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# Analysis of the Implementation of STEAM Learning for Children Aged 5-6 Years at TK IT Syeikh Abdurrauf

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## ABSTRACT

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This study discusses STEAM Analysis through color mixing experiments for children aged 5-6 years at TK IT Syeikh Abdurrauf. *STEAM learning* through the color mixing experiment science center implemented is not optimal. From these activities it is concluded that children are still not able to develop curiosity, openness to experience and propose building knowledge around them by exploring, observing, discovering and investigating something around them. The purpose of this study is to describe how the implementation of *STEAM learning* for children aged 5-6 years at TK IT Syeikh Abdurrauf. This study uses a descriptive qualitative approach method with data collection techniques through observation, interviews, and documentation. The results of the study indicate that the analysis of STEAM learning through color mixing science experiments effectively increases children's experience in STEAM learning which is able to encourage children to build an observation and investigation activity. STEAM allows children to reason by asking questions they want to know and discussing with their class teacher. The application of STEAM to children aged 5-6 years is able to develop children's abilities both in terms of skills, knowledge, and abilities of children in terms of aspects of their development.

**Keywords:** STEAM; Science Learning; Early childhood.

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## INTRODUCTION

Education (PAUD) is a very important education because the development of children in the future will be determined by various meaningful stimulations given from an early age. Based on Law Number 20 of 2003 concerning the Early Childhood Education System (PAUD) is a development effort aimed at children from birth to the age of 6 years which is carried out through providing educational stimulation to help growth and development of providing educational stimulation to help physical and spiritual growth and development so that children have readiness to enter further education (Permendikbud RI, No. 20 of 2003).

Early childhood, also often called preschool, is a sensitive period in its development, during which physical and psychological functions mature and it is ready to respond to various stimuli from its environment. This period is the most appropriate time to lay the first and foremost foundation for developing various potentials and abilities in physical, cognitive, language, art, social-emotional, spiritual, self-concept, discipline, and independence (Mulyasa, 2014).

Early childhood is actually a child who has a high curiosity and a problem solver. Children always want to try various ways to help themselves when facing problems (Siantajani, 2020). Based on Law Number 137 of 2014 Article 13 concerning the National Education System states that "Learning is a process of interaction between students and teachers and learning resources in a learning environment" (Law No. 137, 2014). Early childhood learning occurs through play. Play activities enable children to make choices, solve problems, communicate, and negotiate. They create imaginary events and practice physical, social, and cognitive skills. During play, children can express and practice emotions based on everyday experiences and events (Yeni, 2021).

In light of the explanation above, there is a need for learning media in schools that can optimize child development, one of which is STEAM learning. The STEAM learning approach is inextricably linked to the involvement of the child's immediate environment, which can be used as a learning object. Essentially, this learning aims so that children are able to empower their own environment today and can start early (Munawar, 2019). With STEAM learning, children will explore producing a real work so that children will feel that they have extraordinary potential (Laelasari, et al., 2022). In other words, the concept of STEAM learning using Loose Part media is learning that has relevance and meaning for early childhood because by using loose parts, children will have critical thinking skills, where these skills are collaborated with a child-centered creative learning model (Redhana, 2019). Therefore,

STEAM learning activities are expected to equip children with basic skills and developments that are appropriate to their time, so that schools can make children act and relate effectively to their environment.

Furthermore, STEAM learning aligns with constructivist learning theory, which emphasizes that children actively construct their own knowledge through interaction with their environment. According to Piaget, children learn best through hands-on experiences that allow them to explore and discover concepts independently (Hadani, H., & Rood, E. 2018). Similarly, Vygotsky emphasized the importance of social interaction and guided learning in supporting children's cognitive development. Through STEAM activities, children engage in collaborative learning, communication, and problem-solving, which enhance both cognitive and social-emotional development.

The role of teachers is also essential in facilitating effective STEAM learning. Teachers act as facilitators who provide appropriate learning environments, materials, and guidance to support children's exploration. Teachers must design meaningful learning experiences that encourage curiosity, inquiry, and creativity. By providing opportunities for experimentation and exploration, teachers help children develop scientific thinking skills, creativity, and confidence in their abilities (Casey, T., & Robertson, J. (2016); Flannigan & Dietze (2018)). Therefore, effective STEAM implementation requires intentional planning, appropriate materials, and responsive teaching strategies.

