

The Importance of STEAM Loose Part Learning Effectiveness in Early Childhood Cognitive Learning

Siti Muntomimah*, Rina Wijayanti

Universitas PGRI Kanjuruhan Malang

Malang, Indonesia

*muntomimah@unikama.ac.id, rinawijayantipsi@unikama.ac.id

Abstract—Early Childhood Education is the first foundation that is essential in intervening the child cognitive development. Many methods can increase cognitive development which of them is method based on Science, Technology, Engineering, Art, and Mathematics (STEAM) with Loose Part media. This study aims to examine the effectiveness of learning using the STEAM Loose Part method on cognitive development in early childhood. The researcher used descriptive qualitative analysis, content analysis, and library research in written texts to relevant documents. This research exhibits the learning effectiveness and cognitive development in early childhood such as the enhancement of creativity, problem-solving, and others after employing the STEAM Loose Part method. Here, STEAM loose Part learning stress out in freedom to explore, solve, and think so that the children can have space to think, evaluate, and determine the best way to achieve their goals and complete the project.

Keywords—learning effectiveness, STEAM loose part, cognitive development, and early childhood

I. INTRODUCTION

Learning is an individual process of understanding something that is useful for all aspects of life and the future. Learning is relating with a change with the changing outcome is coming from developing a new skill, experience, knowledge, and change of attitude [1]. The essence of the learning process is very important as a means of transferring useful things. The learning objective itself lies not only in the process of mastering formal material but also in the process of developing a positive attitude towards learning, various studies find and have the ability to solve problems. If it only presents formal material, it will not make individuals have complex attitudes. It's all part of learning to find their identity. Therefore, it is necessary to teach children as soon as possible to get better results from early childhood.

Child development at an early age is a very important phase to pay attention to. In this phase, children at an early age have a very good and fast absorption of new knowledge in their brains. They are fast in understanding and memorizing new information and knowledge. The development of children's knowledge can be obtained from various aspects. Early Childhood Education (PAUD) is the first and most important foundation in children's personal development, whether related to character, physical abilities, cognitive, language, art, socio-emotional, spiritual, self-discipline, independent. concept, as

well as independence and the five senses [2]. PAUD plays a very important and decisive role in the history of child development. That happens because PAUD is the basis for the basis of a child's personality. PAUD determines the success of a person in the future, how a person responds to the various problems faced in every step of life is very much determined by the experience and education he gets from an early age.

The law of the national education system states that early childhood education is a coaching effort aimed at children from birth to six years of age which is carried out through providing educational stimuli to assist physical and spiritual growth and development so that children have readiness to enter education with information further (Law Number 20 Year 2003 Chapter I Article 1 Paragraph 14). Early childhood education (PAUD) is one of the bases for developing all aspects of early childhood development which is in the golden age [3]. Early childhood are individuals who are at the age of 0- 6 years to experience rapid growth and fundamentals. It grows rapidly because early childhood development moves quickly so that all information provided by the environment will be absorbed properly or not well. This is also a fundamental period because children are on a good cognitive, physical and socio-emotional foundation. All of that is given to early childhood through play while learning context.

Early childhood is an important stage of life in terms of children's physical, intellectual, emotional and social development. The growth of mental and physical abilities takes place at an incredible rate and a very high proportion of learning occurs from birth to six years of age. This is a time when children crave personal care and high-quality learning experiences. Education begins when the child is brought home from the hospital and continues when the child starts attending playgroups and kindergarten. Human learning abilities continue for the rest of their lives but not at the intensity shown in the preschool years. With this in mind, babies and toddlers need positive early learning experiences to foster their intellectual, social and emotional development and this lays the foundation for later school success.

The scope of development developed through PAUD includes several aspects, namely cognitive aspects, religious and moral values, language, physical motor skills, social emotional, and art. Cognitive development is one important aspect that needs to be developed. Cognitive is the ability to

recognize, compare, remember, solve problems, and intelligence [4]. Furthermore, cognitive processes involve changes in abilities and thinking patterns, language proficiency, and how individuals acquire knowledge from the environment [5]. Activities such as observing and classifying objects, combining several words into one sentence, memorizing rhymes or prayers, solving problems, and telling experiences and reflecting on roles are cognitive processes in individual development.

The importance of developing cognitive abilities is intended so that children are able to explore the world around them through their five senses so that with the knowledge they get, children will be able to carry on their lives. Piaget states that there are four phases of cognitive development. There are four stages of development, namely: a. sensorimotor stage (birth to about 2 years of age), b. preoperational stage (age 2 years to about 7 years old), c. the concrete operational stage (ages 7 to 12 years) and d. formal operational stage (ages 12 years to adulthood) [6].

