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The Steam Educational Approach in the Pedagogical Practice of Early Childhood Teachers: Reality or Utopia?

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Abstract

The STEAM educational approach with the passage of time has been contributing to the improvement of the effectiveness of the teaching process at different educational levels, since its interdisciplinary approach supported by the implementation of active methodologies such as project-based learning or gamification along with collaborative work, have allowed to ensure the active participation of students. Mixed research is carried out to report the competencies around this educational approach that exhibits a probabilistic sample of teachers linked to the official sector of a Colombian border city, who work in the Transition grade. The results show an incipient implementation process propitiated by the lack of teacher qualification around this educational approach, which demands public policies aligned with this approach that permeate school curricula together with their institutional pedagogical models and thus guarantee the development of the competencies demanded by today's society. Complementarily, the need to consider and work on the socioemotional competencies of both teachers and students was identified. It is expected that these results will contribute to the transformation of educational processes where the student is an active agent in his or her education, framed in relevant activities aimed at solving problems observed in everyday life.

Keywords: *STEAM, Early Childhood Education, Pedagogical Process, Competencies for the 21st Century.*

Introduction

Contextualization. The STEAM (Science, Technology, Engineering, Arts, and Mathematics) educational approach emerges as an interdisciplinary proposal that integrates the teaching of these five disciplines along with the other disciplines of the school curriculum, all with the purpose of addressing real-world problems. A characteristic feature of this educational approach is that the various disciplines are expected to interact in an articulated and complementary manner, thus ensuring not only the understanding and development of the cognitive component, but also the promotion of creative skills, problem solving and innovation, essential aspects to meet the challenges of this new century (Alsina, 2020; López et al., 2020).

In the current educational context, STEAM has gained recognition as a transformative approach, capable of fostering in students' competencies such as critical thinking, collaboration, communication and digital literacy (Rodríguez, 2024). Competencies demanded by a labor market characterized mainly by being increasingly technological and globalized, which expects from the educational process its contribution in the formation of citizens capable of understanding, analyzing and contributing to the dynamics of this contemporary world. This approach connects what happens in the student's context with classroom activities, through the implementation of active methodologies such as project-based learning or gamification, providing the student with a leading role in his own learning.

In this context, reflecting on the viability of STEAM in early childhood not only requires analyzing its potential benefits, but also questioning the structural and pedagogical conditions that allow it to become a transformative tool in early education, as outlined in the work of Cardona & Rodríguez (2021).

The incorporation of STEAM in early educational stages, such as early childhood (ages 4 to 6), poses challenges and opportunities, since, at this stage, children are natural explorers given their innate curiosity, creativity and strong desire to interact with the environment. These characteristics make early childhood a

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propitious time to introduce STEAM activities that develop fundamental skills such as observation, questioning and experimentation, where children begin to lay the foundations for logical, creative and collaborative thinking (Romero & Díaz, 2022).

However, the implementation of the STEAM approach in teaching practice during early childhood faces significant barriers. Among them are the lack of specialized training for educators, insufficient resources, and curricular limitations that do not always favor interdisciplinary approaches. This scenario raises the question of whether it is possible to transcend the current limitations to effectively integrate this approach into the classroom, or whether its application at this crucial stage of development is more of an aspiration than a reality.

Importance of the STEAM approach in Early Childhood. Early childhood is a crucial stage in human development, characterized by the acquisition of fundamental skills at an accelerated rate of learning. In these early years of life, the brain reaches its greatest plasticity, allowing the formation of neural connections essential for cognitive, socioemotional and creative development. Research in neuroscience and developmental psychology such as that of Delgado (2018) and Berger (2007) highlight that experiences lived in early childhood have a significant impact on the construction of skills such as problem solving, communication, critical thinking and the ability to work in teams, competencies that are the basis for lifelong learning.

The STEAM educational approach could become an ideal pedagogical tool to enhance competencies from early childhood, since it promotes the innate curiosity of infants through exploration and discovery. Through practical activities based on everyday life, such as the construction of structures with recycled materials, the observation of natural phenomena or artistic creation combined with mathematical concepts, fostering cognitive skills together with creativity and emotional intelligence.

The educational objectives of early childhood seek to form integral, curious children with skills to face challenges, so the STEAM approach not only stimulates cognitive development through problem solving and experimentation, but also strengthens socioemotional skills through teamwork, effective communication and empathy (Santillán-Aguirre et al., 2020). By including the arts in its structure, STEAM broadens its impact by stimulating imagination and creativity, essential aspects in the integral development of the child.

Despite the mentioned barriers that this educational approach must face, STEAM represents a unique opportunity to transform educational practices and provide children with essential tools to cope in a constantly changing world, recognizing that early childhood is the foundation for learning, since it is a strategic period for promoting in children the desire to explore, create and learn in an active and meaningful way.

