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Research Article

SOME APPROACHES TO IMPROVE THE LEVEL OF ACCESS TO STEAM EDUCATION FOR STUDENTS MAJORING IN PRESCHOOL EDUCATION

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ABSTRACT

Early childhood education students are the future preschool teachers, and their success in implementing new methods such as STEAM (Science, Technology, Engineering, Arts, and Mathematics) largely depends on their access to, acceptance of, and application of these methods in their professional practice. This article analyzes preschool education students' exposure to STEAM education and proposes measures to enhance their access to it. Implementing STEAM in preschool education requires teachers to directly engage with the preschool education program, gaining knowledge, skills, and confidence in integrating STEAM principles into their teaching practices. These factors rely not only on the efforts of the teachers and the training process but also on the importance of preschool teacher training institutions. These institutions must pay greater attention to preparing students with the necessary knowledge and skills related to STEAM education throughout their classroom learning, ensuring they are equipped to effectively apply STEAM in their future roles as preschool educators.

Keywords: STEAM education; STEAM education approach; STEAM education approach of students majoring in preschool education

1. Introduction

STEAM education (Science, Technology, Engineering, Art, Math) is a global educational trend that has attracted significant interest from educators (Dinh & Dang, 2022) and is inevitable in the context of current educational reform. With its remarkable advantages, STEAM education has many points of alignment and similarities with the goals of the current preschool education program (PEP), capable of meeting the requirements of thematically integrated education and child-centred teaching aimed at developing necessary skills, creative thinking, and problem-solving abilities for children in modern life (Nguyen, 2022). Effectively applying STEAM education in the implementation of preschool education

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programs primarily depends on the role of the teaching staff, who are directly responsible for educational tasks. Students in the PEP will become preschool teachers in the future, and the success of applying STEAM education in the PEP largely depends on how they understand, accept, and apply these methods (Keys & Bryan, 2001) in their professional practice. However, the current access to STEAM education among students in the PEP program is still limited (Jamil, 2018; Tran, 2020). Therefore, enhancing access to STEAM education for PEP students during their training process is essential. This article presents several measures to improve students' access to STEAM education in the PEP.

2. Research results

2.1. Access to STEAM education for students in preschool education

STEAM is not merely an acronym. It represents a way of thinking—a philosophy about how educators at all levels should help learners integrate knowledge across disciplines and encourage them to think in a more interconnected and holistic manner (Sneideman, 2013).

Previous researchers have indicated that the application of STEAM education for preschoolers is effective. STEAM education offers numerous benefits for young children by integrating learning through hands-on experiences, creativity, and problem-solving. STEAM encourages preschoolers to think creatively through activities such as drawing, building, conducting scientific experiments, and creating crafts. This helps children develop their imagination and innovation from an early age. Children are guided in solving real-world situations through STEAM projects, which helps them hone their logical reasoning and solution-seeking skills. STEAM activities often require children to work in groups, helping them learn how to share ideas, listen, and collaborate with peers. STEAM introduces preschoolers to basic concepts in science, technology, and art, laying the foundation for later academic and professional skills. STEAM activities typically require children to use their hands to assemble, draw, or design, aiding in the development of fine motor skills. Rather than teaching each subject in isolation, STEAM integrates them into activities, helping children understand the connections between different fields in life. STEAM creates an engaging learning environment that piques curiosity and fosters a passion for exploration, encouraging children to enjoy learning from an early age. Several studies emphasize that the effective application of STEAM in preschool education requires enhanced access to STEAM education for young children through play, focusing on playful activities rather than embedding numerous STEAM activities into the curriculum (Fleer, 2021). It is essential to avoid teaching STEAM to children in ways similar to the approaches used in primary schools (Fleer, 2021; Hoang, 2020). Moreover, teachers should encourage and stimulate children's natural curiosity regarding observing phenomena, asking questions, exploring, creating, and hypothesizing (Knaus, 2017), or integrating STEAM activities into the school curriculum (Bagiati, 2010). This indicates that the effectiveness of STEAM education for preschoolers

largely depends on educators' understanding of the concepts, processes, and skills involved in integrating science, technology, engineering, art, and mathematics into children's daily activities (Knaus, 2017; Halton, 2017).

