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STEAM-based Learning to Enhance Early Childhood Creativity

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Abstract

This study aimed to determine the application of STEAM Education-based learning to improve early childhood creativity abilities. A literature review conducted to gathering and evaluating library data and connecting it to research to find solutions to issues. The study's conclusion is that early childhood creativity can be enhanced by the STEAM approach. High creativity is characterized by flexible thinking, innovative thinking, detailed/elaborative thinking, and fluid thinking.

Keywords: STEAM Education, Creativity, Early Childhood Education

INTRODUCTION

The early childhood world is a world of creativity. Children need thinking and emotionally guided space. The ability to think is one aspect that influences the emergence of creativity. The ability to think that can develop creativity is the ability to think divergently, namely the ability to think of various alternative solutions to a problem. Because STEAM places a strong emphasis on creativity and design, integrating the arts into STEM subjects makes sense (Sharapan, 2012). The value and applicability of integrated understandings of science, technology, engineering, and mathematics in both educational contexts and daily life are highlighted by the rise of STEM as a major area of interest for kids. Recognizing the importance of creativity and invention, as well as the critical role the arts can play in extending STEM into STEAM (Johnston et al., 2022).

Creative thinking skills play an important role in the learning of all students and are part of the higher-order thinking skills that need to be developed. Creative thinking has little attention in science learning. However, when early childhood focuses on the learning process, creativity will increase understanding and encourage students' cognitive development (Sari et al., 2018). Early childhood educators need to help children explore their creative potential in order to address a variety of contextual problems that call for critical thinking, reasoning, and argumentation. Achieving science learning objectives requires the application of both critical and creative thinking abilities. These are the kinds of skills that need to be developed. Early childhood scientific education that is more relevant enables children to ask questions and share

their thoughts. Given the significance of creative thinking abilities, educators should design lessons to support students in developing higher-order thinking abilities when learning science.

The importance of the influence of learning with the STEAM approach on creativity is good learning because learning activities using the STEAM approach can increase student creativity directly because they can increase the ability to think creatively consistently. Therefore, learning with the STEAM approach is an alternative learning activity that can be used to improve the basic skills needed in this century (Widiawati et al., 2022; Jones, 2011).

One of the challenges of integrating STEAM into early childhood curriculum is Teacher readiness. Despite increased knowledge and skills, educators may feel reluctant to implement STEAM lessons independently due to a lack of confidence or training (De Jarnette, 2018). The goal of study on creativity and STEM education is to advance future studies on children's STEM learning development. Fostering inquiry and creativity in the early years of STEM education is crucial for addressing the challenges teachers face and their need to integrate creativity skills in education at the preschool level. (Amran et al., 2021). Creativity is at the heart of those with a creative spirit because creativity elicits higher-order thinking by provoking and inspiring curiosity.

An integrative review and conceptual framework can be used to integrate and navigate STEAM in early childhood education (Ng Andrea et al., 2022). Until now, this student's thinking skills have not been taken seriously by the teachers in the school. This is supported by the findings (Rofi'udin, 2000) that there are complaints about the low critical-creative thinking ability because thinking education has not been handled properly. Therefore, handling critical-creative thinking skills must be integrated into each subject.

People with creative thinking skills, often called divergent thinking, have high creative power and benefit many people. Therefore, creative thinking skills are very important to be taught in schools. Creativity is important to be the best in schools, campuses, companies, communities, and elsewhere (Buzan, 2005). Why do people worldwide complain that their minds go blank when asked to develop an original idea or an innovative answer? The simple explanation is that people don't use all their brain power.

Generally, the average person uses less than one percent of their brain in creativity, memory, and learning. When people can use their brainpower to reach 20%, 40%, or even 100%, this will give extraordinary creative results. The mind map provides training to optimize the brain's potential in producing something creative.

Early childhood STEAM education can be implemented by establishing a secure and enjoyable learning environment. Key tasks that can be carried out in implementing STEAM

include giving kids the chance to explore, find, construct, conduct experiments, forecast, look for temporary solutions, and connect knowledge to real-world situations (Putri & Bayuni, 2019).

Educators may struggle because they believe STEAM is only about integrating art because many are not trained artists or are unsure of how to make STEM subjects "A" grade worthy. A more comprehensive understanding of STEAM incorporates the scientific discipline that we require, with entry points in all situations. This implies that the integration of art, which focuses more on a few principles—interdisciplinarity, creativity, original or real-world learning, and project-centered thinking—is one of STEAM's linked viewpoints (Henriksen, 2017).

