# Early Scientific Thinking : Basic Stimulation in Early Childhood Cognitive Development

Salsabila Hasiana Tanjung[1], Dorlince Simatupang[2], Artha Mahendra Diputera[3], Kamtini[4]

{salsabila97@unimed.ac.id}

Universitas Negeri Medan, Medan, Indonesia

**Abstract.** Cognitive development in early childhood is one of the achievements of human development that is urgently needed to be given appropriate stimulation and by the needs of children. Through this research, children are given learning activities that can strengthen their scientific thinking skills. Early childhood aged 4 to 5 years were the subject of this program with the help of two teachers. The data obtained were then tested for correlation and regression to see the relationship and how much influence scientific thinking skills were given to strengthen of cognitive development in early childhood. The implementation carried out shows that the scientific behaviour that the child does has a good sign on the sustainability of the achievement of the stages of children's cognitive development.

**Keywords**: Children, Cognitive, Scientific.

## 1 Introduction

Scientific learning in early childhood provides opportunities for children to be able to carry out activities and activities to see and observe objects carefully, ask questions related to the material, collect information, make analogies and communicate things that children can make conclusions. These activities provide opportunities for children to be stimulated by the achievements of children's cognitive development. Through scientific learning children can be invited to think critically about the activities that children do. The use of images in learning activities makes it easier for children to receive information, this is because children are in the pre-operational period, and learning is symbolically assisted by the use of images in learning activities. Learning in children aged 4-5 years to stimulate cognitive development which must be conditioned by the child's personality and the characteristics of the child's developmental achievements. . Provide learning activities to provide training and stimulate the children of cognitive development also require to create a learning model appropriate to the child's developmental stage. The thinking process carried out by children in the cognitive development phase, including in terms of remembering, critical and scientific thinking. There are several ways to do cognitive development, one of which is by playing activities. This can help children in the development of intelligence and memory, then think about the past, present the future. Cognitive processes are closely related and correlated with the level of multiple intelligences of children, which indicates that a person with a variety of interests and developmental achievements is especially devoted to ideas and processes of learning activities.

ICONSEIR 2022, November 24, Medan, Indonesia

DOI 10.4108/eai.24-11-2022.2332530

Cognitive development in children needs to be given learning stimulation according to the characteristics of the child. Cognitive development will play a major role in other child development achievements [1]. Cognitive development plays a role in other developments, this is because achieving development other than cognitive, requires the child's ability to think well. Children who have good cognitive abilities will have the opportunity to solve simple problems in their lives [2]. Children need fun and meaningful learning so that their cognitive development achievements can be stimulated significantly. The abilities expected in early childhood in aspects of cognitive development, namely being able to carry out logical and critical thinking activities, being able to give the right reasons, solving simple problems and being able to find causal relationships. One of the aspects of this cognitive development is that children can name differences in color, geometric shapes and causal reasons. When parents and teachers wish to develop children's cognitive abilities, it is necessary to create an active, innovative, fun, interesting and meaningful learning process for children. There are several elements that influence the learning process, including the teacher who understands the child's personality as a whole, the different characteristics of the child, the selection of learning methods that are centered on children's learning activities, adequate means of activity, has various sources and learning media that attract and encourage child to study. Cognitive abilities in children can be stimulated properly, so things related to learning activities are needed. Such as determining the right learning model and according to the needs and interests of children. The learning model is a general pattern of the actions of researchers and students in realizing teaching and learning activities in a systematic and well-planned manner.

Children's cognitive abilities go through a cognition process which includes various aspects such as perception, memory, thoughts, symbols, reasoning, and problem-solving. Cognitive development is an important aspect of development to be developed and given stimulation, because through cognitive development children can gain the ability to think, solve problems and think symbolically. At the age of 4-5 years, children with the achievement of cognitive development are expected to have good symbolic thinking skills. These achievements include counting many objects from one to ten, getting to know the concept of numbers, getting to know number symbols and getting to know letter symbols. These aspects of development require a learning model that can invite children to be stimulated so that the four aspects of symbolic thinking can be achieved properly. Cognitive abilities in children require stimulation, there are aspects that are developed in early childhood. These aspects are being able to understand the symbols that exist in the environment around the child, being able to solve simple problems that occur in his life so that he can grow into a person who can help himself, train his memory of all natural events and develop thinking.

