

STEAM Model: An innovative pedagogical approach that promotes the comprehensive development of early childhood education students

Modelo STEAM: Enfoque pedagógico innovador que favorece el desarrollo integral de estudiantes de educación inicial

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ABSTRACT

This article aims to analyse the STEAM model as an innovative pedagogical approach that promotes the comprehensive development of early childhood education students in the Ecuadorian context. A review of 26 scientific papers was conducted. In an Ecuadorian context characterised by cultural and geographical diversity, STEAM adapts to local educational needs, promoting the comprehensive development of students through a combination of cognitive, social and emotional skills. The use of emerging technologies in the classroom facilitates dynamic and collaborative learning, promoting inclusion and equity. Therefore, the integration of the arts allows students to express their creativity and understand the world critically. This approach contributes to the formation of responsible, creative citizens capable of facing the global challenges of the 21st century, aligning with national educational policies that seek to improve the quality of education in Ecuador.

Descriptors: preschool children; nursery schools; day nurseries. (Source: UNESCO Thesaurus).

RESUMEN

Este artículo se inserta el objetivo de investigación basado en analizar el modelo STEAM como enfoque pedagógico innovador que favorece el desarrollo integral de estudiantes de educación inicial en contexto ecuatoriano. Se trabajó en la revisión documental de 26 trabajos científicos. En un contexto ecuatoriano caracterizado por su diversidad cultural y geográfica, STEAM se adapta a las necesidades educativas locales, promoviendo el desarrollo integral de los estudiantes mediante la combinación de habilidades cognitivas, sociales y emocionales. El uso de tecnologías emergentes en el aula facilita un aprendizaje dinámico y colaborativo, favoreciendo la inclusión y la equidad. Por lo tanto, la integración de las artes permite a los estudiantes expresar su creatividad y entender el mundo de manera crítica. Este enfoque contribuye a formar ciudadanos responsables, creativos y capaces de enfrentar los desafíos globales del siglo XXI, alineándose con las políticas educativas nacionales que buscan mejorar la calidad educativa en Ecuador.

Descriptores: niño en edad preescolar; escuela de párvulos; guardería infantil. (Fuente: Tesauro UNESCO).

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Review articles



INTRODUCTION

Education in Ecuador faces the constant challenge of adapting to global changes, promoting inclusive, equitable, and quality learning that responds to the needs of all students, regardless of their social and cultural context. In this context, the STEAM (Science, Technology, Engineering, Arts and Mathematics) educational model is presented as an innovative pedagogical tool that not only promotes knowledge in scientific and technological disciplines, but also incorporates the arts, contributing to the comprehensive development of students from early education onwards. By integrating multiple disciplines in an interdisciplinary manner, it promotes essential skills such as critical thinking, creativity, problem solving and collaboration, which are necessary skills for facing the challenges of the 21st century (Avendano-Uribe et al., 2022; Hunter-Doniger, 2021).

In Ecuador, cultural, geographical and linguistic diversity requires a flexible pedagogical approach that addresses the particularities of students, respecting their identity and promoting their comprehensive development. The STEAM model, by allowing the inclusion of different areas of knowledge, fits perfectly into this context, as it offers a space for children to develop not only academic skills, but also socio-emotional, cultural and creative competencies. In this way, STEAM promotes a comprehensive education that fosters meaningful learning, active participation and student empowerment (Bhor & Varghese, 2024; Başaran & Bay, 2023).

Consequently, the implementation of the STEAM model in early childhood education in Ecuador has the potential to transform the way teachers approach teaching, integrating innovative methodologies that promote active and collaborative learning. In this sense, project-based teaching practices, the use of emerging technologies, and interdisciplinary work allow students to become active participants in their learning process, developing a closer and more



meaningful relationship with the educational content (Kangas, Sormunen, & Korhonen, 2022; Li et al., 2022). Thus, the STEAM model not only enriches academic knowledge but also fosters the development of critical, creative citizens who are committed to their community and the environment (Rodrigues-Silva & Alsina, 2023).

This pedagogical proposal is aligned with national education policies, which seek to improve educational quality in Ecuador by addressing the challenges of the education system through the implementation of innovative approaches that integrate science, technology, mathematics and the arts. Through the adoption of STEAM, Ecuador has the opportunity to train students capable of facing global challenges with a critical and creative vision, using scientific and technological tools in a responsible and ethical manner (Cabello et al., 2021; Marín-Marín et al., 2021). Therefore, this model represents an invaluable opportunity for early childhood education, contributing to the development of a more equitable, inclusive society that is prepared for the challenges of the future.

In accordance with the above, the research objective is to analyse the STEAM model as an innovative pedagogical approach that promotes the comprehensive development of early childhood education students in the Ecuadorian context.

