

# Introduce Mathematical Concepts for Early Childhood: Inhibiting and Supporting Factors through Play in Children's Cognitive Stimulation

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**Abstract---** *Mathematical ability is essential in everyday life and is beneficial in all fields of life. Introducing the concept of mathematics from an early age is very important so that children have readiness in facing mathematics in subsequent education. This article aims to describe the inhibiting and supporting factors of learning mathematical concepts at an early age through playing at PAUD institutions in Solo Raya, Central Java Province of Indonesia. The data collection techniques used are observation and interviews analyzed through a qualitative approach. The results obtained from this study are that mathematical concepts can build children's cognition to reason, think creatively through imaginative play. By playing imagination, children can explore the media used to find mathematical concepts, both in introducing the idea of numbers, geometry concepts and patterns.*

**Keywords:** *Early Childhood, Mathematical Concepts, Play Imagination*

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## I. INTRODUCTION

Early childhood education is the provision of stimulation so that various aspects of development in children become optimal and ready to continue to the next stage of development correctly. The role of early education becomes an essential saint in human development. Therefore in providing stimulation must be under its construction. Children who attend education at an early age or preschool have a significant impact on their progress, including cognitive development. There are six aspects of development that need to be stimulated in early childhood, namely language development, development of religious, moral values, motoric physical growth, art development, social-emotional development, and cognitive development. Learning mathematical concepts in early childhood is not visible in the Early Childhood Education (PAUD) curriculum.[1]

Learning mathematical concepts become part of the stimulation of children's cognitive development. The introduction of mathematical concepts becomes important because mathematics is open as a basic ability to provide various opportunities in helping individuals in the development success in the fiel of

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academic achievement, but in everyday applications requires mathematical concepts. In various fields of mathematics, it can support career and have an impact on the quality of human development. Introducing mathematics is not only because mathematics is the subject of subject matter, but the ability of the field of mathematics allows individuals to be able to stimulate strong quantitative reasoning thinking as a foundation in various aspects of life, both in school achievement and in supporting one's profession. [2]

Mathematics can be a scourge or a frightening field of study, so the concept of mathematics needs to be stimulated as early as possible. Introducing mathematics from an early age in a way that is appropriate to the child's development can prevent children from feeling excessive phobias or fears in the field of mathematics study. In line with Karabon, introducing mathematical concepts through games can develop interpersonal skills and change behavior. In Indonesia, the practice of learning mathematics in PAUD education is not a separate field of study that has a curriculum. But introducing mathematics is integrated into themes.[3]

In daily activities, learning must be able to stimulate all aspects of development that exist, such as cognitive aspects, moral religion, art, language, social emotions, and cognitive. Stimulation of mathematical concepts becomes part of the cognitive development aspects of children. In various observations in PAUD classes in Solo Raya, although it cannot be said all, most of the learning models used in introducing mathematical concepts are still conventional. The teacher still uses the children's worksheets on paper, so that formal classroom learning is still visible. The teacher explains the tasks that must be completed by the child, and demonstrates, then the child does the job as simulated by the teacher and collects his project in class. The practice in the field by providing a formal learning experience in mathematics can have a phobic effect on children.[4]

Other problems are the low score of the Program for International Student Assessment (PISA) and the Trend in Mathematics and Science Study (TIMSS), TIMSS needs to get attention to Indonesia. Based on the research Organization for Economic Co-operation and Development found that children who attend pre-primary school) have a higher score than students who attend a shorter primary education. The research gives strategic significance to the importance of pre-school education. If the fundamental knowledge of individuals succeeds in undergoing developmental tasks, it is expected to be ready to go through further developmental tasks. This means that if the concept of mathematics can be stimulated well in PAUD institutions it is expected to have a positive impact on improving Indonesian students on PISA and TIMSS scores.[5]

