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Implementation of STEAM Approach to Develop Critical Thinking Abilities of Children Age 5-6 Years Old

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Abstract

This study aims to describe 1) implementation of the STEAM approach when learning at the block center, 2) knowing the critical thinking skills of children aged 5-6 years, 3) describing the supporting factors and the inhibiting factors. The method used in this research is descriptive qualitative. The research location is in Taman Belia Candi Kindergarten, Semarang City.Subjects in this study were block center teachers and school principals, for the object of research were block center teachers and children aged 5-6 years. Data collection techniques are carried out through interviews, observation and documentation. Data analysis used the theory of Miles and Huberman.The validity of the data is based on the degree credibility form of triangulation of sources and referential adequacy, transferability, dependability, confirmability. The results showed that the implementation of STEAM in Taman Belia Candi Kindergarten in the beam center is a way of thinking for children to solve problems in the surrounding environment by exploring, asking and investigating. STEAM is applied during learning in the beam center with scientific processes, inquiry and projects supported by loose part learning media. Science activities in the form of observing, investigating through videos related to market and animal themes, children understand technology when using various tools such as ladders, baskets, besides that, the use of laptops, LCDs, projectors, while engineering shows that children are able to think of ways to make solid buildings, children's work in decorating building blocks according to their imagination is included in art, finally mathematic where children can get to know the geometric shape of the number, the position of the block arrangement activity. The developing critical thinking skills are shown by the response given by the child in the form of questions or answers to the material presented, trying to solve problems, the child is able to convey and accept the child's opinion is able to have an open mind. While the supporting factors in its implementation are the desire of teachers who want to continue learning, the provision of STEAM learning socialization for parents of students, a good learning environment, use of loose parts and supporting school infrastructure. This inhibiting factor is that some teachers have not been able to let go of expectations of children and the selection of play activities that are tailored to the characteristics of children with special needs.

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INTRODUCTION

The development of the era that entered the industrial revolution and the 21st century in line with the development of science and technology demands to further improve the quality of human resources. Education as one of the basic ways to prepare children, equip them with 21st century skills. The existence of this 21st century challenges us to be able to create education that can contribute to producing human resources who are able to build creative ideas, collaborate with critical and capable thinkers. establish active communication. Partnership for 21st Century Skills (2011) defines 21st century skills with the skills of collaboration, communication, critical thinking, and creativity or often referred to as 4C's skills. These skills are needed for children to be successful in the world of technology and support lifelong education.(Nafiah, 2014) 78% critical thinking skills are the most important skills that must be possessed

Critical thinking is an attitude of willing to think deeply about problems and things that are within the reach of one's experience. In line with this statement, Slavin (Anggreani, 2015) states that critical thinking is the ability to make rational decisions about what to do or what to believe. This is supported by Natalina (2015) that critical thinking is a process to judge conclusions based on evidence.

In principle, people who are able to think critically are people who do not simply accept or reject something. They will examine, analyze, and evaluate this information. The way an individual is able to think critically is not easy, it requires a continuous process and a supportive environment. Therefore, it must be started to be trained and developed from an early age. The development of critical thinking skills can be learned for early childhood using materials and methods that are in accordance with the stages of children's thinking skills which are still concrete.

The ability to think critically in children can be obtained from observing activities, in this activity children who think critically can find and question things they do not know, provide comments, find differences and similarities. That way children are directed to be able to make correct, careful, systematic, logical decisions to be able to solve problems.

Education must undergo changes in order to learn so as to learn from a 21st century generation and equip young people with education from an early age. The golden period occurs only once throughout life, so that early childhood life is at a critical age. Early childhood will be easily influenced by information and what children see around them. The 21st century gives children the opportunity to freely explore and innovate according to their children's interests. So that child-centered learning will create a classroom atmosphere that encourages children to be more active in learning. (Anjarsari, 2019)

One of the educational innovations to prepare children for the times is STEAM (Science, Technology, Engineering, Art, Mathematics). According to Riley (STEAMPortal, 2019) STEAM is a learning approach that uses science, technology, art and mathematics as an access point to guide student inquiry, dialogue and critical thinking. The foundation of learning lies in inquiry, critical thinking, and process-based learning when asking questions, arousing curiosity, and being able to find solutions to problems. This is in accordance with Helen's opinion (Sari & Rahma, 2019) that STEAM-based learning can make children think critically, comprehensively, and stimulate children to solve problems.

