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The Role of Teachers in Promoting Play-Based Learning in STEAM Education in Early Childhood Education

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ABSTRACT

In recent years years, play-based learning (PBL) has gained attention as an effective approach to early childhood education, especially in STEAM. Play-based learning can be an effective way to introduce young children to science, technology, engineering, art, and mathematics concepts in a very fun and engaging way. Teachers play a vital role in promoting PBL in early STEAM education by creating a classroom environment that encourages exploration, experimentation, and collaboration skills. However, the limited research on the roles of teachers in promoting play-based learning in STEAM in early childhood education (ECE) drives the author to conduct this study to provide insight into how teachers can engage constructively to promote PBL in STEAM in early childhood education. This study aims to address this gap by exploring the role of teachers in promoting PBL in early STEAM education. Through a literature review, the paper defines PBL and STEAM, emphasizing the importance of PBL for young children's development. It also discusses the significance of teacher training and professional development in enhancing their ability to support PBL. Lastly, identifies challenges and opportunities in implementing PBL in STEAM, offering recommendations for future research to better integrate these practices in early childhood education.

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1. INTRODUCTION

Play-based learning is widely recognized as an effective pedagogical approach for enhancing children's learning and development in Early childhood education (Taylor & Boyer, 2020). However, there is limited research on how teachers can take part in play-based learning with STEAM education, particularly in ECE settings, which aims to foster children's skills and competencies in science, technology, engineering, arts, and mathematics. Most of the studies have focused on the integration of STEAM and the perfect match between play-based learning and STEAM in education settings, and have not considered specifically teachers' roles in promoting play-based learning. This study aims to fill this gap in the field. Moreover, the roles of teachers in supporting play-based learning in STEAM in early childhood education are not well understood. Therefore, this study aims to explore the critical roles of teachers in promoting play-based learning in STEAM in Early Childhood Education, using library research. This study examines the significance of play-based learning in ECE, the basic roles of teachers in promoting play-based learning in STEAM in ECE, the effective strategies for promoting play-based learning in STEAM education, and the challenges that teachers encounter in promoting play-based learning in STEAM education. The study will also investigate the importance of teacher training and professional development, and opportunities associated with promoting play-based learning in STEAM education in early childhood education. The study will contribute to the existing literature and practice of play-based learning in STEAM in ECE by providing a comprehensive and nuanced understanding of the roles of teachers in this emerging field. The study will also offer practical implications and suggestions for teachers, researchers, and policymakers who are interested in play-based learning in STEAM in Early Childhood Education.

Play-based learning and STEAM education are two approaches that can be used to enhance young children's learning experiences (Mong & Ertmer, 2013). In early childhood education, the integration of science, technology, engineering, arts, and mathematics (STEAM) is advocated as a contemporary educational goal. Play-based learning is an effective way to introduce STEAM concepts to young children. Teachers play a crucial role in integrating play into STEAM education. They can create a learning environment that encourages children to explore, experiment, and discover. Teachers can also design activities that promote creativity, critical thinking, and problem-solving skills. In addition, they can provide children with opportunities to collaborate, communicate, and share their ideas. By integrating play into STEAM education, teachers can help children develop a love for learning and prepare them for future academic success (Ng et al., 2022). Play-based learning is a pedagogical approach that emphasizes the importance of play in children's learning and development. It is based on the idea that children learn best through play, which provides them with opportunities to explore, experiment, and discover new things in a safe and supportive environment (Ali et al., 2018). Play-based learning is widely used in early childhood education, as it helps children develop a range of skills, including social, emotional, cognitive, and physical skills.

Play-based learning (PBL) unifies play and educational pedagogy. PBL is child-centred and focuses on children's development, interests, and abilities through engaging and developmentally appropriate structuring of academic learning. The essential purpose of PBL is for children to learn while playing experiences (Pyle & DeLuca, 2017). STEAM is the term that stands for science, technology, engineering, arts, and mathematics. It is designed to help children develop the skills they need to succeed in the 21st century, such as critical thinking, problem-solving, creativity, and collaboration. Play-based learning is a cornerstone

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of early childhood education provision as it provides opportunities for young children to explore ideas, experiment with materials, and express new understandings which is vital for developing STEAM concepts in young minds (Edwards, 2017). However, there remains limited research examining the specific roles that teachers play in promoting PBL within STEAM in early childhood education settings. This gap underscores the need for further investigation into how educators can effectively integrate PBL into STEAM curricula to enhance learning outcomes. Thus, the objective of this study is to address this research gap by exploring the role of teachers in promoting play-based learning in STEAM education for young children. Specifically, the study aims to identify the strategies teachers employ to facilitate PBL in STEAM, examine the challenges they face, and provide insights that will inform future efforts to strengthen PBL integration into early STEAM education.