All in all, the STEAM framework falls short when it comes to explaining how social and cultural dimensions of scientific creativity serve as the foundation for creative cognition. Teaching strategies are therefore not culturally adjusted to promote innovative cognition. In order to achieve educational objectives, the task is to incorporate the arts within STEAM education as best as possible (De Vries, 2021). Young children in preschool have an innate interest in science, and STEAM education can foster their creativity (De Jarnette, 2018).

Early childhood education is the best setting in which to implement STEAM education because it increases children's enthusiasm to learn, helps them make connections between STEAM subjects and careers, and helps them grow into active citizens. The following fresh information on STEAM at a young age was found by the empirical investigation that was done: a) Early childhood educators use STEAM education techniques that emphasize the development of students' soft skills (problem-solving, creativity, learning capacity, communication) more often than they do the complex skills (mathematics, technology, engineering); this imbalance is beneficial for the growth of a proactive, critically thinking child who is capable of making responsible decisions, but it does not guarantee the long-term development of STEAM abilities; b) The use of cutting-edge STEAM education techniques influences the professional development of teachers; c) STEAM practices have a greater comprehensive impact on the development of the competences of children aged 3-6 through the professional development of teachers rather than directly (Monkeviciene et al., 2020).

STEAM is significant because it supports learning experiences that let kids explore, inquire, investigate, find, and practice creative problem-solving abilities while also assisting teachers in integrating several subjects at the same time (Colker & Simon, 2014). The convergence of the arts and STEM disciplines made possible by STEAM integration can improve student engagement, accelerate learning, and foster innovation. Because of their

respective natures, STEM and the arts are conducive to experiential learning and production (Robelen, 2011).

According to research, giving young children in early childhood and elementary school meaningful hands-on STEAM experiences improves their attitudes and dispositions toward STEAM (Bagiati et al., 2010; Bybee & Fuchs, 2006; DeJarnette, 2012). For kids who are persistent and determined while creating ideas, STEAM concepts are not too challenging; when things don't exactly turn out the way they want, they instinctively strive to correct them (Van Meeteren, 2015)

The research method used in this study is a literature study research method. Literature studies as research conducted by examining various literature studies needed in research (Putrihapsari & Fauziah, 2020). The purpose of using the literature study method in this research is as a first step in planning research by utilizing literature to obtain data in the field without the need to be directly involved. After obtaining the data source as a reference, the literature review data is analyzed using content analysis. Content analysis is where researchers peel a text objectively to get a picture of the content as it is, without researchers' intervention. In this case, researchers will discuss in depth the content of information on data sources that need time settings to read and analyze the data so that there is a result. After that, it is anticipated that these findings will address the issue and be taken into account when determining the scope of early childhood education.

DISCUSSION

Implementation of STEAM

Early childhood education must be ready to meet the difficulties of this era as one of the basic education institutions (Draper & Wood, 2017). Integrating STEAM (Science, Technology, Engineering, Arts, and Mathematics) into early childhood curriculum can be achieved through various methods and activities. **Hands-on activities**: Examining shapes, constructing cardboard forts, playing "grocery store," pouring liquids and other materials, filling and emptying containers of various sizes, and combining paints to produce new hues are all examples of STEAM learning. These hands-on activities can help children develop problem-solving and creativity skills.

Project-based learning: Engage children in long-term, well-integrated STEAM projects, such as learning about the best conditions for a class pet and observing and measuring the conditions to create a new home for the pet. Conversations, open-ended questions, and informal assessments: Encourage children to ask questions, connect with prior knowledge, gather and analyze data, and communicate their findings and ideas.

Integration of STEAM fields: STEAM integration assists educators in concentrating on procedures (how to learn) and content (what to study). To enhance children's understanding of scientific and math topics, you may, for instance, have them make weekly summaries and monitor the daily weather. Professional development for teachers: Teachers should be provided with training and resources to help them feel more comfortable and confident in implementing STEAM activities in the classroom (De Jarnette, 2018).

When children are observing color mixing activities, the STEAM component frequently inquires about the approximate colors that result from combining two colors. The children's growing skills and processes may also determine the shape and size of the grains used in the collage activity. In addition, through investigating and observing, the children are free to mix as many colors as they wish, with the restriction that they can only mix two colors. Through this communication exercise, the student demonstrates both their comprehension of the assignment and their independence in completing it. The final one is playing; without burdening the kids, the teacher packages the learning exercises as enjoyable pastimes (Harjanti & Hardianti, 2020).

