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# Preschool teachers' perceptions of STEAM-based learning in Banda Aceh

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**Abstract**

The purpose of this study was to identify early childhood teachers' perceptions of STEAM-based learning. This qualitative research will be analyzed descriptively, and semi-structured interviews with open-ended questions will be conducted with four early childhood education (ECE) teachers in Banda Aceh. The findings show that ECE teachers' perceptions of STEAM-based learning techniques have a high potential to be implemented in Banda Aceh City ECEs, as the respondents have used aspects of STEAM in their learning. Teachers' lack of knowledge of STEAM-based learning approaches and procurement of materials and funds to fulfil STEAM learning needs are barriers to integrating STEAM in ECE institutions in Banda Aceh. More STEAM socialization and STEAM learning implementation training is needed for ECE teachers in Aceh in general.

***Keywords:*** *Early Childhood Education; Preschool; STEAM; Teacher Perceptions*

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## A. INTRODUCTION

STEAM, an abbreviation of science, technology, engineering, art, and mathematics, are terms applied to human life, including education. According to (Marín-Marín et al., 2021), STEAM education studies started in 2006 and are continuing. Learning systems at each level of education or early childhood education worldwide have involved STEAM as daily activity-led learning, cohesive or blended learning that refers to real-world applications. Nowadays, adults who are teachers and parents pay attention to STEAM to prepare for a successful career in the future life, which begins in early childhood.

The Director General of Preschools has used STEAM-based learning as preschool practice since it was implemented in 2019 (Direktorat Pendidikan Anak Usia Dini, 2020). According to (Wahyuningsih et al., 2020), STEAM learning is considered to combine the skills that children need. According to (Harjanty & Hardianti, 2020), a safe and fun learning environment can help early childhood recognize STEM/STEAM. The preschool teacher took a vital role in this process. It can be started by learning the primary education of early childhood by exploring patterns, relations, and comparisons to understand the world. If the teacher had started it first, children would only have been stimulated enough to do new things. Teacher professionalism is essential in enhancing children's development, as only professional teachers can perform their duties and functions optimally (Rahimah, 2022). This STEAM method could be applied in daily routine class.

Experts agree that the STEAM approach prioritizes certain factors, such as children's age, characteristics, basic needs, and abilities when doing activities (Awang et al., 2020). As is known, many teachers believe that mathematics is not appropriate to be taught in early childhood if the learning process only involves memorizing numbers, basic additions, subtraction, and multiplication. It should be about learning concepts and analyzing patterns, shapes and sizes. Besides, children only utilize advanced technology such as computers, projectors, and laptops from their teacher when teaching and learning to explain and create tools to fulfil humans' needs in solving problems. According to Pramudyani and Indratno (2022), STEAM emphasizes the character formation of critical thinking so children can solve problems creatively and appropriately with what is needed in the world of work in the future and not only focus on science, technology, engineering, art, and mathematics mastery learning. The STEAM method is very effective for early childhood because it helps them learn to think critically and independently in many ways (Harjanty & Muzdalifah, 2022).

The enhancement of technology has changed the life methods of many people. Age and maturity have remained the same problem related to the use of technology skills and early childhood. The number of studies implied that the more advanced technology, the more access for children to learn something, especially children ages 0 to 8 years old, which families tend to choose technology as a learning method (Panjeti-Madan & Ranganathan, 2023). Learning science, technology, art, and mathematics earlier in childhood could contribute to children achieving success and good performance at school and in society, which is related to their skills and knowledge (Leung, 2023).

Studying science or mathematics is far more pleasant in various ways and is not monotonous, increasing interest for children to study until they master it (Wachidi & Sudarwan, 2021). Oddly enough, several applications on a smartphone or device offer

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various problem-solving games that make children interested in playing with real-life activities (Samuelsson et al., 2022). STEAM contributes to the learning environment through real-life experience by directing children to problem-solving activities and bringing them to learn outside (Adawiyah & Fitriani, 2022). Play is a way for children to learn and improve their abilities by interacting with the environment with, others and themselves (Abebe & Keery, 2023). According to (Widayati et al., 2023), learning models can increase students' desire, enthusiasm, and satisfaction in learning.