2. METHODS

The Method used in this study is a Systematic literature review, a rigorous and comprehensive method used to synthesize existing research on a specific topic (Atkinson & Cipriani, 2018). A systematic literature review plays a crucial role in research, providing a comprehensive and rigorous analysis of existing studies within a specific field. The choice of this methodology is the need to build a comprehensive understanding of the subject based on existing knowledge. This systematic literature review examines the critical roles of teachers in promoting play-based learning in early STEAM education.

A comprehensive search strategy was developed using predefined search terms and inclusion criteria such as relevance to play-based learning, STEAM education, and the role of teachers in early childhood education, language of publications as well as time range of 10 years literature inclusion to ensure relevance to the current educational landscape. After screening titles and abstracts, followed by a full-text assessment, a total of 30 relevant studies were included in the review. Data were extracted and synthesized, revealing key themes related to teacher roles, play-based learning, and STEAM education in early childhood education. Data extraction and synthesis are essential steps in research, allowing us to distil meaningful insights from a wealth of information (Taylor et al., 2021).

The data analysis technique employed in the study involved a qualitative synthesis of the findings. First, the quality assessment was performed using established evaluation criteria, ensuring the rigor and reliability of the data. This process likely involved assessing the validity, relevance, and methodological soundness of the sources and data being analysed.

Following the quality assessment, a qualitative synthesis was conducted, integrating and interpreting the results to uncover patterns and relationships. In this context, the synthesis identified the intricate dynamics between teachers' roles, play-based learning, and early STEAM education, highlighting both effective teaching strategies and the challenges educators face in facilitating play-based learning in a STEAM context.

The analysis further extended to examining the implications for practice, suggesting actionable strategies for educators, and future research directions, identifying gaps in knowledge, and proposing areas for further investigation. This approach is commonly used to explore complex, multifaceted issues where subjective experiences and contextual factors play a significant role in shaping outcomes (Elliott, 2018).

3. RESULTS AND DISCUSSION

The study highlights the multiple benefits of play-based learning (PBL) in early childhood education, particularly in STEAM. PBL fosters children's language, literacy, numeracy,

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creativity, and social-emotional skills. Teachers play a critical role in creating rich environments and facilitating inquiry-based learning. Studies reveal that children who participate in PBL show greater engagement and skill development compared to direct instruction.

The findings demonstrate that teachers' involvement in PBL is crucial for promoting holistic development in early STEAM education. This is because teacher-guided play enhances both academic content and essential life skills.

3.1. The benefits of play-based learning in early childhood education

PBL stands as a powerful teaching tool that can benefit children's learning and development in multiple domains and content areas. PBL can also align with the principles of developmentally appropriate practice, such as respecting children's individual differences, providing meaningful and relevant learning contexts, and fostering positive relationships with children, families, and communities (Taylor & Boyer, 2020). This has been widely recognized by various studies for its numerous benefits in fostering the overall development of young children.

Children's language and literacy skills, such as vocabulary, comprehension, phonological awareness, and writing can apparently be gained through cultivating the potential play-based learning. For example, a study by Elly (2015) found that children who participated in PBL showed more complex and diverse language use than children who received direct instruction or free play. Another study claims that children who engaged in PBL with manipulatives and games seem to improve numeracy skills. This implies that play-based learning promotes children's mathematical and problem-solving skills, such as counting, sorting, patterning, and reasoning (Li & Disney, 2023). However, children who participate in play-based learning with peers and adults show more positive emotions, less stress, and better social skills than children who do not. The study reveals that play-based learning can support children's social and emotional development, such as self-regulation, cooperation, and empathy (Alharbi & Alzahrani, 2020). Furthermore, studies show that most teachers who employ play-based learning in their teaching process support this pedagogical approach. It stimulates children's creativity and imagination, such as divergent thinking, originality, and flexibility. For example, children in play-based with open-ended materials and prompts showed more creative responses than children who received direct instruction or structured play (Hoskins & Smedley, 2019).