At the early childhood education level, STEAM is considered appropriate considering that learning models and methods for early childhood have developed a lot and the practice of demonstrating them is done directly with materials that are already available in the surrounding environment, either used or still used as media for playing and study. Agree with this Helista(Nugraheni, 2019)stated that at the early childhood education level, learning is packaged in the form of play and exploration related to STEAM which aims to encourage children to build knowledge around them through observing, questioning and investigating. Another thing was also expressed by Deborah (Tabi'in, 2019) saying that:

"The STEAM method is important for early childhood developing because it emphasizes active learning, stimulates children to solve the problem"

Aspects in STEAM in the form of science, technology, engineering, art, mathematics are a way of thinking to understand knowledge and apply it in everyday life. *Science* is how children try to find out how the world works by carrying out a series of steps called the scientific method which includes observing, forming questions, making predictions, designing and conducting experiments, and discussing. Technology in this case is all human-made objects, technology helps children to better understand, to help make observations, to answer questions, to gather information, and to help them design solutions and

to help them express their ideas and understand about the world. Types of technology areruler, scissors, magnifying glass, computer, spoon, shovel, box and can etc. Engineering as a technique or a way of applying science, mathematics, and technology to solve problems begins with identifying problems, followed by thinking about solutions and trying them out. Art provides the advantage for children to be able to illustrate STEM concepts in creativity and various imaginations, expressing ideas in various ways. The last aspect is mathematic*,* isn't just numeracy but also includes comparing, sorting, recognizing patterns, and identifying forms that are supported by the use of mathematical language when communicating such as bigger, smaller, higher, lower, far and near.

Loose parts is an essential element of STEAM-based learning. It was first developed by the architect Simon Nicholson who stated that a child can use a loose part in various forms and combine it with other loose parts. According to Siantajani (Wahyuningsi & et al., 2020) loose parts can be used as STEAM learning materials because they are suitable for children's characteristics, can be adapted and manipulated in many ways, support children's creativity and imagination, and are able to develop children's ideas.. This opinion is supported by GENÇER1 & AVCI (2017) which states that children can redesign, share, move, separate and combine with other materials in unlimited ways. Besides that, the advantage of using loose parts is that they can be found and available in the natural environment around us. The teacher can help children learn by tinkering with, communicating between different loose parts, collaborating on other loose part components, and using critical thinking skills, and the teacher's imagination in developing learning using loose part materials (Rahardjo, 2019)

Recently, STEAM has been developed in all early childhood education institutions in Indonesia, including one in the city of Semarang. Based on data obtained from Reference Data from the Ministry of Education and Culture (2020) obtained by researchers, the number of early childhood education institutions in Candisari District is 54 consisting of 10 Play Group institutions, five PAUD Post institutions, five institutions. Roudhatul Athfal (RA), 35 Kindergarten institutions, one Child Care Institution. Of the 35 kindergartens, one inclusive kindergarten has implemented STEAM, namely Taman Belia Candi kindergarten

The reason the researchers chose the research location at Taman Belia Candi Kindergarten is because this institution is one of the schools that has implemented STEAM combined with the 2013 curriculum with a scientific approach with the stages of learning a scientific approach that is still in harmony besides the learning model used is the center model, learning activities based on playing while learning implemented with a project system and not using LKS. The learning media used were loose part materials.