Theoretical contribution

The STEAM model, which integrates the disciplines of Science, Technology, Engineering, Arts, and Mathematics, has emerged as a promising educational strategy in modern teaching. In the Ecuadorian context, its implementation is particularly relevant due to the challenges faced by the education system in terms of inclusion, equity, and educational quality. Ecuador, with its cultural and geographical diversity, requires flexible pedagogical approaches that respond to the specific needs of its students, who come from diverse social, cultural and economic backgrounds. In this sense, the STEAM approach not only addresses the development of cognitive skills in academic areas, but also promotes the



comprehensive development of students, fostering their creativity, social and emotional skills.

The integration of the arts into the STEAM model is particularly relevant in the Ecuadorian context, a country with a rich cultural diversity, where traditions and artistic expressions play a central role in the identity formation of children and young people. The combination of scientific and artistic disciplines offers a way for students to not only acquire technical knowledge, but also develop the ability to express themselves and understand the world in a creative and critical way (Avendano-Uribe et al., 2022; Bhor & Varghese, 2024). Likewise, the incorporation of the arts into early education promotes skills that go beyond academic knowledge, such as empathy, cooperation and communication, which are essential for the formation of responsible citizens who are committed to their social and cultural environment (Hunter-Doniger, 2021).

In Ecuador, the implementation of the STEAM model has been driven by various government initiatives and educational projects at the local and regional levels. Programmes such as 'Pequeños Científicos' (Little Scientists) have shown positive results in the teaching of science and mathematics in basic education through the integration of innovative approaches that encourage critical thinking and problem solving (Cabello et al., 2021). These initiatives have demonstrated that by promoting active and participatory learning, students not only improve their academic performance, but also develop a positive attitude towards learning and greater confidence in their abilities.

The use of emerging technologies has also had a significant impact on STEAM education in Ecuador, as technological tools such as robotics and educational applications allow for greater interaction with content and promote more dynamic and personalised learning. In this regard, Kangas, Sormunen & Korhonen (2022) mention that the use of technologies in the classroom not only facilitates the understanding of complex concepts, but also allows students to explore their



creativity and apply what they have learned in practical contexts. In the Ecuadorian context, the incorporation of these technologies is crucial, as it facilitates the overcoming of geographical and social barriers, allowing more children and young people to have access to quality education, regardless of their location.

Therefore, the impact of STEAM on early childhood education has shown that this model contributes to the development of social and emotional skills, in addition to cognitive skills. In response to this, Başaran & Bay (2023) highlight that STEAM activities, being project-based, encourage collaboration among students and teach them to work as a team to solve problems. This perspective is especially relevant in Ecuador, a country that faces challenges in terms of social cohesion and the inclusion of historically marginalised populations. In this way, the STEAM model offers a space for students, regardless of their background, to collaborate and learn from each other, promoting an inclusive environment that values diversity.

In this sense, the STEAM model fits perfectly with national education policies that seek to promote inclusive and quality education. Through its comprehensive approach, STEAM allows students to develop not only academic knowledge but also soft skills essential for their personal and professional development. In this sense, the Ecuadorian education system has begun to adopt more flexible approaches that integrate different areas of knowledge, facilitating the formation of well-rounded students capable of facing the challenges of the contemporary world (Dúo-Terrón et al., 2022). However, challenges remain in terms of technological infrastructure and teacher training, which must be addressed to ensure the successful implementation of the model in all regions of the country.

Furthermore, the STEAM model's pedagogical approach is also aligned with the principles of Universal Design for Learning (UDL), which promotes flexibility in teaching to cater to the diversity of students. In Ecuador, where cultural, linguistic



and cognitive diversity is a determining factor, the STEAM model, with its multidisciplinary and flexible approach, is an appropriate strategy for responding to the needs of all students, providing them with opportunities to learn according to their interests and learning styles (Li et al., 2022; Rodrigues-Silva & Alsina, 2023).

METHOD

This study is part of a documentary review methodology, whose main objective is to analyse the current state of integration of the STEAM model in early childhood education, with an emphasis on the Ecuadorian context. This review focused on the compilation and analysis of 26 scientific papers that address both international experiences in the implementation of the STEAM model and its adaptation to the Ecuadorian educational reality.

The criteria for including articles in the review were based on their relevance to the central themes of the study: early childhood education, the STEAM model and its applicability in diverse contexts, with an emphasis on the Ecuadorian context. Priority was given to studies that presented empirical results and theoretical reviews related to the implementation of STEAM in primary and early childhood education, teacher training in STEAM, and the impact of this approach on students' cognitive, social, and emotional development.

The document analysis was carried out using a qualitative approach, focusing on identifying and extracting the main themes and patterns emerging from the selected texts. To this end, each of the 26 scientific papers was read, highlighting points related to the application of the STEAM model in early childhood education, the integration of disciplines, the use of technologies and the pedagogical methodologies employed.