3.2. Critical roles of teachers in promoting play-based learning in STEAM education

Roles of teachers in promoting play-based learning in ATEAM education can be traced back to the early childhood pioneers, such as Fredrich Froebel (1782-1852), Maria Montessori (1870-1952), John Dewey (1859-1952), and Jean Piaget (1896-1980), who advocated for a child-centered, experiential, and inquiry-based learning. These educators recognize the value of play as a way of learning that is meaningful, enjoyable, and relevant to children's lives. They also emphasized the role of teachers as facilitators, guides, and co-learners, who provide rich and stimulating environments, materials, and opportunities for children to explore, discover, create, and problem-solve (Larkin & Lowrie, 2023). Play-based learning in STEAM education is a way of engaging children in meaningful and authentic experiences that involve science, technology, engineering, art, and mathematics. Teachers play an important role in promoting this type of learning by creating opportunities, asking questions, and facilitating inquiry. In recent years, there has been a growing interest and demand for STEAM education in the global context, as a response to the rapid changes and

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challenges in the 21st century (DeJarnette, 2018). STEAM education aims to integrate the STEAM disciplines in a holistic and interdisciplinary way, and to develop the essential skills and competencies that are needed for the future, such as creativity, critical thinking, collaboration, communication, and innovation.

In STEAM-based early childhood education, it is suggested to make maximum use of the natural environment for exploration (Skoss, 2018). Teachers can promote play-based learning in STEAM education by providing a rich and diverse learning environment, facilitating children's inquiry and problem-solving, supporting children's collaboration, creativity, and self-regulation, and assessing and documenting children's children learning processes and outcomes. By doing so teachers can help children develop the knowledge, skills, and attitudes that are essential for lifelong learning in the 21st century. For example, teachers can offer natural materials, recycled materials, building blocks, art supplies, digital devices, and books that relate to children's interests and questions. According to the article by Alghamdi (2023) teachers should integrate STEAM concepts across different domains and subjects, such as language, literacy, art, and social studies. They should facilitate children's learning by asking open-ended questions, scaffolding their thinking, and guiding them to solve problems. And then this study suggest that teachers should collaborate with other teachers, parents, and community members to share ideas and resources for STEAM education.

However, STEAM education is an emerging approach that integrates science, technology, engineering, arts, and mathematics in a trans-disciplinary and inquiry-based manner. Teachers play a crucial role in facilitating and promoting play-based learning STEAM education in early childhood settings. They need to have a clear understanding of the STEAM model, its benefits and challenges, and the strategies and supports that can help them create effective STEAM learning environments. Teachers also need to be aware of the diverse needs and interests of their students and use motivational and differentiated techniques to apply PBL to ensure equity and inclusion in STEAM activities.

3.3. The effective strategies for promoting play-based learning in STEAM education

Many Studies argue that methods or approaches that enable children to learn through play in a way that is aligned with the curriculum goals and developmentally appropriate for their ages and stages are termed as effective strategies. Hoskins & Smedley (2019) proposed a framework for policy and practice of learning through play at school, based on the science of learning and the impact of play on cognitive, social, emotional, creative and physical skills. Effects of three types of play on children's learning outcomes: free play, guided play, and direct instruction. They found that guided play, which involves adult scaffolding and child agency, can be as effective as direct instruction in teaching academic content, while also fostering social skills and executive functions. They also suggested that guided play can be used to complement direct instruction and free play in the classroom. Taylor & Boyer (2020), explored the definition, types, benefits, and strategies of play-based learning in the kindergarten classroom. They emphasized the role of play-based learning in integrating important academic standards into developmentally appropriate learning experiences, and how educators can facilitate, support, assess, and employ technology to enhance play-based learning. Interaction between teachers and children in play can extend their thinking and learning opportunities. For instance, educators can ask open-ended questions, provide feedback, model skills, or introduce new vocabulary or concepts during play. Creating schedules that allow for uninterrupted and extended periods. This gives children enough time to immerse themselves in play, follow their interest in STEAM subjects, and develop

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their ideas and skills. Moreover, co-plan future experiences based on observations of children's play as well as provide a variety of materials and resources that support children's play to obtain the potential of co-plan future experiences educators can use their observation of children's play to identify their strengths, needs, and interests, and plan for relevant and responsive activities that build on their learning. Educators should take into consideration documenting children's learning through play to make learning visible. Educators can use various methods such as photographs, videos, portfolios, or learning stories, to capture and share children's play experiences and outcomes with parents and other stakeholders. Creating a conceptual Play World, which is a model that integrates STEAM concepts with children's play through intentional teaching, storytelling, and imagination. This approach helps children develop inquiry, creativity, and problem-solving skills, as well as positive attitudes towards STEAM.

In promoting play-based learning in STEAM for young children, educators are obliged to offer the best of their skills and expertise to make learning effective for overall children's development; using child-centered projects that allow them to explore and experiment with different materials, tools, and concepts related to science, technology, engineering, art, and mathematics (Sydon & Phuntsho, 2022). For example, children can plan, design, plant, and car for a class garden, or create stop motion videos using digital devices and props. Also, a finnish approach to STEAM education, emphasizes the learning of 21st century competencies through multidisciplinary, creative, technology-enhanced design and creative processes. For example, children can use various technological activities such as crafting, design, engineering, documenting and sharing, and programming to create their own inventions. This study then suggested; Providing professional development and in-class support for teachers to help them implement STEAM lessons with their children, especially for the first time. For instance, teachers can collaborate with researchers, experts, or peers to co-design, implement, and evaluate STEAM projects and receive feedback and guidance along the way.