However, some domestic and international studies have initially shown a lack of knowledge, skills, and confidence among students and preschool educators regarding access to STEAM education (Jamil, 2018; Tran, 2020). There still exist some obstacles to accessing STEAM education from preschooler's perspectives. Teachers often feel their efforts are not fully utilized and struggle to meet the high academic standards set by the education curriculum. At times, they may also be uncertain about their roles in the classroom, particularly in balancing teacher-led instruction with child-led play. Since play-based activities can take longer than planned, following a strict schedule becomes difficult. Teachers must be skilled in managing students during child-led play to maintain classroom control while ensuring academic learning is not compromised. Additionally, many teachers have not had systematic exposure to programming, science, or other STEM subjects since their own education. As a result, they may find it challenging to implement educational robotics activities and may lack confidence in doing so. Providing teachers with workshops to develop and apply robotics-based learning materials can help bridge this gap and enhance their competence (Papadakis, 2021).

Besides, Hoang and Dang (2021) assume that STEAM education training sessions for preschool teachers are usually conducted over a few sessions, primarily focusing on theoretical discussions. As a result, they fail to highlight the distinct characteristics and role of STEAM education in early childhood learning. Consequently, many teachers attending these training sessions or professional development workshops find them no different from the current educational approach.

This highlights the need for training and capacity-building in STEAM education for preschool educators, as well as the necessity for teacher training institutions to pay more attention to equipping students with knowledge and skills related to STEAM education while they are still in school. In Vietnam, access to STEAM at the preschool level is still in its very early stages. Therefore, this issue needs to be emphasized to prepare a generation of preschool educators who can comprehensively meet the requirements for access to STEAM in the future.

2.2. Measures to enhance access to STEAM education for students in preschool education

2.2.1. Integrating theoretical content on STEAM education in preschool education training module

- **Objectives:** To develop theoretical knowledge about STEAM education, including concepts, content, planning, implementation, assessment, and the conditions for organizing activities for students in the preschool education program through the teaching of training

modules in the curriculum.

- **Content and implementation methods:**

- *Establishing a Theoretical Framework for STEAM Education in Preschool Education Curriculum:*

The theoretical framework for STEAM education encompasses five key principles: integration of STEAM content, problem-based learning, discovery-based learning, creative expression, and collaborative learning. These five components are developed based on Vygotsky's social constructivism theory, focusing on preschool-aged learners. In the preschool program, STEAM education is integrated based on these five principles to develop children's understanding and awareness of the nature of science, technology, engineering, arts, and mathematics. This integration aims to help children maintain and develop a lifelong love for learning in these subjects through effective interaction among influential factors such as infrastructure, management personnel, teacher knowledge and skills, family involvement, and children's basic skills.

- *Integrating Theoretical Content on STEAM Education within Specialized Training Modules:*

In the bachelor's program for preschool teacher training, the STEAM educational model can be effectively integrated into several compulsory courses, such as "Methods for Organizing Creative Activities for Preschoolers" and "Methods for Introducing Preschoolers to Mathematics". In particular, the course "Methods for Organizing Creative Activities for Preschoolers" demonstrates strong alignment with several fundamental characteristics of STEAM education (Pham, 2020). This integration not only enhances the relevance of course content but also supports the development of interdisciplinary thinking, problem-solving skills, and creativity—core competencies promoted by the STEAM approach. Specifically, when applying the STEAM method in organizing the course, instructors should reference the characteristics of the STEAM approach to exemplify organizing creative activities for children. Integrating STEAM education in organizing creative activities involves blending knowledge and fields simultaneously, not solely focusing on the arts. The course "Methods for Introducing Preschoolers to Mathematics" can be integrated through the design of interdisciplinary lesson plans and the organization of classroom activities that promote experiential learning. The introduction of basic mathematical symbols for preschoolers can occur both during class and outside of regular teaching hours. While teaching in class, students design lessons that utilize content learned and available materials in the classroom to implement games, tours, exhibitions, etc., to reinforce knowledge and stimulate children's interest in learning. Students utilize hands-on activities with objects to create specific products and use questioning techniques to help children analyze, compare, contrast, and generalize essential issues.