Challenges and limitations in the implementation of the STEAM educational approach. In the process of implementing this approach in early childhood, multiple challenges arise that limit its effective adoption in educational environments, being the qualification of teachers one of the main challenges, since many educators do not have the necessary skills to design and implement interdisciplinary activities that integrate STEAM disciplines in an adequate and coherent manner; a situation that fosters resistance to innovative approaches, given the overburdened by curricular and administrative demands.

Additionally, the lack of didactic materials, adequate spaces for hands-on learning and accessible technologies restricts the possibilities of developing enriching STEAM experiences, thus deepening educational gaps or inequalities, especially in vulnerable contexts.

On the other hand, at the institutional level, traditional curricula separate disciplines into compartments, making it difficult to implement an interdisciplinary approach. Likewise, educational policies and the prioritization of evaluation standards focused on specific content often ignore the critical skills promoted by the STEAM approach, such as creativity, critical thinking and collaborative work (García, 2023; García et al., 2022).

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These challenges raise the question of whether the integration of STEAM into early childhood teaching practice an achievable goal or an idealistic aspiration is. Although scientific evidence supports the benefits of this approach for children's holistic development, its implementation requires a significant cultural and structural change in educational systems. Without a clear commitment on the part of the institutions, accompanied by investments in teacher training, resources and curricular flexibility, STEAM runs the risk of remaining a utopian proposal, difficult to materialize in the day-to-day classroom.

Literature Review

The following are those publications located in Google Scholar in Spanish, whose publication date corresponds to the period between 2020 and 2024, which show the effects of the implementation of the STEAM approach in early childhood education (consulted on December 7, 2024).

The integration of the STEAM approach in early childhood education has gained relevance in recent educational literature, evidencing both significant benefits and challenges in its implementation, for example, Castro-Zubizarreta et al. (2024) perform a global analysis on the application of STEAM in early childhood education, highlighting its limited development, but noting notable improvements in creativity, critical thinking and problem- solving. They stress the importance of integrating the arts into the STEM model to create meaningful connections between disciplines, although they identify barriers such as the lack of a clear conceptualization and its curricular integration in early age contexts.

In line with this, Rodríguez (2024) explores the implementation of STEAM projects in preschool, observing positive impacts on cognitive, creative and social skills. However, he points out obstacles such as the limited use of technology and the need for teacher training, emphasizing the importance of adequate planning to maximize the impact of the approach.

The relationship between STEAM and playful learning is examined by Rodrigues-Silva & Alsina (2023), who highlight four playful methodologies (free play, guided, formal and gamification) linked to the development of skills such as creativity and critical thinking. They highlight that, in early childhood, free play enhances STEM thinking precursor skills, while guided play can counteract gender biases in areas such as engineering. Both approaches require skilled teachers who are tolerant of ambiguity, underscoring the need to strengthen the STEAM-play convergence.

Raposo-Rivas et al. (2022) analyze 36 international studies on the use of robotics in early childhood education within the STEAM approach. Although they show the potential of robotics to foster skills such as computational thinking, creativity and collaboration, only 19% (approximately) of the studies address STEAM projects that fully integrate the five disciplines. They also highlight an underrepresentation of the areas of art and engineering and limited consideration of gender aspects.

In the area of sustainability and healthy habits, Silva-Hormazábal et al. (2022) describe a STEAM activity implemented in a multigrade group, integrating mathematics and science to promote food literacy. Through playful and contextualized activities, they promote logical- mathematical skills from an early age, demonstrating that STEAM approaches can positively impact vegetable consumption and the integral development of students.

The participation of families in the educational process is addressed by Castillo et al. (2024), who implement pedagogical activities that foster collaboration between school and home, concluding that family collaboration favors comprehensive child development, improves communication between parents and children, and enhances learning based on exploration and curiosity.

In relation to the development of collaborative skills through robotics, Alava & Salas (2024) present a methodological guide that promotes hands-on learning and environmental awareness. Although they highlight significant benefits, they recognize challenges such as the lack of specialized teacher training and adequate technological resources, stressing the importance of fostering collaborative learning aligned with contemporary educational demands.

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Castañeda (2024) analyzes the implementation of the STEAM approach in the early education programs of the Colombian Institute of Family Welfare - ICBF in Colombia. Although a positive impact on the development of key skills such as creativity and critical thinking is observed, challenges such as the lack of continuous teacher training and insufficient technological resources are identified, emphasizing the need for sustainable strategies and specialized training.