## **II. LITERATURE REVIEW**

Meanwhile, according to Montessori's view (2017, 2013), that the concept of mathematics introduced in early childhood is through life skills according to the age of cognitive development of children at the near age. The cognitive stages of early childhood care in the sensory motoric and pre-operational stages. Furthermore, Montessori explained that the child would spontaneously shape his soul (self Construction), informing and developing himself facing the environment in a free atmosphere. So children need to be

given freedom in learning, and mathematics becomes one of the fields that need to be introduced in learning at an early age.[6]

The National Council of Teachers of Mathematics (NCTM) and the National Association for Education of Young Children (NAEYC) explain the need for mathematics learning standards at an early age (2-7 years) where these standards lead to the development of mathematical experiences according to their age, which is quite challenging but accepted by the period of growth. Mathematical learning is a "Mathematics that provides a powerful means for understanding and analyzing the world. Precise ways of describing and representing quantities, shapes, spaces, and patterns help to organize people's insights and ideas about the world in systematic ways "is Cross, Woods, and Schweingruber. [7]

Playing imagination can benefit children's development. Because playing mock involves the manipulation of the components of the invention, representing mentality, images, and memories while demonstrating their imagination. Children will be able to control themselves because it is done in an imaginary situation when they play. (Cook, 2000; Nilsson & Ferholt, 2014) Playing imagination is vital for the development of cognition, social, and emotions for children aged three to six years (Vygotsky, 1967; Erickson, 1963). It includes playing imagination (a) Playing with objects as if they were living things. (b) playing characters, for example, playing as a seller, playing as a postman, being a mother, and others. (c) Playing a logical or sequential story or story. , for example, playing when you want to use the car, he did not find the key.[8]

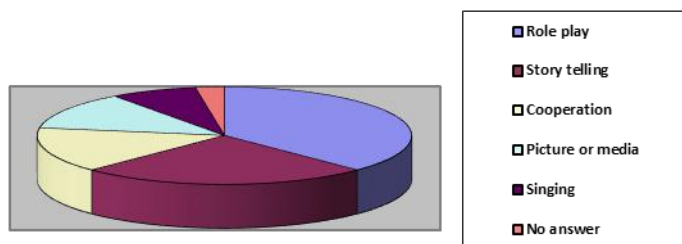
### **III. METHOD**

The method used in this study uses a qualitative approach, where in-depth observations are conducted at ten institutions and interviews with school principals and educators at PAUD institutions in Solo Raya. Questionnaires were also given to teachers about mathematics learning, with 40 educator respondents [9].

### **IV. RESULTS AND FINDING**

Based on the results of observations made, to introduce the mathematical concepts of children in stimulation with a variety of learning methods. Both through singing, telling stories, assigning, playing roles, and class outing. In 40 respondents, it can be described that all respondents agreed if the introduction of mathematical concepts through games.[10]

Figure 1. Methods to Mathematic introduction



While factors that inhibit children's cognitive stimulation include, educational props, child and teacher.

Table 1. Children's factor to cognitive inhibition

Inhibiting factors	Respondents' answers
Props	Lack of supporting game tools
	Fewer props
	The need for real objects Child Factor
Children Factor	Different children's ability to capture
	Lack of concentration
	Lack of understanding of children about mathematical concepts
	Not ready for children to receive stimulation
	The wrong mathematical theory
	Early childhood has not mastered the numbers, still happy with the game
	The child is not interested, not excited
	Cognitive development is not following the stages
Teacher Factor	Introduce new concepts by connecting old ideas
	Teaching management that is not conducive
Others	Policies that do not allow children to learn to count

Regarding to the supporting factors are presented below;

Table 2. Supporting factors to children’s cognitive stimulation

Teaching aids	Available media? The available APE can help the teacher to explain
Child Factor	High child curiosity
	Children's interest in mathematics
Teacher Factors	Creative teachers
Other	Differences in perception are related to learning to read and write arithmetic for early childhood Motivation from home