- *Implementing Extracurricular Programs on STEAM Education Themes:*

During the training of preschool education students at teacher education universities and colleges, extracurricular programs not only provide opportunities for interaction among students within and outside the school but also help students expand and develop essential knowledge and professional skills. The theme of STEAM education is regarded as a global educational trend; thus, department activities or clubs at the school should utilize STEAM education as a topic for students to explore, discuss, and engage with, thereby expanding their knowledge and developing a more accurate perception of STEAM education.

- **Implementation conditions:**

The effectiveness and feasibility of this measure rely on ensuring legal compliance in developing and updating the curriculum to meet societal needs. It is essential to guarantee the principle of integrating theoretical content into STEAM education, to become an evaluation criterion in the training modules.

2.2.2. Organizing activities to develop skills in implementing steam education in pedagogical training modules for preschool education students

- **Objectives:** To develop skills for applying STEAM education for preschool education students by incorporating STEAM into activities during regular pedagogical skills competitions, including pedagogical knowledge, handling pedagogical situations, public speaking, designing educational toys for preschoolers, and organizing teaching activities, thus providing students the opportunity to explore and implement STEAM ideas into practice.
- **Content and implementation methods**

The content of STEAM education will be included as a primary focus in the Pedagogical Skills competitions. For the activity of designing educational toys for preschool children during the pedagogical skills competition, students can utilize models integrating STEAM education, which includes science, technology, engineering, mathematics, and arts education.

For instance, a magnifying glass is a simple yet powerful tool for early science exploration, allowing preschoolers to observe objects closely and discover hidden details. It fosters curiosity, critical thinking, and an appreciation for the natural world. Besides, coding toys like programmable robots and coding kits introduce preschoolers to basic technology knowledge through play. By arranging coding blocks or using simple interfaces, they learn to control robots, fostering computational thinking and problem-solving skills. In addition, toys that mimic real-world engineering tasks, like bridge-building kits or simple machine sets, offer hands-on learning experiences. By constructing bridges, ramps, or pulley systems, preschoolers explore concepts such as load-bearing, leverage, and mechanical advantage while enhancing problem-solving and spatial reasoning skills. Toys like counting bears, number puzzles, and abacus sets help preschoolers practice counting, addition, and subtraction through hands-on play. These activities build numerical fluency and foster a deeper understanding of math concepts beyond simple memorization. Art supplies like crayons, markers, paints, and clay let preschoolers explore colors, textures, and shapes in a

sensory-rich way. Through hands-on creation, they develop fine motor skills, hand-eye coordination, and spatial awareness while expressing their ideas visually.

The model incorporating science education encompasses elements related to the environment and supportive activities to encourage children to explore and investigate natural phenomena (Monkeviciene et al., 2020). Additionally, the design competition for educational toys is not solely a creation by the teacher; it also provides children with the opportunity to co-create with the teacher. The activity should foster children's curiosity about the elements constituting the model through observation and conclusion (Ata Aktürk & Demircan, 2017). The design of educational toys integrated with technology education will require applying the E-E-R process (Engage - Explore - Reflect) (Monkeviciene et al., 2020). This process will stimulate the exploration of the structure and function of tools, simple mechanisms, and devices (Aktürk & Demircan, 2017). Through technology education within STEAM, mathematical skills are also supported by using Lego blocks and robotics kits and identifying the properties of objects. Thus, participating in activities to design educational toys integrated with STEAM education allows students to experience STEAM education concepts in both teaching and learning roles.

