 curriculum is in harmony with learning activities providing real context in the display of themes which primarily strengthens children with their immediate environment. Teachers can use various learning contexts by connecting learning materials with everyday life, so that learning is able to provide real experiences for children so that they are able to analyze and combine the knowledge that has been obtained and the new knowledge provided by the teacher will then be processed by children naturally developing cognitive structures in line with affective and psychomotor.

The achievement of development in children, the stimulation that is expected from an early age leads to the conditions in which children live in their time. 21st century skills, which are the main things that children must master, put forward 4 concepts according to Pamungkas, (2020) containing 4c, namely creativity, critical thinking, communication, collaboration where the learning process will put forward a skill that has the aim of adapting to the conditions of the times where mathematics, verbal and knowledge will get a solution when doing collaboration / collaboration independently in a positive communication.

The problem was found from the results of observations made in Group B of Al Muslim Kindergarten, Waru Sidoarjo District, in children aged 5-6 years, namely in language development, learning carried out by teachers to students is as much as possible, but children still need motivation and there are still children who are given the opportunity to ask questions and express their opinions and there are still some who are shy. As for cognitive development, the process of solving daily problems by doing activities that show children are able to solve problems still needs to be motivated again. It can be seen that during the learning process, children carry out activities according to the teacher's directions, and children just follow the activities that have been prepared by the teacher.

Efforts are made in learning, related to the objectives described above, in the form of using learning strategies with the STEAM approach on the grounds that STEAM learning is very suitable for developing creativity and critical thinking. The selection of the STEAM approach is considered appropriate because children will have the opportunity to explore the surrounding environment and express their ideas and imagination in a game. Learning with the STEAM approach is an interesting learning for children. According to Siantajani, (2020:147) through STEAM learning the teacher will invite children to explore and find new knowledge, invite children to solve problems and find solutions to these problems, so that children's critical thinking skills and children's involvement in the learning process can increase. So that learning based on Science, Technology, Engineering, Art, and Mathematics can be applied.

The general objective of this study was to obtain empirical data to test the effectiveness of the STEAM approach to improve language and cognitive development. The specific objectives of this study were (1) to examine the effectiveness of the STEAM approach to improve language development in children in group B of Al Muslim Kindergarten, Waru District, Sidoarjo Regency; (2) Testing the effectiveness of the STEAM approach to improve cognitive development in group B children of Al Muslim Kindergarten, Waru District, Sidoarjo Regency.

## **THEORETICAL FRAMEWORK**

### **STEAM Approach**

The learning process carried out in Early Childhood is learning with a scientific approach that is integrated with several areas of development. In order for learning to be more meaningful, it is necessary to innovate efforts with the STEAM learning approach so that children are able to work together, communicate, be able to solve problems to build critical, creative and innovative thinking skills. STEAM encourages children to build knowledge about the world around them through observation, questioning, gathering information, reasoning, and communicating.

Buincontro (2017) defines STEAM as the integration of art disciplines into the curriculum and learning in the areas of science, technology, engineering, and mathematics (STEM). Elements of art that will certainly have a positive influence on anyone who enjoys it. The integration of art elements in STEAM can provide opportunities for children to be creative and innovate in the form of artistic creativity that is integrated into learning outcomes.

STEAM stimulates children's curiosity and motivation regarding higher order thinking skills which include problem solving, collaboration, independent learning, project-based learning, challenge-based learning and research. Learning activities that are in accordance with the STEAM approach are project-based learning. Yakman (2012) learning with the STEAM approach is a contextual learning where children will be invited to understand the phenomena that occur close to themselves. The STEAM learning approach encourages children to learn to explore all their abilities in their own way. STEAM

also brings out different works from each individual or group. In addition, collaboration, cooperation and communication will appear in the learning process because this approach is carried out in groups. Grouping children in STEAM requires personal or interpersonal responsibility for the learning that occurs. This process builds children's understanding of the material being studied.

Through the STEAM learning approach, children will be trained to analyze existing problems using various approaches, including science, technology, art, and mathematics. In addition, children will be trained to give their opinions both verbally and in writing.

### **Language Development**

According to Eliason (1994) language development begins in infancy, and relies on its role on experience, mastery, and language growth in the first years of a person's life, his language ability is strongly influenced by stimulation from his environment. Language is obtained based on habituation from the environment, if the environment stimulates language by teaching or familiarizing children with listening to various vocabulary, then the child's language will also develop. On the other hand, if the child still needs to practice getting language stimulation, such as practicing speaking, then the child's language needs to be trained optimally.