Aceh, the westernmost province of Indonesia, has committed to providing equal treatment for all levels of education and pays attention to early childhood education, especially when applying STEAM in learning. However, there are some challenges related to implementing STEAM in ECE because STEAM-based learning is still relatively new. Research related to the analysis of teacher readiness for the application of STEAM learning in kindergarten / junior high school in Leupung District, Aceh Besar Regency, shows that inhibiting factors in the application of STEAM learning methods include the lack of availability of land protected from the weather, parental participation, internet network access, availability of facilities and infrastructure and costs (Yulianti et al., 2023). Some ECEs in Banda Aceh have begun implementing STEAM-based learning methods directly or indirectly. ECE teachers, the main subjects in applying learning methods in ECE, certainly have their perceptions of and understanding of these learning methods. Perception is the ability to see, understand and then interpret a stimulus to produce an interpretation (Suryani & Tripalupi, 2021). This research is needed to identify teacher perceptions of STEAM-based learning in PAUD in Banda Aceh. The results of this study have a meaningful contribution to the world of education to explain the potential for implementing STEAM-based learning methods in Banda Aceh and support from the environment.

## B. METHOD

This study aimed to identify preschool teachers' perceptions of STEAM-based learning at preschools in Banda Aceh. This qualitative research was conducted for one month. Denzin and Lincoln (2018) state that qualitative research involves an interpretive approach where researchers study things naturally, trying to understand and interpret phenomena in terms of meaning. This descriptive qualitative research includes four originating participants from preschool teachers with several considerations as follows: (1) born in the 1990s; (2) have experience teaching for more than five years; (3) have a diploma in the field of knowledge education of early childhood. Four participants were recruited by volunteering at four different preschools in Banda Aceh, Aceh, Indonesia.

Research data collection techniques used in-depth interviews and ten open-ended questions filed during study hours. Findings data interview analyzed and reviewed the references from articles relevant to STEAM-based learning. The interview instrument is as follows: 1) What method is currently used when teaching? 2) When did you hear the word STEAM? Which words or phrases first come to mind? 3) Did you introduce/show/robot/machine artifacts to your student? If so, please explain the artifacts you take and why you decided to bring them/ introduce them 4) What is the potential of STEAM within early childhood education (kindergarten)? 5) What impression does the application of STEAM have on early childhood? 6) What makes children not enjoy STEAM? 6) What is the difficulty in integrating STEAM?; 7) Is STEAM discipline the most difficult

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to integrate?; 8) How does the environment support school and society in the implementation of STEAM?; 9) What are your suggestions for improving the STEAM integration process in preschools?; 10) Is there any else that you want to add?

## C. RESULT AND DISCUSSION

### 1. Result

In the modern era, various sophisticated technologies are used by humans in daily life, not even technology, regardless of the world of education, including early childhood education, to support the learning process. Various types and methods are used in the preschool's learning process: demonstration, play, and singing and telling stories. Several STEAM methods, such as science experiments and technology, have also been implemented in preschools. STEAM-based learning received positive responses from respondents whose answers have been translated into English. A total of four respondents have implemented learning activities using technology at preschools.

> *"Sometimes we use the iPad and PPT inside to convey stories to children."*
>
> Code: IR1.2023/No.1/L.3-4

Nowadays, teachers in Banda Aceh started to encourage digital savvy to follow development in the recent era, but millennial teachers are faster in controlling digital technology. Apart from using technology, all respondents also implemented science activities in their learning. Moreover, one of the schools even has a *science day* program with various activity experiments by the age of the child.

> *"In our preschools, there is a science day for children to experiment in accordance with the level of age."*
>
> Code: IR1.2023/No.1/L.6-8

Based on the findings of interviews, all respondents imagined science and technology that applied in the learning process when they first heard the word STEAM. As many as three respondents had introduced artifacts/robots/machines to their students because, according to them, children need to keep up with the times, and these activities can develop aspects of child development in a fun way. One of the respondents introduced the name of the character who discovered machines, and others brought children to the place of the tofu factory.

> *"The machine is available. Bring the children to the place of processing tofu."*
>
> Code: IR2.2023/No.2/L.20-21

The introduction of such things is exciting and enthusiastic for children because children like new things such as movement, sound, color, and objects that they have just seen. One respondent had never introduced artifacts/robots/machines to his students because teachers' perceptions of technology are not just artifacts of robots and machines. However, respondents were interested in trying to introduce it to students.