Put simply, STEAM has been applied to some of the learning activities in one Indonesian preschool, although instructors' comprehension of STEAM learning is still lacking (Harjanti & Hardianti, 2020). Studies have indicated that teacher professional development that emphasizes particular teaching techniques results in a higher implementation of those practices in the classroom (Huffman et al., 2003).

Children between the ages of five and six benefit from the application of the STEAM learning paradigm in their daily activities, as it fosters creativity and improves problem-solving abilities (Perignat & Katz-Buonincontro, 2019). The findings demonstrated that pupils' inventiveness differed before and after getting STEAM instruction. Proficient, adaptable, creative, and meticulous abilities define exceptional creativity. As a result, incorporating STEAM into education helps foster children's creativity, problem-solving skills, and sense of connection to their surroundings (Habibi M.A. Muazar, 2022). By incorporating these methods and activities into the early childhood curriculum, educators can help children develop critical thinking, problem-solving, and creativity skills, essential for success in various STEAM-related careers.

Furthermore, the STEAM learning paradigm fosters in kids an inquisitive mindset, an openness to new experiences, and the ability to ask questions in order to help kids learn by doing things like exploring, observing, discovering, and researching their surroundings (Perignat & Katz-Buonincontro, 2019). The creation of the finished product and the

manufacturing process is the emphasis of STEAM. Because the manufacturing process involves elements of inquiry, creative thinking, engineering design, creative expression, evaluation, and redesign, it is more significant than the finished product (Perignat & Katz-Buonincontro, 2019).

In this process, the STEAM model can teach children to process through the STEAM Method Effect on the Creativity of Children Aged 5-6 Years observe, play, recognize patterns, and practice creative thinking skills as well as cooperation and communication skills between children in completing a task or project given by the teacher (Guyotte et al., 2014). In addition, in the process, children are required to think creatively and critically about new things obtained by children. Children are also encouraged to solve problems with their teachers and peers (Michaud, 2014).

In the STEAM method, children do more direct experiments to grow their creativity. This is important in science and in building children's intelligence, both socially and emotionally.

It is also possible to apply the growing talents in other curriculum areas including language, technology, and math. It is intended that children would translate their science activity skills—for instance, learning to compare, sort, count, estimate, classify, measure, graph, and even communicate their explanations with others—to mathematics, language, and technology (Dejonckheere et al., 2016)

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When there is limited time left, science is frequently the topic that is neglected by the teacher or saved for last (Britto et al., 2017). When it comes to teaching science to young children, educators should plan scientific experiments pertaining to children's physical, social, moral, emotional, and cognitive development; 2) create a science curriculum that takes into account the needs of each individual student; and 3) start creating a science study unit that incorporates other subjects.

STEAM-Based Learning Tips: Parents or guardians of children design STEAM play activities in advance. Provide interesting materials and tools; when preparing tools and materials, invite children to participate so that children see the process; when you start playing, accompany your child but don't drill them with any restrictions or rules; let the child explore but occasionally explore his curiosity by asking things related to what is being played, Respond when your child asks. Try not to answer clearly, but we ask back to the child so that the child

can find his own answer to grow his analytical skills; use all the five senses of children, find a large play and study space such as in the park/yard so that children can explore more, rather than studying in front of a computer or laptop.

The Influence of STEAM on Early Childhood Creativity

The STEAM learning model can help kids become more creative because it teaches them how to learn processes through playing, observing, and identifying patterns. It also helps kids practice their creative thinking skills and how to collaborate and communicate with other kids to complete tasks that the teacher and facilitator assign.

Learning used based on scientific technology and the ability to solve problems in the real world (Kofac, 2017). Children are trained to dare to express self-expression through criticism and opinions. From this, it improves children's verbal and nonverbal communication skills and openness to other people's perceptions and understanding of new things in children through reflection of their own experiences and emotions (Seidel et al., 2009)

Encourage kids to make connections between the surroundings, learning resources, and instructional design (Sochacka et al., 2016). Students that use the STEAM technique in the classroom will need to think critically and creatively about new material they are exposed to because they will not be aware that they will find multiple pieces of information that overlap. They are also urged to work through issues with their peers and teachers (Michaud, 2014).

Kindergarten is the ideal time to start fostering a child's creative thinking abilities since it allows them to recognize, envision, and create a wide range of concepts and behaviors. Early on, parents and other caregivers should develop a perceptual, conceptual, and analytical point of view for children because this is the time when they begin to develop the foundations of their own creativity, which will influence them later in life (Yalcin, 2015).