The combination of inquiry learning, outdoor education and the 5E model is explored by Fernández & Redondo (2024), who implement activities that develop STEAM and sustainability competencies in children aged 3 to 4 years, showing significant improvements in critical thinking, problem solving and respect for the environment, although they point out the need for institutional support and specific training in STEAM and sustainability.

García (2023) and García et al. (2022) analyze the integration of the STEAM approach in early childhood education and its presence in official curricula, identifying benefits in the development of critical thinking, creativity and collaboration, but also challenges such as the low integration of disciplines such as technology and engineering, the lack of transversality in STEAM projects and the limited consideration of the gender perspective.

The integration of STEAM to address environmental issues is presented by Laso & Hernández (2023), who implement an educational proposal focused on sustainability and the care of bees, highlighting as findings that STEAM methodology promotes skills such as critical thinking and environmental awareness from an early age, although they highlight the need to adapt the activities to the capabilities of children and specific teacher training.

The importance of taking advantage of sensitive periods of neurodevelopment is highlighted by Romero & Díaz (2022), who present a maker-STEAM methodology to develop digital and technological skills and logical-computational thinking from an early age, promoting creativity and the critical use of technologies.

The gender perspective in STEAM is addressed by Juvera & Hernández (2021), who proposed a model of non-formal education with a gender perspective for girls aged 9 to 13, which allowed them to identify motivations and barriers related to gender stereotypes and access to technological resources, concluding that it is essential to mainstream the gender perspective in educational strategies to empower girls and expand their opportunities in STEAM careers.

In the field of teacher training, Cardona & Rodríguez (2021) explore the integration of STEAM in teacher training in early childhood education, highlighting its potential to promote inclusive experiences and meaningful learning, but also the need for specialized training and adaptation of the approach to the formal curriculum.

Alsina (2020) and López et al. (2020) analyze models and strategies for integrating STEAM in early childhood education, emphasizing the importance of working with mathematics and other disciplines in an interdisciplinary and contextualized manner. They present didactic models and strategies that promote key competencies of the 21st century, although they highlight the need for adequate planning, teacher training and pedagogical materials that promote interdisciplinary work.

It is noteworthy that the studies reviewed show that the implementation of the STEAM approach in early childhood education offers significant benefits in the development of essential skills such as creativity, critical thinking, problem-solving and environmental awareness. However, recurring challenges are also identified, such as the lack of specialized teacher training, insufficient technological resources, the need to integrate all STEAM disciplines in a balanced way, and the need to consider the gender and sustainability perspective. Addressing these challenges is fundamental to maximizing the positive impact of the STEAM approach in the early educational stages.

Finally, the purpose of this article is to explore, analyze and discuss the feasibility of implementing the STEAM educational approach in teaching practice during early childhood. In a global context where 21st

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century skills such as critical thinking, creativity, problem- solving and digital literacy are essential, STEAM is positioned as a transformative approach that can prepare infants to face the challenges of an ever-changing world. However, its application in the early years of educational training poses both opportunities and challenges that merit in-depth analysis.

The main objective of this article is to investigate whether the integration of STEAM in early childhood education is an achievable goal within current educational systems or whether, on the contrary, it is an idealistic aspiration that faces structural and cultural barriers that are difficult to overcome. This analysis considers fundamental aspects such as teacher training, educational resources, institutional policies and the adaptability of the approach to the unique characteristics of early childhood.

Within this framework, it seeks to offer a critical and reflective view that not only contemplates the potential benefits of STEAM, but also identifies the limitations and challenges associated with its implementation. Key questions will be raised, such as: are early childhood teachers prepared to adopt an interdisciplinary and active approach such as STEAM, do the necessary pedagogical and technological resources exist in educational institutions to guarantee its success, and does the current curricular framework allow for the effective integration of this approach in early childhood classrooms?

With this paper, the authors aspire to contribute to the debate on the future of early childhood education, opening a space for discussion on how to transform barriers into opportunities and how public policies, teacher training strategies and curriculum design can facilitate this transition. Ultimately, the intention is to answer whether the application of the STEAM approach in early childhood is a feasible reality or whether it is still in the realm of educational utopia. This analysis, based on evidence and experiences, seeks to offer practical and strategic orientations to advance towards an innovative and inclusive early education that is aligned with the demands of the 21st century.

Methodology

For the development of this pedagogical research, a mixed sequential descriptive design is adopted, which begins with the collection of data through a questionnaire for a descriptive quantitative analysis that was filled out by a sample of participating teachers. Subsequently, a selection of three teachers were selected for an in-depth interview that allowed the collection of complementary data for the qualitative analysis.