Sensorimotor stage (infant): In this period, which has six sub-stages, intelligence is shown through motor activities without the use of symbols. Knowledge of the world is limited, but growing, because it is based on interactions and physical experiences. Children acquire permanent objects at around seven months of age (memory). Physical development (mobility) allows children to start developing new intellectual abilities. Some symbolic (language) abilities are developed at the end of this stage. At the age of 2-7 years, at this stage the child has a mental image and is able to pretend, short steps to use symbols [7].

The pre-operational stage (toddlers and early childhood): In this period, which has three sub-stages, intelligence is shown through the use of symbols, use of mature language, and memory and imagination are developed or it can be called the symbolic function sub-phase, egocentric thinking sub-phase, and sub-phase of intuitive thinking [8].

Concrete operational stage (SD and early adolescence): At this stage, characterized by seven types of conservation (number, length, liquid, mass, weight, area, and volume), intelligence is shown through logical and systematic manipulation of symbols associated with concrete objects. Operational thinking develops (reversible mental action). Less egocentric thinking.

Formal operational stage (adolescence and adulthood): At this stage, intelligence is shown through the logical use of symbols associated with abstract concepts. Early in the period, there is a way back to thinking. Only 35 percent of secondary school graduates in industrialized countries have formal operations; many people don't think formally as adults.

The development of cognitive abilities is very much needed by children, because this ability can educate children to have strong discipline, children who have good cognitive abilities will be able to have maturity to decide things maturely [9]. This cognitive ability is obtained by children through

themselves by being directly involved in learning activities. For this reason, educators need to organize child-centered learning activities in developing and processing specific thinking skills. One method that can improve early childhood cognitive development is by using the STEAM learning method.

Based on the 2013 PAUD curriculum with thematic integrative and scientific approaches, it has a very high suitability to be combined with STEAM- based learning. This learning is carried out by using various contexts that can bring the subject matter closer to everyday life or themes that are close to the child's world. This approach is currently being rebuilt in developed countries, one of which is the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach

STEAM (Science, Technology, Engineering, Art and Mathematic) is a development of STEM education by adding elements of art (Art) in its learning activities. STEAM stimulates children's curiosity and motivation about skills higher-order thinking which includes problem solving, collaboration, independent learning, project-based learning, challenge-based learning and research

STEAM (Science, Technology, Engineering, Arts, and Mathematics) learning is an integration of various disciplines, namely science, technology, engineering, arts and mathematics which are in one unified learning approach. STEAM as the integration of art science disciplines into the curriculum and learning in the areas of science, technology, engineering and mathematics which have been known previously as (STEM) [10]. STEAM is a meta-discipline that integrates science, technology, engineering, art and mathematics into an integrated approach that can be implemented in school learning.

The components contained in the STEAM approach are solving problems of innovation and design, linkages between assessment, study plans and learning standards, the combination of more than 1 subject in STEAM and its use in art, collaborative learning environments and process based learning, and focus on things that happen in life.

Yakman argues that learning with the STEAM approach is contextual learning, where students will be invited to understand phenomena that occur close to themselves [11]. The STEAM approach encourages students to learn to explore all their abilities, in their own ways. STEAM will also bring up different and unexpected works from each individual or group. In addition, collaboration, collaboration and communication will appear in the learning process because this approach is carried out in groups. Student grouping in STEAM demands personal or interpersonal responsibility for the learning that occurs, this process will build students' understanding of the material being studied.

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This STEAM approach directs students to have skills, namely problem solving skills, critical thinking skills, and collaboration skills [12]. The STEAM approach seeks students to build their own understanding of the learning process by integrating several fields of study in real life. STEAM also explores students' abilities by using related technologies, which students can choose from or are passionate about and communicate in interesting ways such as art. An understanding of learning with STEAM can also be obtained by students through group work with inquiry (Susan Blackley and Rachel Sheffield). In this case, students learn to look for and find concepts that are being studied independently, both individually and in groups.

The application of the STEAM approach to learning chemistry will make students understand the concept with their respective creativity. Chemistry as a science is close to students so that students know its benefits in daily life. The use of IT in channeling student creativity as a medium for channeling students' passion for computing or smartphones can be used as technology implementation, collaboration during the learning process from the beginning to the formation of the product is an inquiry process, creating creativity in the form of music, stories or posters and also photos are part of the art. The existence of numerical calculations on the material being taught is part of mathematics in STEAM. The integration of several fields of study in chemistry learning with the STEAM learning model will build students' understanding of the concept of material and its relationship with other fields of study.

The STEAM approach at least has several advantages in the implementation process, including: The STEAM approach shows positive results in students' scientific knowledge; the STEAM approach teaches students to think to solve problems in an active, creative and innovative manner; through technology, students are able to create their ideas into the latest technology; the STEAM approach can translate mathematically abstract concepts into science, technology, inquiry and the arts; the integration of art into STEAM will foster student creativity in creating fun learning tools; with the STEAM approach students can apply the learning results obtained into their daily life.