- **Implementation conditions:**

To optimize the implementation of integrating STEAM education into regular pedagogical skills competitions, specifically in the activity of designing educational toys for preschoolers, students need to be equipped with an initial understanding of STEAM education concepts, practical implementation of STEAM education ideas, and supporting tools. Additionally, consensus and encouragement from the teacher training institution and the preschool education department are essential conditions for implementing this measure.

2.2.3. Organizing collaborations with preschool education institutions for students to experience steam education activities

- **Objectives:** To create opportunities for preschool education students to experience the practical applications of STEAM education in children's learning and play activities. Students will have the chance to observe specific activities of STEAM educational models in actual classroom organization at preschool institutions, compare them with knowledge learned and theoretical understanding of STEAM education in the preschool education program, and draw lessons and practical experiences about organizing STEAM educational activities for effective use after graduation.
- **Content and implementation methods:**

Investigating the Practical Organization of STEM Education in Preschool Institutions:

According to Vu (2020), preschool institutions currently have ongoing activities connecting subjects such as science and technology and introducing mathematics and art in the application of STEM/STEAM in teaching children. However, these connected activities are still not cohesive. Therefore, a systematic implementation is required for activities

exploring the practical organization of STEAM education in preschool institutions for students (Vu, 2020).

Providing Students with STEAM Activities and Guiding Teaching Methods in STEAM for Preschool Institutions:

In addition to theoretical knowledge about STEAM education, students will be provided with and introduced to STEAM activities commonly applied in preschool institutions. These include scientific exploration, natural discovery, exploration of robots and transportation means, assembling shapes and blocks, recognizing and creating using familiar materials, arranging objects based on characteristics and order, manipulating materials, changing colours of objects, creative decorating, and using 3D and 4D visuals. STEAM education is used in various contexts in preschool settings, including outdoor play, indoor play, class hours, group activities outside of class, and individual activities outside of class. To implement the STEAM model in teaching, students can employ measures such as creating interest and curiosity in children regarding STEAM topics and posing intriguing questions to encourage children to express what they know or think about the issues being explored. In the STEAM classroom, teachers should always encourage children to work together without direct guidance. The teacher's role in the STEAM classroom is to observe and listen as children interact and collaborate. For issues that need to be resolved, teachers provide children with a set time to address the problem and encourage them to explain and articulate their discoveries in their own words. This way, children can draw conclusions based on evidence with the teacher's supportive guidance.

- **Implementation conditions:**

Ensure that the quality of preschool education institutions meets the theoretical foundation of STEAM education and legal bases according to regulations from the Ministry of Education and Training and the Department of Education and Training. Ensure that the physical facilities of preschool education institutions meet the requirements for organizing STEAM educational activities. Ensure safety for children when students visit preschool education institutions.

2.2.4. Utilizing Teaching Methods Related to STEAM Education in the Training of Preschool Education Students

- **Objective:** Instructors should use teaching methods related to STEAM education, including problem-based learning and project-based learning, in teaching activities for preschool education students to help them become familiar with and experience the characteristics of STEAM education in their studies.

- **Content and implementation methods:**

- *Content of Teaching Methods Related to STEAM Education Used in Preschool Education Students:*

The use of problem-based and project-based learning methods in teaching and training

students is one of the active teaching strategies that effectively address practical requirements. Through real-life problem scenarios, students can experience and develop the necessary skills for their future professional activities (Trinh, 2018). Utilizing problem-based methods helps students have opportunities for collaboration, exchange, and access to the pedagogical environment and vocational reality while linking theory to practice. Consequently, students actively interconnect and weave various individual content areas into a cohesive picture of STEAM education and its application in the preschool education program, meeting societal demands. Project-based learning enables students to acquire knowledge, skills, and attitudes through working over a certain period to investigate and solve practical problems (Nguyen, 2017). Project-based learning requires students to combine group work and individual work, focusing on both theoretical and practical products of their activities. Thus, it is evident that problem-based and project-based methods meet the elements of STEAM education theory in the preschool education program.