According to Littlewood (1992) learning a first or second language requires a process of habituation in learning the language including: children imitate the sounds of people around them, children try to behave and speak to get reactions from people around them, and children repeat sounds so they get used to it. Children's language development is one aspect of the child's developmental stages which is expressed through the child's thinking by using words that mark the increasing ability and creativity of children according to their developmental stage.

The language development of each child is different, but the development span is long, there are important changes at certain times that occur in children. Children's language development includes listening, speaking, reading and writing. All of these abilities are often referred to as literacy development. Burn in Ramli (2007) reveals that reading is a process that involves a number of physical and mental activities. The reading process consists of nine aspects, namely: sensory, perceptual, sequence of experiences, thoughts, learning, associations, attitudes, and ideas. The reading process begins with visual sensory which is obtained through the disclosure of graphic symbols through the sense of sight. Sequence aspect in the reading process is a series of writing activities arranged in a linear manner.

### **Cognitive Development**

Cognitive development shows the development of the way children think. Children's ability to coordinate various ways of thinking to solve various problems can be used as a measure of intelligence growth. The view of the flow of behavior (behaviorism) argues that the growth of intelligence through



the collection of information is increasing. While the interactivionist or developmentalist flow argues that knowledge comes from the child's interaction with the child's environment.

Cognitive development is expressed by the growth of the ability to design, remember and seek solutions to problems encountered (Patmonodewo, 2003). Jean Piaget (in Ibda, 2015) views children as active participants in the process rather than as active recipients of their biological development. Clearly, Piaget believed that the child should be viewed as a scientist looking for answers who experimented with the world to see what was happening. So, cognitive development is a very meaningful aspect.

Cognitive processes are related to the level of intelligence (intelligence) that marks a person with various interests, especially those aimed at ideas and learning. When providing stimulation to develop these cognitive aspects, an understanding of development methods related to cognitive aspects is needed to make it easier for educators or parents to understand the nature of cognitive, and how the cognitive development of children at each level of development. The goal is that educators or parents can anticipate problems that arise at each developmental period, as well as to help children optimize their cognitive development, so that it will affect their success in the future.

### **RESEARCH METHOD**

The research approach entitled "Effectiveness of Using the STEAM Learning Approach to Improve Language and Cognitive Development of Children in Group B of Al Muslim Kindergarten, Waru District, Sidoarjo Regency" uses a quantitative research approach. Quantitative research is done by describing the data in the form of numbers. This study was used to test a hypothesis of the relationship between research variables. The research method used in this study is an experimental method. According to Sugiyono (2014) the experimental method is a research method used to seek certain treatments for others under controlled conditions. The variables in this study consisted of (1) the STEAM approach (X) as an independent or independent variable, (2) language development (Y1), cognitive development (Y2) as dependent or dependent variable.

The research was carried out using a quasi experimental model design or experimental design, where this design had a control group but could not fully function to control external variables that affected the implementation of the experiment. This study uses the Nonequivalent Control Group Design, where the experimental group and the control group are not chosen randomly (Sugiyono, 2017: 79). The design in this study uses a quasi-experimental design where this design has a control group, but cannot fully control the external variables that affect the implementation of the experiment. The following is an illustration of the research design using the Nonequivalent Control Group Design.

**Table 1. Research Design Schematic**

Group	Before Activity	Treatment	After Activities
Experiment	O1	X	O2
Control	O3	-	O4

Information:

- O1 = The results of the initial observation (pretest) of the experimental group
- O2 = The results of the final observation (posttest) of the experimental group
- O3 = The results of the initial observation (pretest) of the control group
- O4 = The results of the final observation (posttest) of the control group
- X = The experimental group was treated with the STEAM approach
- = Control group not given treatment

The research subjects in question are the parties who are the targets of data collection. In this study, the researcher did not use a sample, because all TK B TK A1 Muslim students were respondents. This study was divided into a group of 26 children in TK B1 as the experimental class, while in the TK B2 group with 26 children as the control class.