Moments and situations in the stages of the aged child are fundamentally important and most important and main throughout the span of the phases of growth and development of human life. These periods are marked by various fundamental important moments in the child's development phase in a child's life and subsequent developmental tasks until the end of their development. One of the times and moments that characterize early childhood is the golden age of children, which is a familiar term for education circles. Various concepts and facts found related to early childhood can provide meaning regarding the golden period at that early age, namely the period when all the potential possessed by children develops the fastest. There are several concepts that are juxtaposed and used for early childhood, namely the exploration period, the identification/imitation period, the sensitive period, the child's play period, and the early stages of defiance. Every child who is born and raised brings a variety of potentials and abilities, which are components of various innate abilities. This is realized because of the dynamic interaction and communication between the uniqueness of the child's

personality and the influence of environmental responses. Various abilities that are actualized depart from our brain function. The performance function of the brain is the result of the interaction of a children from genetic blueprint and environmental influences. This golden period only takes place once throughout the span of human life, so early childhood is a critical age. The critical age in the sense of the golden period determines the next development stage for the development of various potentials possessed by children and determines the next stage of development. However, if it is not maximal and not optimal in its stimulation, then the child will have developmental difficulties in the next life. This shows how much it will lose a family, society and nation if they ignore important periods in early childhood.

Every child has different developmental characteristics and learning behaviours. This is the basis that providing learning for early childhood must show a child's interest. So it is very appropriate if children are given a fun learning model. The teacher's role is as a facilitator who provides facilities and situations to help the child's knowledge construction process take place effectively. The learning model is a guideline for designing and implementing learning. The learning model used during the child's learning process consists of systematically arranged and programmed steps or patterns that are applied as a guide to make the achievements of predetermined learning goals well achieved. The learning of activity model plays a role in helping children to obtain information based on the learning material provided during the learning process.

Cognitive is a broad understanding of thinking and observing, so it is the behaviour that causes people to acquire knowledge or what is needed to use knowledge. Cognitive can be interpreted as a mental procedure used to achieve cognitive goals starting from the most instinctive such as sensing to a higher cognitive level, namely observing, storing, remembering, imagining and thinking. Cognitive is the achieve of development, the important aspects of early childhood from the development related to the process of parenting and education and determines success. Parents and early childhood teachers need to have a deep understanding of cognitive development in early childhood. Cognitive is a mental behaviour related to the matter of understanding concepts, considerations and measurements in various simple situations, processing and managing information that children get, implementation of solving problems that children encounter, intentionality and belief in themselves.

The ability to think refers to the process of remembering, making decisions, and solving problems. Learning and problem-solving include the ability to solve simple problems in everyday life in a flexible and socially acceptable way and apply knowledge or experience in new contexts [3]. Thinking logically, covering differences, classifications, and patterns, taking initiative, planning, and recognizing causes and effects. Symbolic thinking, includes the ability to recognize, say, and use the concept of numbers, recognize letters, and be able to represent various objects and their imagination in the form of images.

Cognitive development in early childhood is the ability to think in a child's way of understanding the world through the surrounding environment, exploring himself, other people, animals and plants, as well as various events around him. Jean Piaget referred to early childhood around the ages of 2-7 years as early childhood which is entering the pre-operational stage [4]. When children enter this stage, there is rapid progress in representational or symbolic activity. At this stage, there is a symbolic function sub-stage and an intuitive thinking sub-stage [5]. Symbolic function, spanning 2 to 4 years of age. The symbolic function is increasingly visible when children like to make imitations of objects they do not see, therefore at this stage pretend play develops, for example pretending to be a teacher, parent, hero, astronaut and others. The development of symbolic thinking helps children understand more accurate spatial relationships. Children aged 3 and over can understand the

relationship between an image, map, or scale model and the object or space they represent. Therefore, children begin to draw shapes or objects that are more realistic but not yet proportional [6].

Cognitive is a broad understanding of thinking and observing, so it is the behaviour that causes people to acquire knowledge or what is needed to use knowledge. Cognitive ability is a thought process, namely the ability of individuals to connect, assess and consider an event or events. Cognitive processes are related to the level of intelligence (intelligence) that is sufficient for a person with various interests, especially shown by ideas and learning.