The benefits of the STEAM approach include helping students understand how to work in teams working on real-life projects, by paying attention to the following: a) students can use knowledge and skills from all subjects to support project work, they begin to see how content is used in the realities of life and why it is important to know, b) Students are encouraged to recognize and respect their own and others'

skills and interests. They learn how to fit well in teams based on the roles they do well collaboratively.

Learning with the STEAM approach also builds students' cognitive abilities through meaningful learning, raises student creativity and can stimulate the emergence of student soft skills such as collaboration and collaboration in work groups and criticizing surrounding phenomena.

Learning with STEAM integration refers to constructivism learning theory where students will actively build their own knowledge through a pleasant learning experience [13]. Students will actively create strategies independently for their learning process. This STEAM approach directs students to have skills, namely problem solving skills, critical thinking skills, and collaboration skills [12].

Here, in developing early childhood cognitive learning using the STEAM learning method, loose part media is a media that is very effective and suitable in developing cognitive thinking. Loose parts are essential elements of STEAM-based learning. Loose parts are items that are open, which are easy to find in everyday environments. Our nature is full of loose parts, such as twigs, pinecones, shells, stones, leaves, flowers and other natural objects. Parents and teachers can collect loose parts from anywhere, at no cost.

Loose parts are educational play tools around children in the form of open materials, can be separated, put back together, used alone or combined with other materials. This can be in the form of natural objects (wood, twigs, etc.) or recycled materials (plastic, paper, etc.). Loose parts provide opportunities for children to play with friends, investigate, discover, explore and be creative with various existing materials [14].

This loose part not only supports children's development, but also helps children to connect with their environment. Toys are designed for a specific purpose, and are usually used by children in only one or two ways. Children who bring a toy car will usually use a toy car to play like running a car. However, when children use objects in nature, they can use them for anything according to the child's ideas. This will develop the child's imagination, creativity, language and knowledge.

Loose part is a media for teaching materials that have endless uses in children's learning. Not only that, loose part teaching materials can be used as a tool to explore various aspects: problem solving, creativity, concentration, fine motor skills, gross motor skills, science (science), language development (literacy), art (art), logic, mathematical thinking (Math), Engineering, Technology (Technology) which is very suitable in STEAM (Science, Technology, Engineering, Art and Mathematic) learning.

Learning objectives with Loose Parts teaching materials are; Children will be creative with the principle of using loose parts of teaching materials, they are free to create and dismantle pairs of teaching materials according to their imagination; Children will learn to appreciate the materials or objects around them, such as natural loose parts; Children will also be able to take care of the environment when they understand that used

goods can be recycled and used as materials for play and activities to assemble them into useful items; and, Will develop the economic attitude of the child

As for some of the benefits of Loose Parts media are increasing the level of children's creative and imaginative play, increasing children's cooperative attitudes and socialization, children becoming more physically active, encouraging communication and negotiation skills, especially when done in open spaces, providing quality-rich play experiences, enable children to be fully engaged, and inspire their creative abilities, more economical, because it is cheap and easy to use. can, become more interesting over time, as the skills of the children improve, because it can be redesigned every day.

How to use Loose Parts in learning can be done by considering safety when choosing loose part teaching materials, the characteristics of participants in the class - important to consider, according to age - There are loose parts that are not safe for early childhood, and be aware of the dangers of choking, swallowing, or injured and always have to be under surveillance.

In this article, the author will identify the effectiveness of loose part media in learning using the STEAM method to improve children's cognitive thinking power.

II. METHODOLOGY

In this study, researchers used descriptive qualitative analysis, content analysis, and library research on relevant documents, namely, text / manuscript research, language and literary research materials, and corpus research whose sources came from library materials. The perspective of this research is inductive, focuses on exploring and understanding individual meanings, and translating the complexity of a problem [15]. This research is used to solve actual problems by collecting data, compiling or clarifying, and analyzing it.

Researchers critically examine the discussion of a topic that has been written by researchers or scientists in various sources. Literature sources include journals, research reports, scientific magazines, newspapers, relevant books, seminar results, ebooks, scientific articles that have not been duplicated, resource persons and so on. The responses obtained were analyzed using an interpretive methodology.

Researchers use observational research methods, study documents or book content, describe and conclude by collecting materials in the form of books in the library, articles and writings related to research, then collected, read, explained, analyzed and analyzed are presented in relation to the research carried out. Then, the data collection technique is the documentation method, which is looking for and studying data on variable matters in the form of notes, transcripts, books, newspapers, magazines, and journals. The writing steps taken were: a) collecting data on the effectiveness of loose part STEAM and how effective it is in its implementation in a lesson; b) analyzing the data obtained based on the author's

thoughts; and c) conclude the results of the literature review analysis.