Data were collected using observation techniques. In this study, researchers used a type of systematic observation to observe teachers and students in the process of teaching and learning activities using the STEAM approach. Data collection in this study used an observation sheet that was made to assign values based on the assessment guidelines, namely using a score of number 1 (Not Developed), number 2 (Starting to Develop)), number 3 (Developing As Expected) and number 4 (Developing Very Well). Observation is used to determine the ability to recognize the concept of numbers and fine motor skills of children in group A Kindergarten.

The analysis technique used t-test analysis with the independent sample t-test formula with a significance level of 5%. Instrument trials were conducted to determine the feasibility of a research instrument. The test of the instrument used the formula for testing the validity and testing the reliability. Before testing the hypothesis, an assumption test was carried out, namely the normality test to determine whether the data distribution was normal or not and the homogeneity test to determine whether the sample in the study was homogeneous or not.

## RESEARCH RESULT

Prior to the research, the instrument was tested to determine the validity and reliability. The instrument trial was carried out at the DWP Kepuh Sendan Kindergarten, Waru District, Sidoarjo Regency. The validity test in this study aims to measure the validity of research instruments that will be used in research, including language development instruments and cognitive development. Indicators of language development instruments include 3 aspects of question items including 1) children are able



to compare the benefits of carrots, cabbage, potatoes and beans orally; 2) the child is able to determine the tools used to cook vegetables verbally; 3) the child is able to tell the experience of the vegetable soup cooking process orally and cognitive development as much as 3 aspects of the observation points include 1) the child is able to count the vegetable ingredients that will be used to cook the soup; 2) the child is able to use vegetable cutting tools; 3) the child is able to demonstrate how to cook vegetable soup. The validity test in this study used the Pearson correlation formula. The following results of the validity test are stated as follows.

**Table 2. Results of Language Development Validity Test**

Aspect	r Count	r Table	Information
Item No. 1	0.814	0.423	Valid
Item No. 2	0.845	0.423	Valid
Item No. 3	0.727	0.423	Valid

From table 2, it is known that the rtable value for  $n = 22$  with a significance level of 5% is 0.423. Based on the 3 items on the tested language development ability instrument, there are 3 items that are declared valid. This is because the value of the language development instrument has an rcount value of more than 0.396, so it meets the requirements that rcount  $>$  rtable. Furthermore, the validity test was carried out on the other dependent variable, namely cognitive development. Test the validity of the cognitive development instrument as follows.

**Table 3. Cognitive Development Validity Test Results**

Aspect	r Count	r Table	Information
Item No. 1	0.681	0.423	Valid
Item No. 2	0.806	0.423	Valid
Item No. 3	0.736	0.423	Valid

From the table above, it shows that the cognitive development instrument consisting of 3 items is declared valid. This is because the rcount value of the 3 items has a value of more than 0.423 (rtable). All cognitive development instruments were declared valid with the provisions of rcount  $>$  rtable. Thus, all instruments (language and cognitive development) were declared valid and then all these instruments were tested for reliability.

After the validity test was carried out, the next step was to conduct a reliability test. This aims to determine whether the instrument used for research is reliable or not. Reliability testing in research instruments that have been trusted and reliable produces reliable data as well. The results of the reliability test of language development and cognitive development are presented in the following table:

**Table 4. Reliability Test Results**

Instrument	Cronbach's Alpha	N of Items
Language Development	0.706	3
Cognitive Development	0.787	3

Based on the table above, it shows that the instrument of language development and cognitive development has a reliability value of Cronbach's Alpha  $> 0.6$ . Thus, the instrument of language development and cognitive development has met the requirements that the Cronbach's Alpha value is greater than 0.6 (Hair, et al., 2010), so the instrument is declared reliable.

This study aims (1) to determine the effect of the effectiveness of the STEAM learning approach on language development in group B children of Al Muslim Kindergarten; and (2) to determine the effect of the effectiveness of the STEAM learning approach on cognitive development in group B children of Al Muslim Kindergarten. The researcher used an experimental research design pattern (Quasi Experiment Design) with a nonequivalent control group design experimental design.

The research activity was initiated by conducting initial observations in both groups B of Al Muslim Kindergarten, Waru District, Sidoarjo Regency regarding language and cognitive development in children, this aims to measure the level of language and cognitive development of Group B Kindergarten. The next step is to give treatment to the experimental group. The treatment in the form of a STEAM learning approach was given 3 times a week for 2 weeks, so the total treatment given was 6 times. While the control group continued to follow the routine activities in the classroom as planned by the educators/teachers at their respective institutions.