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> *"Never. There was a plan to do that. Technology does not only relate with machines. But there's no doubt in trying to introduce it."*
>
> Code: IR4.2023/No.3/L.20-24

All respondents agreed that technology and science must be introduced in early childhood to keep up with the times. The four respondents thought STEAM had excellent potential for implementation in early childhood. In addition, science learning can also be applied to early childhood at school and home.

> *"The potential of STEAM is huge, and kids will not be out of date when they work in developed countries; children know technology. Science can also be implemented in a child's learning at school and home."*
>
> Code: IR3.2023/No.4/L.31-38

The impression of learning, such as technology and science, is that it excites children because learning is more varied and fun. Monotonous learning activities make the learning atmosphere unpleasant. Meanwhile, according to respondents, STEAM learning makes children eager to learn while exploring.

> *"Children become happy, and learning becomes varied. Children do not want to study because they are bored. Learning with STEAM makes children more enthusiastic in studying because they find new and unique things."*
>
> Code: IR4.2023/No.5/L.33-42

STEAM becomes unpleasant if the teacher has not mastered the learning methods and techniques for teaching with STEAM. The four respondents thought the school principal, school environment, and parents would strongly support a STEAM-based learning approach for advancing early childhood education (preschools). However, teachers need to understand the STEAM learning concept more in order to implement it.

> *"Constraints from the teacher himself, the teacher's methods, or creativity in conveying the learning. Teacher yet mastered, yet known to convey the technique so that child becomes bored."*
>
> Code: IR4.2023/No.6/L.43-51

Respondents perceive that STEAM is more suitable for younger millennial teachers to implement. In comparison, older teachers with older ages have difficulty implementing STEAM because they are less able to master technology. The difficulty in integrating STEAM is the need for procurement of tools, media, and funds for learning needs, which significantly influences the success of implementing STEAM-based learning. Apart from that, teachers must also be creative in introducing STEAM simply, quickly, and fun way.

> *"Human resources, because STEAM is more suitable for millennial teachers to apply. The old teachers were less able to master technology. Never been involved."*
>
> Code: IR1.2023/No.7/L.60-65
>
> *"Difficulties in the media, funds, and tools used. Teachers must think hard about how to teach as simply as possible by children's brain development."*

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Code: IR4.2023/No.7/L.56-64

Three of four respondents thought STEAM is easy to apply once understood and will be fun once you get used to it. One respondent stated that applying STEAM to learning in preschool was difficult s because of the lack of human resources who understand STEAM. Meanwhile, all respondents support the application of STEAM in learning at preschools. All respondents said that principals, parents, and the environment support the STEAM-based approach for advancing early childhood education institutions.

## 2. Discussion

Preschool teachers' perceptions of learning methods are essential because these perceptions will influence the implementation of the learning methods that will be applied. According to Suryani and Tripalupi (2021), teacher perceptions reflect actions that come from observations. Meanwhile, according to (Habibi, 2023), the teacher facilitates the children's investment and provocation. Learning methods such as demonstrations, playing, singing, experiments, storytelling, and the use of technology in learning at preschools are the efforts of preschool teachers to provide the best education for students.

The launch of the *Merdeka* curriculum to overcome the long-standing learning crisis must be kept from its implementation in preschools. The independent curriculum at the preschool level, often called free play, aimed to give children the perception that learning is not burdensome but rather fun. Play-based learning is used in early childhood learning systems (Veryawan et al., 2023). The educational objectives in the independent curriculum can be implemented through STEAM-based learning. In line with this, the independent preschool curriculum includes literacy and STEAM learning outcomes, which focus on developing literacy skills and the basics of science, technology, engineering, art, and mathematics to build joy in learning and readiness to take it to the next level (Suryawati & Akkas, 2021). STEAM learning is applied to early childhood through play and exploration.

Based on the findings of research that has been carried out, pre-schools teachers in Banda Aceh have so far implemented the STEAM learning concept. This is in line with the opinion of (Kamil & Anggraeni HR, 2023) that STEAM learning is almost fully implemented in various early childhood education institutions. Teachers have implemented learning activities using technology in pre-schools. According to Sulistyaningtyas et al. (2023) the use of technology in the classroom can be beneficial for increasing children's self-esteem, motivation, creativity, curiosity, and enthusiasm for learning as well as their teachers' emotions. The use of technology in learning finds its connection with the STEAM approach.