Cognitive abilities in early childhood, namely the child's power or ability to think and observe, see relationships, and activities that result in a child gaining new knowledge which is supported by the ability to ask questions. Thus it can be seen that cognitive development shows the development of children's thinking. Children's ability to coordinate various ways to solve various problems can be used as a measure of intelligence growth. Children aged 4-5 years are in the preoperational stage. At the preoperational thought stage, the stage of child development is divided into two sub-stages, namely the symbolic function sub-stage which consists of the age range of 2-4 years and the intuitive thought sub-stage which occurs around the age of 4-7 years. Thus, if referring to the opinion above, the age of 4-5 years is in the pre-operational cognitive abilities in the intuitive thinking sub-stage. Piaget identified several characteristics of preoperational cognitive abilities in the intuitive sub-stage, including:

a. The child begins to use primitive reasoning and wants to know the answers to all questions.
b. The child's way of thinking is more intuitive than logical. That is, children say they know something but know it without using rational thinking.
c. Lack of conservation skills, conservation of liquids, conservation of quantity, material, length, content and area.
d. Have a high sense of curiosity over a series of questions asked.
e. Actively pay attention to everything but with a short attention span.
f. Have a good memory.

Preoperational stage children's thinking has several limitations. At this stage, the child shows pre-operational egocentrism, which allows the child not to be able to distinguish other people's points of view from his own. Children still have difficulty understanding why they shouldn't hurt other people's feelings, and why they should be willing to share with friends. This is because children still think that the centre of the world is themselves. Another limitation is the lack of conservation, in which children are not yet able to understand that two things are the same even though their appearance is different. For example, the child does not understand that the volume of water in the two glasses remains the same as long as two glasses of different shapes are not added or subtracted.

Cognitive is a mental activity related to perception, memory, thought, and information processing that enables a person to gain knowledge, solve problems and plan for the future. This ability relates to how individuals learn, pay attention, observe, imagine, estimate, assess, and think about their environment.At around 4-5 years of age, children begin to show early signs of logical thinking but still based on prejudice or intuition, children are not yet able to explain why their conclusions are correct. [7]. Vygotsky agreed with Piaget, that children have the ability to build their own cognitive, through the activities carried out by children, but he stressed the importance of the social context in encouraging cognitive development, namely that children can build their knowledge by learning through the help of adults or other children who are more competent. Vygotsky also emphasized the importance of language as an important foundation for higher cognitive processes, including attention, memorization,

deliberate memory, categorization, problem solving and self-reflection. Language helps children exchange ideas with adults and peers. Language helps children think about their mental activity and behaviour and choose actions [8]. Children aged 4-5 years talk to themselves as self-directed to express their fantasies and emotions. Self-talk will disappear in elementary school as children become more able to master their own actions.

The scientific approach, namely learning includes a series of processes of observing, asking, gathering information, reasoning, and communicating. Learning with a scientific approach can help develop children's cognitive because it is an approach that builds a child's way of thinking. Through the process of observing, asking, gathering information, and reasoning, children improve their critical thinking skills, develop their character and intelligence development and can solve simple problems. Scientific learning uses a basis for conveying information through observations or experiments [9]. The stages of observation or experiment carried out by children can use other stages in obtaining information from various sources.

The scientific approach is giving students an understanding of knowing and understanding various materials, using a scientific approach information can be obtained anywhere and anytime. Furthermore, Machin stated that the scientific approach is important to use in learning because a scientific approach can develop various skills such as critical thinking skills. skills), communication skills (communication skills) [10], skills in conducting research and collaboration skills (research and collaboration skills) as well as character behaviour because the learning experiences provided can fulfil educational goals and are useful for solving real-life problems. The scientific approach used in early childhood learning activities is a learning model that uses scientific and empirical principles which includes a series of activities in collecting information through observational activities, discussion interactions in the form of questions and answers, carrying out scientific experiment activities, processing information or data obtained, then children do verbal interaction with communicated.