Before analyzing the hypothesis testing using the independent sample t-test, it is necessary to first test the assumptions on the data to be processed using the normality test and homogeneity test. The normality test is used to test whether the data is normally distributed or not (Sundayana, 2014: 82). The data of this research is the result of observation of language and cognitive development. Testing for normality using the Kolmogorov-Smirnov formula with a significance level of 0.05 or 5%, using SPSS. The distribution of the data is said to be normal if the significance result is more than 0.05 (Sundayana, 2014: 88). The results of the normality test are shown in the table below:

**Table 5. Results of Language Development Normality Test**

<b>Variable</b>	<b>Class</b>	<b>Score Significance</b>	<b>level</b>	<b>Information</b>
Language development (pretest)	Experiment	0.084	0.05	Normal
Language development (posttest)		0.179	0.05	Normal
Language development (pretest)	Control	0.167	0.05	Normal
Language development (posttest)		0.114	0.05	Normal

Based on table 5 above, it is stated that all data from language development research have a value of more than 0.05, so it can be stated that language development research data is normally distributed.

**Table 6. Cognitive Development Normality Test Results**

<b>Variable</b>	<b>Class</b>	<b>Score Significance</b>	<b>level</b>	<b>Information</b>
Cognitive development (Pretest)	Experiment	0.088	0.05	Normal
Cognitive development (Posttest)		0.122	0.05	Normal
Cognitive development (Pretest)	Control	0.138	0.05	Normal
Cognitive development (Posttest)		0.110	0.05	Normal

Based on table 6 above, it is stated that the data from the cognitive development research has a value of more than 0.05, so it can be stated that the cognitive development research data is normally distributed.

This homogeneity test was conducted to test the similarity of several parts of the sample. This homogeneity test uses the Levene Test with SPSS with a significance level of 5% or 0.05 (Priyatno, 2016:46). This means that if the calculated significance is more than 0.05 then the data variance is said to be homogeneous. The results of the homogeneity test are shown in the following table.

**Table 7. Results of Homogeneity Test of Language Development**

Variable	Class	Score Significance	level	Information
Language development (pretest)	Experiment Control	0.496	0.05	Homogeneous
Language development (posttest)	Experiment Control Control	0.183	0.05	Homogeneous

Table 7 is the homogeneity test data of the results of language development research using a significance level of 5%, which is 0.05. In conclusion, if the significance value is  $< 0.05$  then the variance of the data group is not homogeneous, and if the significance value is  $> 0.05$  then the variance of the data group is homogeneous. In the pretest obtained a significance value of  $0.496 > 0.05$ , it can be said that the variable is homogeneous. While the posttest obtained a significance value of  $0.183 > 0.05$ , it can be said that the variable is homogeneous. Thus, all variants of language development data are concluded that the data is homogeneous or has met the basic assumption of homogeneity.

**Table 8. Results of Cognitive Development Homogeneity Test**

Variable	Class	Score Significance	level	Information
Cognitive development (Pretest)	Experiment Control	0.589	0.05	Homogeneous
Cognitive development (Posttest)	Experiment Control	0.622	0.05	Homogeneous

Table 8 above is the homogeneity test data using a significance level of 5%, which is 0.05. Cognitive development research data (pretest) obtained a significance value of  $0.589 > 0.05$ , it can be said that the variable is homogeneous. Cognitive development research data (posttest) obtained a significance value of  $0.622 > 0.05$ , it can be said that the variable is homogeneous. From the data that has been described, it can be concluded that the variants of cognitive development research data have homogeneous criteria or have met the basic assumption of homogeneity.

Hypothesis testing in order to answer the formulation of the problem and the hypothesis proposed in this study. Hypothesis test used in this research is using t test. The t test is needed to test the significance level between each independent variable influence on the dependent variable partially.

**Table 9. Hypothesis Testing**

Variable	T	df	Sig. (2-tailed)	description
Recognizing the Concept of Numbers	3,475	50	0.001	Ha accepted
Fine Motor Ability	2,771	50	0.008	Ha accepted

The ttable value refers to the formula  $(a/2)$ ; (df) is equal to  $(0.05/2)$ ; (60), so that the ttable value is 2.009. In language development, the tcount value is 3,475. When a comparison is made, the value of  $tcount > ttable$  that is  $(3,475 > 2,009)$  and the results of sig. 2 tailed worth  $0.001 < 0.05$ , meaning that there is a significant difference. Thus, the STEAM learning approach is effective for improving language development in group B Kindergarten children.