Based on initial observations conducted by researchers at TK IT Syekh Abdurrauf, located on Jalan Sultan Iskandar Muda, Meuraxa District, Banda Aceh, STEAM learning was implemented using a science center model. One of the activities conducted was a color-mixing experiment involving water, oil, and dyes. However, the observations revealed that some children showed limited interest in observing and exploring the materials provided. Some children lacked initiative to ask questions, collaborate with peers, or actively engage in the exploration process. Additionally, some children spilled materials during the activity and were unable to identify colors independently, indicating that they still required teacher assistance.

According to Permendikbud No. 146 of 2014, science learning provides opportunities for children to observe, ask questions, gather information, reason, and communicate their findings.<sup>12</sup> However, the implementation of STEAM learning in the observed classroom had not fully facilitated children's curiosity, exploration, and independent investigation. Children

had not optimally developed their ability to explore, observe, discover, and construct knowledge through hands-on experiences. Therefore, it is necessary to examine how STEAM learning is implemented in children aged 5–6 years at TK IT Syeikh Abdurrauf. This study aims to describe the implementation process and its role in supporting children's developmental outcomes.

## METHODS

The approach used in this study is qualitative. Moleong defines qualitative research as research that aims to understand the phenomena of what the subject experiences by describing them in words and language in a specific, natural context and utilizing various natural methods (Sugiono, 2012). Qualitative research is research that focuses on a quality and important points in the form of events, phenomena, and social symptoms that occur behind the event (Putra & Ninin, 2016). The type of research used is descriptive *research*, descriptive is a type of research that provides a picture or description of a situation as clearly as possible without any treatment. Qualitative research is conducted because researchers want to reveal events that cannot be qualified, namely descriptive, such as work steps, considerations of a concept, characteristics, images, behavioral procedures and so on (Sugiono, 2017).

The research location refers to the place where the study process is carried out to find a solution to the problem being researched. In this case, the location Research is a place where researchers collect data, analyze it, and interpret it to gain a deeper understanding of the problem being studied (Darmadi, 2011). This research was conducted at TK IT Syeikh Abdurrauf. This research was conducted during the even semester of 2023/2024. Data sources were obtained through observation techniques.

The research subject is an object, thing, or person to which the data for the research variables are attached and which is being questioned. The subjects in this study were the principal, class teachers, and early childhood children aged 5-6 years in class B of TK IT Syeikh Abdurrauf Aceh Besar. The object of this research is the cognitive development of children through *STEAM learning using loosepart* media at TKIT Syeikh Abdurrauf Aceh Besar.

The primary data sources in qualitative research are words and actions, with the remainder being supplementary data such as documents and other sources. <sup>1</sup>The data sources

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<sup>1</sup>Sugiono, *Understanding Qualitative Research* (Bandung: Alfabeta, 2012), p. 63

in this study consist of people, objects, and events. The people in this study serve as research subjects, namely the principal, class teachers, and children. TK IT Syeikh Abdurrauf Aceh Besar. Objects as data sources mean important documents or records found in TK IT Syeikh Abdurrauf Aceh Besar, which can provide information about the substance of the problem in the form of teacher preparation or learning plans, teacher archives, school profiles, guidebooks, organizational structures, and others. Events as data sources are ongoing and readable conditions or events and atmospheres related to daily activities consisting of behavior or attitudes and activities of teachers and children that are visible in connection with the activity "STEAM Learning Using Loose Part Media in Developing Cognitive Skills of 5-6 Year Old Children at TK IT Syeikh Abdurrauf".

Data collection in this study was conducted to answer and explain the researcher's problems objectively. The data collection techniques used by the researcher were: a) Observation, which was carried out by the researcher related to all play activities provided by educators to children related to children's cognitive development (Anggito & Johan, 2018); b) Interviews namely a meeting that is directly planned and the interviewee to provide/receive certain information. Interviews can be defined as a method used to obtain information from *respondents* by asking questions directly face to face (Sugiyono, 2012). Data analysis is the stage carried out after the data is collected. This study uses qualitative descriptive analysis, so the data collected is verbal, using words rather than numbers, which describes cognitive development in TK TK IT Syeikh Abdurrauf throughout the analysis process. The data obtained in this study were analyzed in accordance with the Miles and Huberman flow model, namely data reduction, data presentation, and drawing conclusions.

## RESULTS AND DISCUSSION

This research discusses the description of observations, interviews, and documentation with the research subjects. The author will describe the collected data so that it can be presented clearly, in detail, and easily understood by the reader. The results of this research were obtained from two types of data: observations and interviews with classroom teachers, as well as documentation during the data collection process.