Kindergarten is a place for children to learn in acquiring initial knowledge so this time it is called the golden age [11]. At this time all the potential that exists in children can be optimally developed. Of course, developing potential in children requires support from people who are in the child's environment. One of the abilities that are being developed in Kindergarten is cognitive ability. Cognitive is a development related to the ability to think [12]. Cognitive related to thinking and intelligence is one of the main aspects that need to be developed in early childhood education. Applied an approach to learning certainly has a goal to be achieved. The following are the objectives of the scientific approach to learning:

a. Improve and stimulate the child's ability to think.
b. Forming children's abilities in solving simple problems in children's lives.
c. Creating fun learning situations so that children feel that learning is an important and meaningful activity.
d. Train and get used to children to express ideas and ideas.
e. Improving the achievement of children's learning outcomes.
f. Developing the quality of the character of the child's personality.
g. Train students to be able to formulate problems (by asking lots of questions), not just solve problems by answering them
h. Train students' analytical thinking so that they have the skills to make the right decisions because they don't just rely on mechanistic thinking (routinely by just listening and memorizing)

Learning to use the first scientific approach is observing. This step prioritizes the meaningfulness of the learning process (meaningful learning) [13]. Observing or observation is very useful for fulfilling students' curiosity so that the learning process has high significance. By observing, students are expected to be able to find the fact that there is a relationship between the object being analyzed and the learning material taught by the teacher.

Implementation in the next step in the core of the scientific method used is the activity of asking. The second step of this scientific approach can be done by asking or giving several questions about information that is not yet understood from what is observed or questions to get additional information about what is observed. The third step of scientific learning is to collect information that children get when they contaminate objects. The activity of collecting information carried out by children is a follow-up to the activity of asking questions. This activity is carried out by exploring and collecting information from various sources in various ways that children can do. Students can read various sources symbolically, pay more attention to the given phenomena or objects, or even conduct experiments or test hypotheses to get as much information as possible about the material being studied.

The next step is to associate or process information from the sources that children get. In giving children the opportunity to carry out activities associating any information that children get, children use their ability to think scientifically. The framework of the learning process in early childhood which by applying a scientific approach, it is hoped that children will become active and responsive learners in every given activity. Reasoning itself is a process of thinking logically and systematically towards empirical facts that can be observed to conclude in the form of knowledge and science. The final step of the scientific approach is communicating. Students must be allowed and given opportunities to communicate what they have learned. This activity can be done by writing or telling what is found in information seeking activities based on the phenomena the child sees, associating the information obtained, and finding the appropriate pattern.

## 2 Research Methods

This research has targets and achievements in the form of developing a scientific-based pictorial learning model for childhood to stimulate the cognitive development of children in aged 4 until 5 years. Children who gived activities, namely learning activities and follow the pattern of a scientific approach, namely learning activities that can stimulate developmental achievements. The number of children who participated in learning activities was fifty children.

The things that are noticed in the behaviour that appears in children are indicators of the ability to think scientifically. These aspects are the child's behaviour in carrying out activities of observing, asking, gathering information, associating or processing information, and the peak aspect of the ability to think scientifically is that the child can communicate the ideas and ideas that the child has.

## 3 Results and Discussion

Research that has been carried out, research produces learning models that play an important role in stimulating every cognitive aspect of children aged 4-5 years. Based on these considerations, the implementation of this research has carried out the preliminary study test

stages and processes which are the initial stages of conducting research. In the process of conducting a preliminary study, researchers conducted tests and obtained research data by conducting interviews with teachers related to the principles of the needs and characteristics of children's development related to their cognitive development. Based on the needs analysis stage test, teachers need learning innovations in the form of learning models that can be used specifically to stimulate and train cognitive development. This is still based on paying attention to the types of children's needs during the learning process activities.

**Table 1.** Stages of Cognitive Development Achievements for Children Aged 4-5 Years

| *Premiliminary Field* | |
|---|---|
| Mean | 3,4 |
| Standard Error | 0,08164966 |
| Median | 3 |
| Mode | 3 |
| Standard Deviation | 0,40824829 |
| Sample Variance | 0,16666667 |
| Range | 1 |
| Minimum | 2 |
| Maximum | 3 |
| Sum | 70 |
| Count | 25 |

In accordance with the table it can be know that the cognitive achievement from the children has an average value of 3.4, that is, if it is adjusted to the assessment of early childhood it can be interpreted as starting to develop. There is an increase in stimulus achievement according to the indicators used in measuring children's cognitive development. Every child experiences self-adjustment in the implementation of the research carried out. Children feel happy in carrying out the learning process. The activities carried out by the children were carried out in a fun way and the intended results were achieved according to the research implementation plan.