Furthermore, in cognitive development, the tcount value is 2.771. When a comparison is made, the value of  $tcount > ttable$  that is  $(2,771 > 2,009)$  and the results of sig. 2 tailed worth  $0.008 < 0.05$ , meaning that there is a significant difference. It can be stated that there is a significant difference in children's cognitive development Group B Kindergarten between the control group and the experimental group.

## DISCUSSION

### The Effectiveness of the STEAM Approach to Improve Children's Language Development Group B Kindergarten Al Muslim Waru

Based on the results of data analysis that has been done, the analysis of the results of hypothesis testing on language development (pretest) obtained a tcount of 0.513 ( $0.513 < 2.009$ ) and the results of sig. 2 tailed worth 0.610 ( $0.610 > 0.05$ ), meaning that there is no significant difference between the control group and the experimental group when the pretest (initial test). Furthermore, in the language development (posttest) the tcount value was 3.475 ( $3.475 > 2.009$ ) and the result was sig. 2 tailed value is 0.001 ( $0.001 < 0.05$ ), meaning that there is a significant difference after using the STEAM learning approach between the control group and the experimental group when the posttest (final test) is carried out.

Basically, the ultimate goal of learning is to produce children who have the knowledge and skills to solve problems they will face when they grow up. To produce children who have reliable competence in language development, a series of language development learning strategies are needed, especially different language developments shown when comparing the treatment of groups of children using the STEAM learning approach who have better language development than groups of children using conventional learning approaches.

According to Dhieni (2008) language is a liaison or communication tool between community members consisting of individual thoughts, feelings and desires. In line with Soegeng (2006) describes that child are in the stage of combining mind and language as a unit, when children play with friends, children

communicate with each other using children's language and that means indirectly children learn language.

Gordon & Browne (in Moeslichatoen, 2004) state that language skills can also be developed through educational play activities that aim to communicate verbally with others. The use of the STEAM approach in learning is expected to support the learning process for the better. The presence of the STEAM learning approach as a way to improve children's language development has quite an important meaning, to assist the teacher's task in conveying the messages that will be given to students. This is also in accordance with Santrock (2011) regarding the theory of language development according to Piaget, in the pre-operational stage following the sensorimotor stage and appearing between the ages of 2 to 6 years. In this stage, children develop their language skills. They begin to present imitating letters, children can classify letters by circling them. Gardner (in Susanto, 2012) states that the function of language for kindergarten children is as a tool to develop children's intellectual abilities and basic abilities. In particular, the function of language for kindergarten children is to develop expressions, feelings, imagination, and thoughts.

Children aged 4-6 years experience the development of brain nerve cells very rapidly. The first five years of brain nerve cell development reaches 50% (Rushton, S., 2010). Furthermore, Rushton (2010) explained that at the age of 0-5 years, brain nerve cells develop into billions. Along with the growth of brain nerve cells, children also experience very fast physical, intellectual, social and emotional development (Rushton, 2010). The child's response to stimuli from the environment is very fast. Stimuli can be in the form of interaction, communication, stories, or games. Children will more easily grasp the stimulus if it is done repeatedly and continuously.

Children's language development is one aspect of the child's developmental stages which is expressed through the child's thinking by using words that mark the increasing ability and creativity of children according to their developmental stage. The STEAM approach in learning activities can stimulate children's thinking skills to think critically in solving problems, is open, and fun for children, because it provides opportunities for children to think more creatively with all of the children's ideas.

This learning is prepared to meet children in the 21st century. Because the STEAM learning approach emphasizes active learning, stimulates children to solve problems, focus on solutions, build logical and systematic ways of thinking, and sharpen critical thinking skills. So it has a big role in preparing children to build career opportunities in the technical and creative fields in the future. Science, Technology, Engineering, Art and Mathematics (STEAM)-based learning is taught in an integrated manner in PAUD (Wahyuningsih, et al., 2020). STEAM is used to focus on understanding the integrated nature of the disciplines of science, technology, engineering, and mathematics and the importance of children in children's long-term academic success, economic well-being and community development (Han, 2003).