- *Implementation Procedures for Problem-Based and Project-Based Learning Methods in STEAM-Integrated Preschool Education Curriculum:*

The implementation of the problem-based method begins with constructing problem scenarios. Specifically, this involves determining the learning content objectives, identifying questions or scenarios, gathering information, and creating the scenario. Next, instructors outline the scenario and prepare the case study to edit, revise, and test before presenting and announcing it to the class group. After receiving the scenario, students resolve the issue under the guidance and organization of instructors. Upon completing the scenario resolution, students present their or their group's proposed solutions. The proposed solutions are discussed, evaluated, and summarized by instructors and students in class. In the case of project-based learning, instructors select learning content with tasks that can be executed in real life. They develop project ideas and identify resources to support students. Following that, instructors divide students into groups to implement the project and establish specific project tasks. Students execute the project within the permitted timeframe and context. Students or student groups present the products and results of their project alongside evaluations and summaries by the instructor after a specified duration.

- **Implementation conditions:**

Certain conditions must be fulfilled to ensure the quality of the aforementioned teaching methods, such as ensuring the presented scenarios and projects contain conflicts and are linked to the educational content but remain feasible, engaging, and stimulating for students. Projects must have detailed implementation plans, account for specific resources, and not execute too many projects in one semester. The quality of the project should be assessed based on detailed tools for progress evaluation and summative assessment under the ongoing monitoring and supervision of instructors.

3. Conclusion

The application of STEAM education in preschool education brings numerous benefits to preschool children, and STEAM education has become a significant trend in preschool institutions. This article presents measures to enhance students' access to STEAM education in the preschool education program to address current deficiencies in knowledge, skills, and confidence regarding their access to STEAM education. These measures contribute to improving the quality of training for preschool education students at educational institutions.

❖ ***Conflict of Interest:*** *Author have no conflict of interest to declare.*

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MỘT SỐ BIỆN PHÁP NÂNG CAO MỨC ĐỘ TIẾP CẬN GIÁO DỤC STEAM CHO SINH VIÊN NGÀNH GIÁO DỤC MẦM NON

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TÓM TẮT

Sinh viên ngành giáo dục mầm non sẽ là những giáo viên mầm non trong tương lai và sự thành công của các phương pháp mới như STEAM phụ thuộc phần lớn vào việc họ tiếp cận, chấp nhận và áp dụng những phương pháp này trong thực tiễn hoạt động nghề nghiệp. Bài viết này phân tích thực trạng mức độ tiếp cận giáo dục STEAM của sinh viên ngành giáo dục mầm non và đề xuất một số biện pháp nâng cao mức độ tiếp cận giáo dục STEAM cho sinh viên ngành Giáo dục mầm non. Để ứng dụng STEAM vào giáo dục mầm non một cách hiệu quả đòi hỏi giáo viên mầm non là những người trực tiếp thực hiện chương trình giáo dục mầm non cần có kiến thức, kĩ năng và sự tự tin trong tiếp cận giáo dục STEAM. Những yếu tố này không chỉ phụ thuộc vào nỗ lực của giáo viên, vào quá trình tập huấn, bồi dưỡng năng lực giáo dục STEAM cho giáo viên mầm non mà còn đòi hỏi các cơ sở đào tạo giáo viên mầm non quan tâm hơn đến việc chuẩn bị cho sinh viên những kiến thức và kĩ năng liên quan đến giáo dục STEAM ngay khi còn ngồi trên ghế giảng đường.

Từ khóa: giáo dục STEAM; tiếp cận giáo dục STEAM; tiếp cận giáo dục STEAM của sinh viên ngành giáo dục mầm non