III. RESULTS AND DISCUSSION

Cognitive is often defined as intelligence or thinking. Cognitive development shows the development of the child's way of thinking. The ability of children to coordinate various ways of thinking to solve various problems can be used as a measure of intelligence growth. How to learn through initiative, experience and also habituation to learn from experience. Here the child will continue to learn about certain things to become a standard behavior for the child.

The following are some of the effectiveness resulting from the use of STEAM loose parts in early childhood cognitive development. First, the natural environment is an environment to find a large part of which is an important part of providing a play space for children [16]. Incorporating freelance teaching materials in early childhood classes provides excellent opportunities for children to explore the world around them using natural, synthetic and recyclable materials. Loose parts can be an incentive to have meaningful conversations and encourage interaction between students.

Through this loose part, the children did not take long to appreciate the conversation with each other in their group. Discussions about loose sections will further foster mutual respect in the multicultural class [17]. Students will express their own experiences at school, some of which come from members of different cultural environments in the multi- ethnic school. The exchange of students' ideas reflects an awareness of their future role in helping children become good members of multi-cultural communities.

Second, Cloward Drown emphasized that loose parts are more dynamic and allow for natural changes in the playing process. Traditional games that initially only use natural materials for play equipment make over time children will use natural materials that allow children to stimulate creativity [18].

Third, the importance of loose part is that children continue to choose their own activities and the elements of explored nature show the ability to focus and attend and show a curiosity that attracts attention and supports their involvement [19]. In using loose part materials with a background game from outside the classroom. The original definition by noting that the more involvement of children using loose parts, the wider the thinking will be [20].

Fourth, if we compare the classroom activities provided by the teacher and the freelance play provided by pre-service teachers, it is clear that the use of loose passages is more likely to support high-quality arts education. High quality art education can provoke creativity [21]. Different types of ingredients provide many sensory experiences. Experience develops artistic capacities and perceptions.

Fifth, furthermore, experiences allow children to build knowledge about their world [22]. Knowledge construction through active exploration can be considered as science

education. In Indonesia, especially in early childhood education, the emphasis of science education is on science process skills. The child's play experience in tinkering with loose parts will contribute to later understanding of science [23].

Sixth, freedom of process creation also contributes to the development of mathematical skills. An example was found where a child wanted to add a ladder to his ship. He chose a pop stick to make a ladder. Initially, the pop stick was too long. He cut the pop sticks in equal length, then arranged the sticks to make a ladder. The pre-service teachers identify technical processes and math skills such as measurement, algebra, and geometry there. They argue that the child has a clear picture of what a ladder looks like (understand patterns: algebra and geometry). The child also modifies the stick to meet his needs. He performs engineering processes and he occupies a simple technological tool (scissors).

Seventh, loose parts provide freedom from the start to the final design process. Research in Western countries shows that freedom develops creativity. Before the freelancing project, most teachers tended to control children's activities. Class practices resemble Chinese preschool classes highly structured. In highly structured classes, the teacher usually prepares closed activities and limits material. As a result, the art product will be the same for all students in the class, but with this loose paper, the results obtained are very diverse [24].

Eighth, freedom during the manufacturing process allows children to face various problems. In other words, the freedom of the creative process is closely related to problem discovery. Loose parts cause many problems for children. To solve problems children need to closely observe a thing, event or process. Observation is a science process skill. After careful observation, they may predict, do things, and deduce their actions. The problem-solving process is closely related to engineering and technology.

Ninth, loose parts can develop children's potential to make connections between learning materials, learning designs and the surrounding environment [25]. Children who learn in the classroom using the STEAM method do not know that they will find various overlapping information so that this will require children to think creatively and critically about new things that are received by children. In addition, they are also encouraged to solve problems with their teachers and peers [26].

There are many benefits from loose part STEAM learning in the effectiveness of learning, especially in early childhood cognitive enhancement. With STEAM loose part learning, children are taught to process learning in the form of observing, playing, recognizing patterns and practicing creative thinking skills as well as collaboration and communication skills between other children in completing a task given by the teacher and facilitator.

IV. CONCLUSION

Loose part is a media that has the potential to support STEAM learning in children because the use of loose parts results in freedom and various problems that must be solved. Different types of loose part materials allow children to check the properties of the materials carefully. The use of loose parts triggers their observation skills. In addition, children have the opportunity to play with the material. The use of loose parts helps learning mathematics and others. At the same time, freedom presents many problems to be solved. Different materials present different problems. Children are encouraged to observe, try, and then decide what kind of material to choose and is suitable for solving the problem.

By using loose part media in learning with the STEAM method, it has proven to be very effective in improving early childhood cognitive, such as critical thinking, creative thinking, problem solving, learning to count through nature, and many more. Therefore, it would be nice if the teachers implement loose part STEAM learning so that their children can have space to think, evaluate, and determine the best way to achieve their goals and complete the project.

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