STEAM products do not only contain some cognitive aspects, but will also make other aspects, namely affective and psychomotor which can be developed in general by children in facing the era of the industrial revolution 4.0. The complexity of the 21st century today demands abilities from various fields and STEAM-based learning can be preparation and practice for all of them (Wijaya et al. 2015). For this reason, language and cognitive development must be developed in various forms, one of which is through STEAM-based learning that integrates design, creativity, innovation, technique, and mathematics so that they can develop the skills needed to deal with the times that children will face in their time.

Yakman & Lee (2012) learning with the STEAM approach is a contextual learning where children will be invited to understand the phenomena that occur close to themselves. The STEAM learning approach encourages children to learn to explore all their abilities in their own way. STEAM also brings out different works from each individual or group. In addition, collaboration, cooperation and communication will appear in the learning process because this approach is carried out in groups. Grouping children in STEAM requires personal or interpersonal responsibility for the learning that occurs. This process builds children's understanding of the material being studied.

Early childhood is not yet able to use a pencil to write, but when the child knows the sounds and symbols of a letter, children aged 5-6 years will be able to write the words they know. Experience is an important aspect in the reading process. Children who have a lot of experience will have a wider opportunity to develop understanding of vocabulary in reading. Concrete experiences and indirect experiences will increase the child's conceptual development. The affective aspect is a reading process related to focusing activities.

Language development is related to cognitive development, which means that cognitive factors greatly influence the development of language skills. As stated by Santrock that knowledge of vocabulary is essentially part of intelligence tests, and is as important as other aspects of language development which are important aspects of children's intelligence (Santrock, 2011). This agrees with Mansur (2005) that language skills are closely related to children's cognitive abilities, although initially language and thought were two different aspects. But in line with the cognitive development of children, language becomes an expression of the mind.

### **The Effectiveness of the STEAM Learning Approach to Improve Cognitive Development of Children in Group B Al Muslim Waru Kindergarten**

In the analysis of the results of hypothesis testing on language development (pretest), the tcount value of 0.837 ( $0.837 < 2.009$ ) and the results of sig. 2 tailed value is 0.407 ( $0.407 > 0.05$ ), meaning that there is no significant difference between the control group and the experimental group when the pretest is carried out. Furthermore, the language development (posttest) obtained a tcount of 2.771

(2.771>2.009) and the results of sig. 2 tailed value of 0.008 (0.008 <0.05), meaning that there is a significant difference in the use of the STEAM learning approach between the control group and the experimental group when the posttest is carried out. From these results it can be concluded that the STEAM learning approach is effectively used in learning to improve the cognitive development of children in Group B Kindergarten.

Children's cognitive development is one of the six aspects in Kindergarten. These aspects are physical, motor, language, art and creativity, as well as social and emotional. Cognitive processes have a lot to do with various concepts that children already have and with regard to their thinking ability in solving a problem. (Mulyasa, 2014:25).

Children's thinking ability or cognitive development has its own stages, according to Piaget's stages of cognitive development (in Beaty, 2013: 269) there are 4 stages, namely sensorimotor, preoperational, concrete operations, formal operations. Group B Kindergarten children aged 4-5 years are included in the preoperational stage. Where at this age children master symbolic thinking? Children use objects to symbolize actions and events. Children learn to predict the effect of one action on another, children are affected by appearances, and children think about the final product. Meanwhile, according to Ministerial Regulation No. 58 of 2009 that children aged 4-5 years have a level of achievement of cognitive development covering three aspects, namely learning and problem solving, logical thinking, and symbolic thinking.

In cognitive development research focused on indicators which include, namely: 1) the child is able to count the vegetable ingredients that will be used to cook vegetable soup; 2) the child is able to use vegetable cutting tools; 3) the child is able to demonstrate how to cook vegetable soup. Learning to count objects, time, place, distance, and speed is a counting function. Understanding graphs, tables are also arithmetic functions. In other words, it is very important for children's lives (Suyanto, 2005:56). Cognitive development has a deep role for the growth and development of a child. Therefore, cognitive development is very influential on the thinking process of children in addressing a problem, especially for early childhood. At this time the child has the ability to think extraordinary or golden age. This sensitive period has a very important meaning for every child's development, it means that if parents know their child has entered a sensitive period and immediately provide the right stimulation, it will accelerate the child's mastery of developmental tasks at his age. Soylu (2016) argues the importance of STEAM being applied from early childhood that the need to emphasize science, mathematics, technology and engineering lessons in the school environment to improve 21st century individual skills, starting with early childhood by using an approach that is in accordance with the development stated by a large number of studies.