Science day programs with various experimental activities have been carried out in preschool activities. According to Taşdemir and Yıldız (2024), most children want to learn about scientists, experiment, and understand how tools and equipment operate. Preschool teachers in Banda Aceh have conducted science experiments, learning with iPads and PowerPoint and introducing artifacts/robots/machines and their creators to

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preschool children. According to the learning content, preschoolers were taught that STEAM is related to science and technology. In addition, (Sung et al., 2023) research findings reveal the effectiveness of STEAM programs integrated with robotic devices that are developmentally appropriate for children.

However, STEAM is not just about learning about science, technology, or other material approaches; more than that, children are trained to indirectly identify problems, solve problems, and think creatively from an early age. This is in line with Wahyuningsih et al. (2019), who stated that the STEAM method increases creativity in children's thinking, making them able to solve problems more effectively. Meanwhile, teachers must understand the learning methods applied for learning objectives in early childhood to be effective and optimal.

STEAM learning makes children eager to learn while exploring. According to Maharani and Zulminiati (2021), the STEAM method stimulates children to solve problems, emphasizing active learning. STEAM education allows students to work together to solve problems (Erol & Erol, 2023). The teachers agreed that technology and science must be introduced in early childhood. Preschool teachers' perceptions regarding the STEAM-based learning approach have good potential to be implemented in preschool institutions because it gives the impression of active, varied, and fun learning, which children like, thus making them enthusiastic. It also aligns with Abror et al. (2021), who stated that the STEAM method is an active and fun learning method that can be implemented in preschools. For learning to be successful, many people must work together to implement the learning method.

Teachers' perceptions regarding the potential for implementing STEAM-based learning in Banda Aceh City preschool are getting better because of support from school principals, parents, and the environment for a STEAM-based approach to the progress of preschools. Sari and Rahma (2019) state that parental support and the environment significantly impact children's development. This support is a motivation for preschool teachers to implement learning methods.

The difficulty in integrating STEAM is the need for procurement of tools, media, and funds for learning needs, which significantly influences the success of implementing STEAM-based learning. According to Ningsih and Farida (2023), media is an essential tool in learning planning because it is an intermediary in various forms, such as humans, objects, or materials. Early childhood education institutions can only implement STEAM using media in learning. Implementing STEAM-based learning will be easy if teachers understand the STEAM learning method. Teachers must be creative in implementing STEAM learning in early childhood in a simple, easy, and fun way that fits the child's development. Human resources who understand STEAM at preschools in Banda Aceh are still lacking. Based on this, it can be concluded that preschool teachers in Banda Aceh are willing to implement STEAM-based learning methods, but there is a lack of human resources who understand STEAM.

For this reason, more outreach is needed, starting with students, teachers, parents, and the community regarding STEAM. According to Juwati and Pardimin (2022), increasing competence regarding STEAM-based learning can be done through training

and mentoring by keynote speakers or peers. There is a need for training, seminars, or workshops for teachers to implement STEAM at preschools in Banda Aceh.

## D. CONCLUSION

Preschool teachers' perceptions regarding the STEAM-based learning approach have good potential to be implemented at preschools in Banda Aceh because so far, respondents have applied STEAM elements in learning, including science experiments, learning with iPad and PowerPoint as well as introducing machines and their creator figures to children. Preschool teacher respondents perceived STEAM to be related to science and technology. Teachers must be creative in introducing STEAM simply, efficiently, and fun. STEAM provides the impression of active, varied, and fun learning that children like, making them enthusiastic. Meanwhile, the perception of preschool teachers is that children like things that move, make sounds, are colored, and objects that they have just seen. Support from school principals, parents, and the environment for a STEAM-based approach to the progress of preschool is a supporting factor in teachers' perceptions of implementing learning methods in preschool. The inhibiting factors in integrating STEAM in preschools are teachers not fully mastering STEAM-based learning methods, lacking human resources who understand STEAM in preschools Banda Aceh, and procuring tools and funds for learning needs. For this reason, more socialization, starting with students, teachers, parents, and the community, regarding STEAM will solve this problem. Future research can examine the implementation of STEAM-based learning in Banda Aceh preschools.

The limitation of this research lies in the interview process. Sometimes, the answers given by participants do not match the questions the researcher asked. To solve this problem, the researcher repeated the question and explained the meaning of the question asked.

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