The learning process will be more successful if it is equipped with an infrastructure that supports learning. To introduce mathematical concepts. During the process of observation and interviews, it is known that 75% of the learning of introducing mathematical concepts are still many teachers who use conventional methods such as using a paper, pencil, or commonly called a child worksheet (LKA). The rest make use of beads, buttons, ice cream sticks, numbers, blocks, paper calendar puzzles, and other media for children's play. 2. Student Factors Early childhoods are immature thinkers and learners. They need the information to build new understanding and strategy in solving problems.[11]

From the perspective of sociology, children are actors in their development and society. They are CO-constructors, open, passive objects. So in the implementation of learning, children need to be involved in every learning process so that all children become active and enthusiastic according to their developmental tasks. 3. Teacher Factors. The ability of teachers to develop mathematics learning activities is needed. Teachers are required to be creative in designing learning activities to build curiosity, children's interest in mathematics, and encourage children to think, ask questions, and share experiences on what they are experiencing. If the teacher presents conventional learning, still based on a worksheet, the child will give boredom and the child's disinterest in the field of mathematics. It is because children always want to get new experiences and challenge their curiosity. [11]

Teachers need to continue to develop their skills and abilities in managing learning. The PAUD teacher competency standards are explained in the minister of education and culture regulation number 137 of 2014 concerning national PAUD standards. Ertle et al. (2008; 64), there are five stages needed in learning mathematics. (1) Environment. (2) Play (3) Teachable moment (4) project. (5) The curriculum Learning environment can support mathematics and other learning. This environment is used as the stimulation of children in play, exploring so that children can make their discoveries in education. As required in PAUD through the Early Childhood Environment Rating Scale-Revised (ECERS-R) instrument, it requires the use of an environment that supports learning. In playing, children can learn mathematics through their daily activities, which helps their life skills because from playing, children can find new things that make them very interested. From their imagined results. .[12]

Teachers need to understand the right moment when children have a great interest and curiosity through observation when they play. It includes teachers having to follow and be able to analyze the academic needs and social, emotional needs of children so that they can modify lessons and activities so that children are not quickly bored. The project referred in mathematics learning must involve elements of measurement, space, perspective representation and other ideas related to mathematics material, for example using a scientific approach such as in the 2013 curriculum in PAUD (Minister of Education and Culture Regulation number 146 of 2014 concerning the 2013 PAUD curriculum) which can stimulate children to be curious and explore so that it helps children learn to understand real-life problems with stimulation that is fun. This current project in PAUD practice has not optimally stimulated the attractiveness and interest of children to explore and build the skills and abilities of children to solve everyday problems.[13]

In the mathematics curriculum for early childhood, what needs to be learned are the concepts of numbers, shapes, patterns, measurements, number operations, and space. The most important thing is to give mathematical concepts following a logical sequence, focus and have a depth of material that can help children build children's knowledge and abilities, done in a coherent way and according to plan (NAEYC / NCTM, 2002; 10) so that children's cognitive can also be optimally stimulated. At present, there is no independent curriculum for early childhood mathematics. In the field, there were even differences in perceptions between managers and parents related to learning to read writing and arithmetic in PAUD practices. Material, The concept of introducing mathematics becomes part of cognitive development. [14]

## **V. CONCLUSION**

Learning Mathematical Concepts early on in early childhood education institutions becomes important given to early childhood because they can prepare themselves when entering primary education to have a robust basic concept of mathematics. Introducing mathematics from the beginning, not only stimulates children's cognitive but can foster children's interest in mathematics and avoid fear when entering the next learning phase.

The method used by children to learn mathematics is through play. Children like playing fake, imagining what they are playing, exploring media, or props. Playing imagination does stimulate not only cognition, but also their social and emotions. Children also need interaction and help from the surrounding environment to build their understanding of the concept of mathematics. The inhibiting factors are the lack of media and teaching aids, differences in the abilities of children, and the lack of teachers' ability to plan and implement payments that do not understand their needs and children's character in learning. Another factor is the difference in perceptions between parents and the management of institutions about learning mathematics, especially the theme of reading writing and arithmetic.

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