Observation stages have been carried out on 27 children in Class B1 at TK IT Syeikh Abdurrauf through science play activities mixing colors/color rain. The interview process was

aimed at the class teacher, Mrs. Nur Sakdiah, S.Pd in order to obtain accurate and in-depth data. Documentation was carried out in order to capture events during the research process. Observations were carried out to see how children carry out a series of STEAM activities through color mixing experiment activities, as well as analyzing STEAM activities during the activities for children. Interviews were conducted to find out how STEAM activities were carried out, starting from the steps of the activities, how teachers facilitate children, attract children's interest, improve children's learning experiences, obstacles during science activities, challenges in STEAM activities, and the advantages and disadvantages of STEAM activities. The results of the research obtained regarding the analysis of STEAM implementation in children aged 5-6 years at TK IT Syeikh Abdurrauf, Blang oi Village, Meraxa District, can be described as follows:

### **1) Activities Implemented in STEAM Learning**

The results of observations at TK IT Syeikh Abdurrauf for children aged 5-6 years in class B1 on Wednesday, November 6th in the science center with color mixing experiment activities. The results of interviews conducted by researchers with class teachers are as follows . Researchers asked questions to class teacher Mrs. Nur Sakdiah about what activities were carried out in STEAM learning at TK IT Syeikh Abdurrauf in class B1. The results of the interview with Mrs. Sakdiah stated that "STEAM learning in this school includes playing with loose parts, there are also simple experiments, there are also trying jengki learning, color change experiments using loose part media to train children's science, engineering, and mathematics, using loose part media, if science is more about simple experiments assembling toy cars and making used cars, there are also making windmills with an air theme" .

Based on the interview results above, we can conclude that Syeikh Abdurrauf Kindergarten has implemented a variety of STEAM-based science activities. Loose-part materials, obtained from the surrounding environment, are introduced to children through STEAM activities. Color-change experiments also greatly engage children. Syeikh Abdurrauf Kindergarten also provides jengki (traditional pestle) tools to introduce to children. During the air theme, children experimented with assembling toy cars and making used cars and windmills from natural materials. These STEAM activities can help develop engineering skills. children because this activity can stimulate children to build a work of art from the materials around them.

## 2) Steps in Implementing STEAM

The implementation of STEAM activities at TK IT Syeikh Abdurrauf Blang Oi Village has been optimally organized, so that the learning activities carried out can run according to what has been planned in the teaching module. STEAM activities at TK IT Syeikh Abdurrauf Blang Oi Village are carried out in 5 centers, namely the art center, science center, diniyah center, block center, and preparation center, teachers will carry out activities according to the center that matches the theme of the activity later. Based on the researcher's observations, the STEAM steps are the same as a series of activities contained in the RPPH that have been prepared previously, namely:

- a) The teacher invites the children to sit neatly, usually in a circle or in a row. Then, the teacher invites the children to sing and recall.
- b) The teacher and children engaged in physical motor skills activities. This was followed by a prayer before learning. Afterward, the teacher gave the children an English lesson.
- c) The teacher invites the children to pray Dhuha, perform the pledge, pray, and memorize the text. Afterward, in the initial activity, the teacher provides an apperception to the students, invites them to sing, and plays with STEAM media according to the pre-prepared provocations.
- d) The teacher first invites the children to eat and pray before the closing activity. After that, the closing activity includes asking the children how they felt today, recalling the situation, praying, and closing with a greeting.

Based on the results of the interview, the class teacher said, "The steps to use the center method in learning center activity are preparation centers, science centers, educational centers, and block centers. In the block center, children will build square-shaped buildings using rectangular and round blocks. There are also children who make televisions from cardboard, there are also experiments with volcanic eruptions or experiments with balloons that inflate themselves using soda and vinegar. The steps we take are according to the characteristics and ages of the students." According to Mrs. Nur Sakdiah, it can be concluded that in determining the steps for STEAM activities, teachers prepare centers first, and also adjust the difficulty of the activities according to the age of the children so that the children will not have too much difficulty during the activity, and the expected child development can be achieved.

### **3) The Role of Teachers in Facilitating STEAM Learning to be Effective and in Accordance with Children's Developmental Characteristics**

The results of interviews with class teachers stated that "the teacher as a teacher facilitator facilitates media for children to conduct media experiments used by the teacher according to the age level of children aged 4 to 5 adjusted to the age level with the level of difficulty of the game being played. If conducting color change experiments and experiments making rainbows and volcanic eruption experiments and experiments making colors from leaves by pounding on mixing colors with paint using basic colors and adjusted to the age and interests of children ". So it can be concluded that before carrying out a series of STEAM activities, the teacher first prepares the materials and tools to be used, arranges a comfortable classroom, arranges children when entering the classroom, carries out class activities in accordance with the RPPH procedures that have been carried out.