RESULTS

The implementation of the STEAM model in early childhood education offers a transformative pedagogical perspective that responds to the need to develop cognitive, emotional, and social skills in children from the earliest stages of their academic training. The STEAM approach, which integrates Science, Technology, Engineering, Arts and Mathematics, has proven to be an effective tool for fostering critical thinking, creativity and problem solving, essential qualities in today's world. This model is perfectly suited to the Ecuadorian educational context, characterised by its cultural and geographical diversity, which requires inclusive and flexible pedagogical methods that can meet the diverse needs of students.

One of the essential elements of STEAM is its interdisciplinary approach, which not only promotes learning in specific areas but also integrates different disciplines in a holistic manner. Therefore, it is not just an educational trend but a response to the demands of the 21st century, where education must prepare students not only with knowledge but also with skills to face complex and dynamic challenges. In this sense, studies have shown that the STEAM model contributes significantly to the development of cognitive skills in younger students, favouring both their ability to understand scientific and mathematical concepts and their ability to apply creativity through art (Bertrand & Namukasa, 2023; Bhor & Varghese, 2024).

The use of STEAM-based projects has been highlighted by various authors as one of the best practices for promoting meaningful learning in early education. According to Başaran & Bay (2023), STEAM activities in preschool education not only foster the development of cognitive skills, but also social skills, such as collaboration and communication. These projects allow children to work together to solve complex problems, which helps them understand the importance of teamwork and develop social skills essential for their comprehensive



development. It is important to note that the use of project-based learning methodology has a positive impact on student motivation, a fundamental factor in maintaining their interest and commitment to the educational process (Li et al., 2022; Hunter-Doniger, 2021).

Therefore, the STEAM approach is presented as a driver of creativity, in which, according to Kangas, Sormunen & Korhonen (2022), emerging technologies play a crucial role in the integration of this pedagogical model, as the use of technological tools such as mobile applications and robotics not only facilitates the learning of science and mathematics, but also allows children to express their creativity through artistic means. In this sense, the combination of art and technology in the classroom offers fertile ground for the development of interdisciplinary projects that foster innovation and critical thinking. This approach also reinforces students' ability to understand and apply abstract concepts in a practical and dynamic context, which improves knowledge retention (Wahyuningsih et al., 2020; Zhan et al., 2023).

On the other hand, the implementation of STEAM in early education not only benefits students, but also has a positive impact on the professional training of teachers. Consequently, the model requires educators to not only possess knowledge in specific areas, but also to be able to integrate different disciplines in a creative and effective manner. This implies that teachers must update their pedagogical skills and adopt a flexible and adaptable approach in their daily practice (Monkeviciene et al., 2020). The use of STEAM in teacher training contributes to the professionalisation of educators, enabling them to address student diversity and adapt to their particular needs (Pant et al., 2020). This approach also fosters a culture of continuous learning, which is key in the digital age, where educational demands are constantly evolving.

The application of STEAM also has a direct impact on the sustainability of learning, particularly in terms of research and analysis skills. According to



Rodrigues-Silva & Alsina (2023), the STEAM model in early childhood education promotes sustainable inquiry behaviours, allowing students to develop a deep understanding of social and environmental issues. This prepares children to address global challenges through an integrated approach that encompasses both science and the arts, enabling meaningful learning that lasts over time.

In the Ecuadorian context, the adoption of the STEAM model could contribute to overcoming gaps in access to quality education, as the country's social and cultural diversity requires inclusive education that values different forms of knowledge and expression. In this sense, the STEAM model allows students to learn in a contextualised way, actively involving them in their environment and local issues, which enhances their sense of belonging and social responsibility (Cabello et al., 2021; Dúo-Terrón et al., 2022). By integrating the arts and local culture, the model not only fosters intellectual development but also an appreciation for cultural identity, a cross-cutting issue in a country as diverse as Ecuador.

CONCLUSION

The STEAM model is presented as an innovative and flexible pedagogical strategy that effectively responds to the needs of the Ecuadorian education system, characterised by its cultural, social and geographical diversity. By integrating scientific disciplines with the arts, it not only promotes students' cognitive development, but also fosters socio-emotional skills and key competencies such as critical thinking, creativity and problem solving. This interdisciplinary approach enables students to tackle complex and dynamic challenges, preparing them for a globalised future. Furthermore, the implementation of emerging technologies in the educational process helps to overcome geographical and social barriers, facilitating access to equitable and quality education. In this way, STEAM aligns with Ecuador's goals of inclusive and quality education, shaping students with a critical, creative, and responsible mindset, capable of addressing the challenges of the 21st century.



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