Approach STEAM learning can be applied from an early age by collaborating relations between sciences knowledge that coexists with everyday life through integration between components that exist

in themes in one school year (Wahyuni, et al., 2020). Early childhood education is one form of education that focuses on laying the foundation for growth and 6 (six) developments: religion and morals, physical motor, cognitive, language, socio-emotional, and art, in accordance with the uniqueness and stages of development. development according to the age group that is passed by early childhood (Ministry of Education and Culture of the Republic of Indonesia, 2014). Research conducted by (Becker & Park, 2011) shows that the STEAM learning approach has a positive effect on children's learning. The STEAM learning approach in learning is able to train children both cognitively, skills, and affective, besides that children are not only taught in theory, but also in practice so that children experience the learning process directly.

The expected end result of applying the STEAM learning approach is a child who takes serious risks, engages in experiential learning, persists in problem solving, embraces collaboration, and works through the creative process. In addition, in the STEAM learning approach, the teacher acts as a facilitator, and the child is the center of the learning process, both inside and outside the classroom. The STEAM learning approach puts forward collaborative learning (Wahyuni, et al., 2020). Therefore, the classroom must be specially designed to produce an interactive and fun teaching and learning atmosphere. Chairs and tables are not arranged in a row and rigid, but can be moved flexibly according to student learning needs (Apriliana et al., 2018).

Cognitive development shows the development of the way children think. Children's ability to coordinate various ways of thinking to solve various problems can be used as a measure of intelligence growth. The view of the flow of behavior (behaviorism) argues that the growth of intelligence through the collection of information is increasing. While the interactivionist or developmentalist flow argues that knowledge comes from the child's interaction with the child's environment. Cognitive development is expressed by the growth of the ability to design, remember and seek solutions to problems encountered (Patmonodewo, 2003). Jean Piaget (1896-1980) viewed children as active participants in the process rather than as active recipients of their biological development. Obviously, Cognitive processes are related to the level of intelligence (intelligence) that marks a person with various interests, especially those aimed at ideas and learning. When providing stimulation to develop these cognitive aspects, an understanding of development methods related to cognitive aspects is needed to make it easier for educators or parents to understand the nature of cognitive, and how the development of cognitive abilities possessed by children at each level of development. The goal is that educators or parents can anticipate problems that arise at each developmental period, as well as to help children optimize their cognitive development, so that it will affect their success in the future.

## CONCLUSION

The effectiveness of the STEAM learning approach can improve language development in group B children at Al Muslim Kindergarten, Waru Sidoarjo District. This is evidenced by the average value of language development in the experimental group at the time of the pretest, which is 6.50 and after

being given treatment, the posttest average value is 9.38, while the average value of language development in the control group during the pretest is obtained. 6.27 and after being given treatment, the posttest score was 7.73. In addition, based on the results of the t-test analysis with independent sample t-test, it was obtained that  $t_{count} > t_{table}$  ( $3.475 > 2.009$ ) and sig. 2 tailed is  $0.001 < 0.005$ . Therefore,

The effectiveness of the STEAM approach can improve cognitive development in group B children at Al Muslim Kindergarten, Waru Sidoarjo District. This is evidenced by the average value of cognitive development in the experimental group at the time of the pretest, which is 6.62 and after being given treatment, the posttest average value is 9.58, while the average value of cognitive development in the control group during the pretest is obtained 6.27 and after being given treatment, the posttest score was 8.42. In addition, the results of the t-test analysis with independent sample t-test obtained  $t_{count} > t_{table}$  ( $2.771 > 2.009$ ) and sig. 2 tailed is  $0.008 < 0.005$ . Therefore,

It is recommended for teachers to use the STEAM learning approach in learning because it can attract children's interest and enthusiasm in participating in the learning process. In addition, the STEAM learning approach can be a solution in improving the language and cognitive development of children in group B Kindergarten. Furthermore, other researchers in conducting further research can use a similar approach with improvements in various ways to get more optimal results and can also be combined with other variables related to learning.

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