The research is focused on looking at the learning activities in the block center. The purpose of this study was to determine the implementation of the STEAM approach during learning activities in the block center, to know the critical thinking skills of children aged 5-6 years in, and to determine the inhibiting and supporting factors of learning.The strength of this research is the topic of discussion about STEAM, which for early childhood education is a new thing that is starting to develop in Indonesia, so there is not much research done. In addition, the research location which is focused on the beam center is expected to help find out and understand how the activities of each existing STEAM component.

RESEARCH METHODS

The method used in this research is a qualitative descriptive approach is a research procedure that produces descriptive data in the form of written or oral sentences based on people's statements and observable behavior. The research location is in Taman Belia Candi Kindergarten, Semarang City, this school has implemented STEAM which is integrated with the 2013 Curriculum and scientific approach, project-based learning and loose-part as a learning medium.Subjects in this study were block center teachers and school principals, for the object of research were block center teachers and children aged 5-6 years. The data analysis method is based on Miles and Huberman's theory which consists of four processes, namelythe process of collecting data in the field through the process of observation, interviews and collection of documentation, Reducing the data that has been obtained then used as a transcript of the results of the interview, The process of presenting data is carried out in the form of making quotations, last make temporary conclusions from the results of data collection. Data were collected through interview techniques conducted with block center teachers, school principals and PAUD practitioners; observations madeby observing the learning activities of the teacher and some of the children in Kindergarten B, and documentation in the form of photos, videos of activities, and other do-

cuments to support the completeness of the data. The validity of the data is seen from the degree of trust (credibility) in the form of triangulation of sources and referential adequacy, involvement (transferability) is carried out by finding and collecting empirical events about the similarity of context, dependability (dependability) through checking research results, confirmability by testing research.

RESEARCH RESULTS AND DISCUSSION

*In the e-book Understanding STEAM and how children use it*explained that STEAM learning occurs naturally every day when children play to investigate and try new things because when playing children explore and build new knowledge about the world and gain experience while investigating, finding and solving problems. In line with this Helista(Nugraheni, 2019)stated that STEAM aims to encourage children to build knowledge about the world around them through observing, questioning and investigating (inquiry). Observations and interviews show that the application of STEAM in Taman Belia Candi Kindergarten is a way of thinking used to solve problems, a mindset or mindset that encourages children to build knowledge about the world around them through 5M activities (scientific approach) which include observing, asking, seeking information, reasoning and communicating, with this process children can also form critical thinking skills. In learning the curriculum reference used is the 2013 curriculum with a scientific approach combined with the center learning model and learning is carried out with the project system.

1. STEAM Component Activities at Sentra Balok

STEAM stands for Science, Technology, Engineering, Art and, Mathematics. The Scince component according to Counsel (2016) states that:

"Science is the observation and investigation of the natural world and how it work"

Another opinion according to Sharapan (2012) science deals with experimenting, encouraging, investigating and asking, for early childhood science is about everyday experiences, such as how to make shadows, how plants grow, why ice melts, differences in where animals live and what they eat. Observations at the beam center show that the teacher encourages children to learn science including health science, space and environmental earth science, life science, physical science, by teaching children to further investigate and observe or inquire about things or the environment around them. they. The teacher brings up science concepts when explaining material topics through videos and asking open-ended questions to children.

*Technology*according to the e-book Understanding STEAM and how children use it, technology in this case applies to all types of man-made objects. Children are able to understand that various tools can help them to make observations or make experiments on children's ideas. In the beam center, you can see the use of technology when children use stairs to help them arrange higher blocks, besides the use of simple technology such as paper and pencil to write or draw, children use baskets to pick up blocks, teachers use laptops, LCDs and projectors to display videos .

*Engineering*according to Counsell (2016) it is defined as a technique / way of applying science, mathematics, and technology to solve problems according to how it works, hereby children can build a concept of thinking about how to work a more effective tool to help children solve problems by testing or distinguish a tool whether it is appropriate to use. In the beam center of Taman Belia Candi Kindergarten, engineering activities can be seen when children design a building by choosing the right blocks so that the building becomes solid.