### **4) How to Deal with Students Who Have Less Interest in Learning in STEAM Activities**

Based on the results of the interview, the class teacher said, "Here, when we plan learning, it involves students, so the students themselves decide what they will play tomorrow, so here, the children want to play, if there are children who don't play, we say that you chose this activity yesterday." When the class is still going on, before closing the activity, the teacher first asks the children one by one to ask for their approval for the game activities that will be carried out the next day. This is done to prevent children who are reluctant to attend class because they are bored or not interested. Through this agreement, the teacher can know what activities will be carried out in the classroom .

### **5) Children's Skills When Doing STEAM Learning Activities**

Based on the researcher's observations in class B1 in the science center with color mixing experiment activities, the number of children present that day was 24 children. The class was opened by reading short surahs, starting from Surah Al-Fatihah, Al-Alaq, Al-Bayyinah, and Surah Al-Qadr. The first activity was the researcher invited the children to form a circle and sit in a circle. In this activity, the researcher will take attendance of the children in class B, namely the class where the researcher conducted the research. The researcher asked about who took them to school, what day it was, what uniform they were wearing, and how the children were doing. Before starting, the researcher invited the children to pray before studying, followed by a prayer of light and reading Surah At-Takatsur. The researcher gave the children

the opportunity to lead the clapping of the surah and began reading Surah At-Takatsur together. The researcher asked the children to recite the hadith prohibiting criticizing. Do not forget to give them a silent clap and a concentration clap when the children start to lose focus.

Observation of the first day on Wednesday, November 6, 2024, the experimental science activity began with the teacher asking the children about the available colors, the children enthusiastically answered the names of the colors one by one. During the activity, the activity carried out was a color change experiment. In this activity, children were introduced to basic colors and also colors resulting from mixing colors such as green which is produced from mixing blue and yellow. However, when the color mixing experiment activity took place, there were still children who spilled too much color so that the mixed colors did not The results came out as expected. Some also used too much color and spilled too much water, resulting in less than perfect colors. Although some children were still unsuccessful in the color-mixing experiment, they thoroughly enjoyed the process.

Based on the results of the interview with the class B1 teacher, he said: "If the child's skills can be seen, the child is very skilled at playing, coloring, mixing colors or experiments with volcanic eruptions. Every time there is an experiment, the teacher gives steps to the teacher and the child to observe and ask questions while playing. They will be directed at how they carry out their activities. If the child cannot do it, the teacher will facilitate it by asking provocative questions and giving open questions to the child."

Through observations and interviews, it was concluded that the children's science skills were excellent. They were not afraid to start activities, were able to initiate activities at their own pace, and followed the teacher's instructions. They were skilled throughout the activities. Although some failed to add color, they persisted in completing their experiments.

## **6) Science Can Improve Children's STEAM Learning Experience**

The results of the previous observation, namely Wednesday, November 6, there were still children who had not perfectly carried out the color mixing science experiment activity, but the children did not give up and tried again the color mixing experiment on Thursday, November 7. Today the class was attended by 26 children. In this step, after the children have observed and had experience, the children are expected to be able to provide new ideas that have never existed before and these ideas feel easy for the children to do, so that when the

children are given the opportunity, the children are able to play games based on their own ideas. In this second experiment, many children have succeeded, only a few also succeeded, but did not like using many colors, only wanted one color. There were also those who spilled water too much so that their color experiment was less successful.

The results of the class teacher interview said that "Science activities are activities that are very popular with children because science is identical to playing, very visible and concrete and contextual because in science learning, children's cognitive abilities are trained, children's curiosity is trained, so children who have a great curiosity will be very interesting and very interested in science activities, especially the science activities provided by the teacher, the media are varied, media from the natural environment that is close to the children, so children are very interested in participating in science learning.

The direct experience felt by children when carrying out color mixing experiments leaves a deep impression on children, because in this activity children can directly see and touch the concrete and contextual materials used by the teacher so that it can train children's development and provide a very good experience for children.

### **7) Challenges Faced by Teachers in Conducting Science Activities**

According to the results of interviews with class teachers, it shows that "For teachers, the challenge is more on the teacher rather than the child. For children, there are no challenges, it is more on the teacher's lack of scientific knowledge for early childhood and then the lack of insight into developing science learning, but teachers will find out and participate in training and share with the principal and often with colleagues in order to find solutions so that we can take action."

It can be concluded that the implementation of STEAM is a learning application that has recently been implemented in Indonesia, even only a few schools have been able to implement it, considering that STEAM is a learning method that has the latest technological developments that continue to develop, resulting in limited science competency standards in early childhood education (PAUD). Teacher training can improve the ability to use alternative resources in integrating science into learning activities in schools. Educational institutions must also be able to develop a flexible and adaptive curriculum for STEAM learning .