3.4. The challenges teachers encounter in promoting play-based learning in STEAM education

There are, however, significant challenges to embedding learning through play in practice. The first hurdle is semantics. Play is a complex phenomenon that is difficult to define. This presents a challenge that the very basis for learning is a contested notion. Further, the lay definition of play is to engage in an activity for enjoyment or recreation rather than a serious purpose (Truelove et al., 2017). Play's reputation as a non-serious/non-work-related pursuit is problematic, especially at school, where teachers are accustomed to a more rigid curriculum structure and attainment targets.

Based on the studies from the library and web search results, some challenges pull back the efforts exerted by educators in promoting a play-based learning approach in STEAM subjects particularly for young children. Many studies locate them as obstacles for teachers to offer their expertise to its fullest. Teachers face challenges in promoting play-based learning in STEAM because of the lack of time, resources, and professional development opportunities. Additionally, teachers may feel pressure to adhere to standards and assessments that do not align with the inquiry and creative nature of STEAM learning (Wanyi et al., 2022). Another scholar says "Teachers face challenges in promoting play-based learning in STEAM because of the misconceptions and stereotypes that surround these disciplines". For example, some teachers may think that STEAM subjects are too difficult or abstract for young children, or that they require specialized equipment or

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materials. Teachers may also lack confidence or interest in teaching STEAM subjects, or may not see the connections between them and other areas of the curriculum.

The challenges in the field of education particularly play-based learning and STEAM in early childhood education can be drawn from the articulation that 'We live in a world where; challenges are investable rather to find possible solutions in the given context. Teachers encounter various challenges, especially in the context of virtual teaching; Lack of resources and support: Teachers may not have access to adequate materials, technology, or guidance to implement play-based learning in STEAM effectively. For example, some teachers may not have enough devices, internet connection, or software to facilitate online interactions and activities with their students. Teachers lack collaboration and communication as well as assessment and evaluation (Lockwood, 2023). Teachers may struggle to assess and evaluate the learning outcomes and progress of young children in play-based learning in STEAM in a virtual setting. For example, some teachers may not have clear or consistent criteria or rubrics to measure the students' performance, skills, or understanding (Bertrand & Namukasa, 2023). In other ways, poor student engagement and motivation disturb teachers' performance in promoting play-based learning in STEAM as teachers may find it difficult to capture and sustain the interest and attention of young children in a virtual environment. For example, some children may be distracted by their surroundings.

Another study shows that teachers encounter challenges in aligning play-based learning with the curriculum standards and learning outcomes. Teachers may find it difficult it to balance the freedom and flexibility of play-based learning with the expectations and requirements of the curriculum. Designing meaningful and engaging STEAM challenges. Teachers may need to develop their own skills and knowledge in STEAM disciplines and pedagogies to create effective and relevant STEAM challenges for their students. They may also need to consider the students' interests, abilities, and backgrounds to ensure that the challenges are accessible and motivating for them (Bertrand & Namukasa, 2023). Research conducted by Lockwood (2023) found that providing adequate resources and support for play-based learning is a challenge. Teachers may face limitations in terms of time, space, materials, and equipment for play-based learning in STEAM. To address these challenges and barriers, some educators and researchers have suggested that play-based learning can be a powerful and promising pedagogy for STEAM education, especially in the early years. Play-based learning can provide children with authentic and meaningful contexts and experiences to engage with STEAM concepts and practices and to develop their STEAM skills and dispositions.

4. CONCLUSION

Based on this review, this study concludes that play-based learning, when facilitated by well-trained teachers, offers significant advantages for early childhood education, particularly in STEAM fields. The findings suggest that providing adequate teacher training and resources can enhance STEAM learning outcomes, promoting creativity, problem-solving, and lifelong learning skills in young children. This has the potential to influence educational policies and teaching strategies, ultimately leading to more effective early childhood education.

In the 21st century, children face new opportunities and challenges that require them to develop a set of skills that go beyond the traditional academic domains. These skills include communication, collaboration, creativity, curiosity, caring, and coping with change. Teachers play a vital role in fostering children's natural curiosity and creativity through play-based

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learning in STEAM. Educators can integrate STEAM concepts and skills into meaningful and engaging activities that allow children to explore, experiment, discover, and create.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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