The ability to think logically is the process of using consistent reasoning to draw a conclusion, both symbolic thinking of children aged 4-5. Symbolic thinking is part of cognition, children begin to use symbols when they use an object or action to represent something that is not in front of them and is included in the concept-learning stage. Third Solve the problem of children aged 4-5 years. Problem-solving is part of the thinking process and is one of life's tasks that must be faced in everyday life with difficulties ranging from the simplest to the most complex.

Sharpening children's cognitive abilities cannot be separated from the role of educators or teachers. Educators should be able to provide appropriate teaching and learning strategies to help children's cognitive abilities. One approach that can develop cognitively is a scientific approach. The scientific approach is a learning process designed in such a way that students actively construct the components of attitudes, knowledge and skills through the stages of observing, asking, gathering information, reasoning and communicating.

## 4 Conclusion

The scientific approach is not something new within the scope of education. Some institutions have implemented a scientific approach, even though its application is not often done, this is because teachers experience problems and difficulties in implementing learning with scientific approach process. Through the application of using a scientific approach in the learning process activities, it will become an important basis for early childhood to acquire and understand knowledge scientifically, besides that using the scientific method will integrate language, cognitive and affective abilities. Learning given to children using a scientific approach is intended or intended to provide opportunities for children to know and understand various information and material that children get with scientific activities. New information and knowledge that children get can come from anywhere, anytime and anywhere. The most important thing is that children are facilitated properly so that they can maximally use their senses in carrying out learning. The scientific approach used in early childhood learning is believed to be an important bridge in stimulating developmental achievements and skills in early childhood. Through this activity, children are asked to be able to take advantage of learning opportunities and be able to communicate any findings they get.

## References


[1] Decety, J., Meidenbauer, K. L., & Cowell, J. M. (2018). The development of cognitive empathy and concern in preschool children: A behavioral neuroscience investigation. *Developmental Science*, *21*(3), e12570

[2] Moll, H. (2018). The transformative cultural intelligence hypothesis: Evidence from young children's problem-solving. *Review of Philosophy and Psychology*, *9*(1), 161-175.

[3] DeRobertis, E. M. (2020). Piaget and Husserl: Comparisons, contrasts, and challenges for future research. *The Humanistic Psychologist*.

[4] Oogarah-Pratap, B., Bholoa, A., & Ramma, Y. (2020). Stage Theory of Cognitive Development— Jean Piaget. In *Science Education in Theory and Practice* (pp. 133-148). Springer, Cham

[5] Papalia, D.E. Olds,S.W. & Feldman. (2008). *Human Development.* Jakarta : Kencana

[6] Papalia, D.E. Olds,S.W. & Feldman. (2008). *Human Development.* Jakarta : Kencana

[7] Murtazaevich, M. K. (2020). Development of mathematical abilities in preschool children by the method of design activity. *European Journal of Research and Reflection in Educational Sciences Vol*, *8*(1).

[8] Berk, E.L. (2012). Development Through The Lifespan. Yogyakarta: Pustaka Pelajar.

[9] Hopkins, E. J., & Weisberg, D. S. (2021). Investigating the effectiveness of fantasy stories for teaching scientific principles. *Journal of Experimental Child Psychology*, *203*, 105047

[10] Kelly, R. S., Boulin, A., Laranjo, N., Lee-Sarwar, K., Chu, S. H., Yadama, A. P., ... & Weiss, S. T. (2019). Metabolomics and communication skills development in children; evidence from the ages and stages questionnaire. *Metabolites*, *9*(3), 42.

[11] Morgan, P. L., Farkas, G., Hillemeier, M. M., Pun, W. H., & Maczuga, S. (2019). Kindergarten children's executive functions predict their second-grade academic achievement and behavior. *Child development*, *90*(5), 1802-1816.

[12] May, T., Chan, E. S., Lindor, E., McGinley, J., Skouteris, H., Austin, D., ... & Rinehart, N. J. (2021). Physical, cognitive, psychological and social effects of dance in children with disabilities: systematic review and meta-analysis. *Disability and rehabilitation*, *43*(1), 13-26.

[13] Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied developmental science*, *24*(2), 97-140.