### 8) Advantages and Disadvantages of STEAM Learning

learning is an approach that can stimulate children to develop curiosity and ask questions so that children can build knowledge in their surroundings through exploration, observation, and discovery. Through STEAM learning, teachers will encourage children to explore and discover new knowledge, inviting children to solve problems and find solutions to these problems so that children's critical thinking skills and children's involvement in the learning process can be increased. STEAM learning is an authentic observation when children play whether children use media for their needs.

According to the interview results, the B1 class teacher said, "There are many advantages in this steam learning, besides developing children's cognitive skills, steam learning also trains children's fine and gross motor skills, trains children's language, and also trains children's social skills. In art learning, there are no shortcomings, everything is met because the team is indeed student-centered learning . " The shortcomings of STEAM learning lie in the limited adequate learning resources. The lack of teachers' scientific abilities so that the skills and knowledge needed to teach STEAM are inadequate.



Documentation: STEAM Media at TK IT Syekh Abdurrauf and Interview with Class Teacher

Based on the results of observations, interviews, and documentation, the findings indicate that the implementation of STEAM through color-mixing experiments provided meaningful and engaging learning experiences for children. The activity stimulated children's curiosity and encouraged active exploration. Most children demonstrated improvement in completing STEAM activities independently, and they were able to connect observations with simple reasoning processes. These findings suggest that hands-on, inquiry-based STEAM activities can enhance children's engagement and conceptual understanding, particularly in science-related exploration (Wan et al., 2021). The data analysis revealed significant progress in children's participation and problem-solving abilities. During the third observation (Friday, November 8th), only 7 out of 26 children still experienced difficulties in conducting the color-mixing experiment, while the majority successfully completed the activity. This improvement indicates that repeated exposure to structured STEAM experiences supports children's cognitive development and scientific thinking skills. Research suggests that early exposure to integrated STEM/STEAM activities enhances executive function, logical reasoning, and problem-solving skills in young learners (Bagiati et al., 2017; Campbell et al., 2018).

Furthermore, the findings highlight the essential role of teachers in facilitating effective STEAM learning. In STEAM-based instruction, teachers are not merely transmitters of knowledge but facilitators who scaffold children's inquiry, encourage questioning, and guide reflection. Teachers must intentionally design learning environments that integrate science, creativity, and problem-solving within meaningful contexts. This aligns with studies emphasizing that teacher scaffolding significantly influences the success of STEAM implementation in early childhood classrooms (Park et al., 2017; Fleer, 2019). Teachers also reported that STEAM learning increased children's motivation and classroom engagement. The integration of experimentation, creativity, and collaborative tasks made learning more enjoyable and meaningful. Motivation is a crucial factor in early childhood learning, as children learn best when they are emotionally engaged and intrinsically motivated. Research shows that STEAM-based learning environments foster creativity, persistence, and positive learning attitudes because children are encouraged to design, manipulate materials, test ideas, and refine their thinking processes (Hadani & Rood, 2018; Özkan & Umdü Topsakal, 2021).

Additionally, STEAM learning supports the development of creativity and flexible thinking. The color-mixing experiment required children to predict outcomes, observe changes, and reflect on results. Such activities promote divergent thinking and scientific inquiry skills. By integrating artistic elements into scientific exploration, STEAM enables children to express



ideas imaginatively while developing analytical thinking. This interdisciplinary approach strengthens both cognitive and affective domains, contributing to holistic development (Marsh et al., 2019). Overall, the findings demonstrate that the implementation of STEAM learning in TK IT Syekh Abdurrauf has positively contributed to children's problem-solving skills, creativity, and engagement. Although some children initially required teacher assistance, continuous exposure to structured STEAM activities gradually enhanced their independence and confidence. These results support previous research indicating that STEAM learning provides meaningful, child-centered experiences that foster critical thinking and creativity in early childhood education (Wan et al., 2021).

## CONCLUSION

The results of observations and interviews stated that the analysis of the application of STEAM learning to children aged 5-6 years at TK IT Syekh Abdurrauf in class B1 through color mixing science experiments can make children active and take the initiative in developing their own knowledge. Experience in STEAM learning can increase children's self-confidence, encourage children to build a concept of knowledge through observation activities, investigations, and allow children to reason by asking questions they want to know and discussing with their class teacher. The application of STEAM to children aged 5-6 years can develop children's abilities both in terms of skills, knowledge, and children's abilities in terms of aspects of their development.

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