The effect of the STEAM method leads the child to an increase in creativity in the way of thinking. They become better able to solve the problems faced more effectively. Note in this study that if healthy children are given the right methods, they will improve the quality of solving the problem at hand.

The results showed that the instructors' self-efficacy in STEAM did positively grow as a result of the workshop, the resources provided, and the modeling of the STEAM activities. During the interview process, instructors disclosed that they would still require extra professional development to effectively incorporate STEAM lessons inside their classrooms, despite the fact that their survey scores indicated an improvement in their dispositions and confidence. This is consistent with the findings of (Ralston et al., 2013), who discovered that support was necessary for K–12 instructors to successfully integrate the STEM component of

engineering instruction. They also underlined that, in order for STEM education to be effective, both teachers and students must engage in practical STEM training—just hearing or reading about the subject is insufficient. Since this researcher has also discovered this to be the case, all of the workshops provided are practical and serve as models for STEAM education for educators.

Interestingly, despite receiving a comprehensive resource book with lessons and STEM learning kits for learning centers, not a single teacher had implemented a STEAM lesson in their classroom during the two months following the initial hands-on workshop. Though they were hesitant to use the STEAM activities in their classrooms, the teachers expressed how much they had loved the sessions and felt that their preschool pupils would too. Even with the recent emphasis on STEM, there is still a gap in the effective education of PK–12 teachers and the support provided to them as they strive to integrate STEM subjects into their curricula for students (Gomez & Albrecht, 2013).

According to the research findings, preschool instructors' confidence in their capacity to organize and carry out STEAM lessons for their young charges grew in a way that was statistically significant as a result of participating in professional development sessions. Nevertheless, despite their increasing knowledge, abilities, and attitudes toward STEAM implementation and active engagement, none of the preschool instructors throughout this study (self-reporting) independently conducted a STEAM lesson, indicating that they were still hesitant to put STEAM into practice. As more states adopt the Next Generation Science Standards (NGSS), which explicitly encompass STEM and engineering teaching across all grade levels, more study has to be done on the use of STEAM in PK-3 classrooms. Research ideas include looking into professional development techniques that boost the possibility of actual classroom implementation, such providing in-class assistance to teachers while they are introducing STEAM lessons to their students for the first time.

Empirical studies have demonstrated that arts education can improve students' capacity for creativity, critical analysis, invention, teamwork, and interpersonal communication. The STEAM idea was launched in Indonesia as a result of the acknowledged outcomes and advantages of this art education (Perignat & Katz-Buonincontro, 2019). The impact of STEAM learning on children's ability to be more engaged and self-reliant in their own learning is also covered in the literature. Through their professional learning, teachers who are impacted by STEAM integration have a good impact on children. This review also shown that children's self-confidence can be boosted by STEAM experiences. Furthermore, STEAM education is thought to be able to incorporate the skills that kids need. Children are encouraged by STEAM

to observe, investigate, and ask questions in order to gain information about the world around them. The purpose of this review is to examine advanced STEAM learning in early childhood education (Wahyuningsih et al., 2020)

A survey of the literature was done because there isn't much information available on STEAM learning in early childhood education. According to Brophy et al. (2008), there is a lack of focus in the literature on STEM (science, technology, engineering, arts, and mathematics) in early childhood education. This is regrettable since young children are inherently scientists and engineers. The goal of the literature study is to present an overview of STEAM learning in early childhood education for the twenty-first century by analyzing work on early childhood learning that applies STEAM, which was chosen through a survey of the literature of various research publications.

Teachers need to be involved in the planning and design of STEAM learning in order to support the growth of the STEAM curriculum (Land, 2013); their role is critical to the success of this type of learning in the early years. Preschoolers can comprehend STEAM concepts at a deeper level if they receive targeted support in the form of organized, engaging, and developmentally appropriate activities (Aldemir & Kermani, 2017).

It is frequently the topic that piques young children's curiosity and satisfies their need to learn (Krogh & Slentz, 2008). Science is the systematic acquisition of knowledge via investigation, study, and experimentation. It encompasses physics, chemistry, biology, and its derivatives as well as other fields of study like astronomy, geology, oceanography, ecology, botany, and zoology when it comes to the natural world. Children find science interesting and it makes sense for it to be included in their curriculum because the subjects are tangible, approachable, and connected to their daily lives (Madden et al., 2013).

CONCLUSION

The result of the study is that the STEAM approach can improve the creative ability of early childhood. Fluent thinking, flexible thinking, original thinking, and detailing/elaboration thinking skills characterize high creativity.

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