*Art*or added art because a creative mindset is so important to a STEM subject. Active discovery and self-discovery are the core components of the arts in STEAM's learning goals. According to Sharapan (2012) art provides benefits for children to develop creativity and imagination and express ideas through music, dance, pictures, building blocks etc. Children are able to describe the STEM concept by expressing their ideas and thoughts into a work in creative and imaginative ways. The child's process is in making a work, and not just the result, In the block center the children's work is in the form of pictures, the results of building blocks. Children can make good works according to their imagination.

*Mathematic*according to Sharapan (2012) that is more than just counting but also thinking mathematically including comparing, sorting, recognizing patterns, and identifying shapes. In addition, the language of the game is an important part, in the block center, the mathematical concept is seen when children build blocks, children can recognize the shapes and sizes of various types of blocks, understand addition, balance, weight, position of the placement of blocks.

Educators in learning activities can en-

courage the development of children's STEAM thoughts with the stages of explore (exploration), extend (challenge), engage (involvement) and evaluate (evaluation). The exploratory process is carried out by the teacher by giving children time to observe and explore various materials for playing with various senses, encouraging children's curiosity and asking questions. The process of extending or challenges is given to children to develop their work or assignments and invite children to investigate. The process of engaging (involvement) in this process the child looks focused and absorbed in his work, does not move around playing activities, is not easily distracted, uses a lot of his time. The teacher provides support and links children's interests with KD achievements on that day. The last is by conducting evaluations between teachers and children, as well as fellow teacher.

2. Early Childhood Critical Thinking Ability

According to Paul & Elder (Nafiah, 2014) Children's critical thinking skills are shown by children who can ask important questions about problems; the child can collect and assess relevant information; children can make conclusions and solutions with the right reasoning; children can think with an open mind; children can communicate effectively in delivering solutions to problems.

Observations show that the child's critical thinking ability is seen when the child asks important questions about a problem. It can be seen when the child finishes watching the video shown by the child's teacher and responds with several questions. Both children are able to collect and assess information seen when children can express good reasons and provide reasonable and acceptable answers. This is seen when children are able to explain their reasons for making their work. Furthermore, that is the child is able to make conclusions and solutions, it appears that the child can use many ways to realize their ideas when the child runs out of the same type of blocks to arrange, after that the child replaces blocks of different sizes and is arranged by paying attention to the position of the blocks to be balanced. The fourth thought with an open mind when the child finished watching the floating market video and discussed with the teacher about today's theme (the market) when the child was given the task of building blocks related to the market, there was a child who made a mosque on the grounds that there were rarely mosques around the market so he built a mosque so that easy people to worship. Fifth. Communicate effectively in conveying solutions to problems

3. Supporting and inhibiting factors

Based on the results of observations, it shows that the supporting actors in the implementation of the STEAM approach are teachers willing to learn more, adequate infrastructure provided, learning media that uses loose part. As for the inhibiting factor, namely teachers have not been able to let go of expectations of children and teachers who need to adjust play activities with the characteristics of children with special needs.

CONCLUSION

Based on the research results, it can be concluded that:

1. Implementation of the STEAM approach, namely as a way of thinking for children to solve problems in their environment by exploring, asking and investigating. Learning at the block center is carried out by means of scientific processes, inquiry and projects. Activities of science concept activities are in the form of observing, investigating through video. *Technology* or visible tools with the use of tools when building blocks such as ladders, baskets, besides the use of laptops, LCDs, projectors. Engineering shows that the child is able to think of ways to make a sturdy building. Art can be seen with the children's work decorating the building blocks according to their imagination. Mathematic children can recognize the geometric shape of the number, the position of the activity of arranging blocks.

2. The developing critical thinking skills are the responses given by children to the material presented, trying to solve problems, expressing opinions. Supporting factors in its application are the desire of teachers to continue learning, the provision of STEAM learning socialization for parents of students, a good learning environment, the use of loose parts and school infrastructure.

3. Meanwhile, the inhibiting factor is because some teachers have not been able to let go of expectations of children and the selection of play activities that are tailored to the characteristics of children with special needs.

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