The population of interest is made up of teachers employed by the Municipal Secretary of Education of a capital city of Colombia who work in the Transition grade, totaling 283 professionals. A probabilistic sample was selected under the simple random sampling technique of 122 professionals, who were extracted from a list provided by said municipal entity. Initially, a sample size of 204 people was obtained using the finite population formula with the following parameters: a) margin of error of 2.8%; b) confidence level of 95%; c) population size of 283; d) probability that the selected teacher has a degree in Early Childhood Education or related subjects 0.78; but later an adjustment was made to finally reach the sample size mentioned above. In a complementary manner, a focus group of three teachers was generated, who made up the qualitative sample; they were selected considering their institutional leadership, their professional training together with their years of experience as teachers and their commitment to continuous improvement.

Regarding the instruments for data collection, for the quantitative phase, a questionnaire designed and validated by Prada et al. (2024) was applied, consisting of 51 items distributed in the following categories of competencies in: active pedagogies, innovation and creativity, disciplinary integration, digital, learning assessment, collaborative work, adaptability and flexibility, inclusion and diversity, educational leadership, critical and professional reflection; which were assessed by means of a five-level Likert scale. Regarding the qualitative phase, a script was designed for the focus group aimed at exploring experiences, barriers and/or potentialities in the implementation of the STEAM approach, consisting of eleven questions (one for each competency mentioned above) together with a final reflection question, in which space was created for the participants to provide additional information they considered relevant. The questions were endorsed by a panel of three experts in the field of education, with lines of research in STEAM education, in Education and Technology, and in the Design of Instruments for data collection.

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Regarding the phases of the research, it began with the quantitative phase, then with the data collected after the application of the questionnaire, descriptive analyses were carried out to identify general trends in the STEAM competencies applied by teachers and ended with an analysis of correlations between various variables of the questionnaire. Then, the qualitative phase allowed to broaden the understanding of the nuances derived from their pedagogical experience in the subject, allowing them to identify obstacles in their implementation process.

Finally, from the triangulation of the information it was possible to contrast quantitative and qualitative findings to validate this research, while identifying the level of STEAM competencies in teachers in order to understand the barriers and opportunities; with which it is expected to contribute to the design of training programs that promote the effective implementation of STEAM in early childhood education, within the framework of an educational public policy..

Results

The results derived from the quantitative phase begin with Table 1 where the general characteristics of the surveyed teachers are identified, highlighting that with respect to the demographic profile there is a predominance of the female gender (Alonso et al., 2022), which in the future could become a difficulty as Redó (2012) points out, since teachers working at this level of schooling are more likely to be affected by emotional fatigue, a situation that worsens with the passage of time, which in this case highlights that one out of every two respondents is 40 years old or younger. Regarding the professional profile, approximately nine out of ten respondents have training for the population to be served, such as a bachelor's degree in early childhood or Initial Education, but few have advanced postgraduate studies, identifying that it is necessary to expand the teaching qualification at this level; it is recognized that in this secretary of education, educational institutions located in urban contexts predominate.

Table 1. Demographic and professional characteristics of respondents

Feature	Response options	Percentage
Genre	Female	96.7
	Male	3.3
	Total	100.0
Age range	Between 20 and 30 years old	24.6
	Between 31 and 40 years old	28.7
	Between 41 and 50 years old	26.2
	More than 50 years	20.5
	Total	100.0
Professional training	Graduate	88.5
	Senior Teacher	11.5
	Total	100.0
Highest level of schooling attained	Undergraduate	50.0
	Specialization	22.1
	Master's Degree	26.2
	PhD	1.6
	Total	100.0
Geographic location of the educational institution	Urbana	91.0
	Rural	9.0
	Total	100.0

To facilitate the interpretation of the results obtained, the authors decided to group the two levels of the favorability scale in a single category called It is applied in the pedagogical activities, in contrast to the two levels of the rejection scale in a single category called It is not applied, and the intermediate or neutral level

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is maintained. Based on the above, Figure 1 shows the level of appropriation of the various competencies associated with the STEAM educational approach in classroom work by Early Childhood Education teachers.

When observing the results, it stands out that Competence in Collaborative Work is the most applied, in one out of two respondents, which reflects the priority of teachers in fostering group dynamics in which infants and in some cases, all members of the educational community participate. The development of activities based on collaborative work during early childhood is fundamental for various reasons that impact the learning and comprehensive development of children, as outlined in Arteaga (2018) through collaborative work, infants are taught social skills necessary for the establishment of healthy and effective relationships with their peers, such as communication, problem solving and empathy. Likewise, by developing group activities, infants develop autonomy along with positive interdependence since each one, as an active member of the group, contributes to the achievement of a common goal. In these workspaces, children freely express their ideas while questioning those of their peers, thus stimulating respect for differences along with critical thinking in search of creative solutions to the challenges or problems proposed.

In contrast, the Disciplinary Integration Competencies are the least applied, with 12%, evidencing a possible area for improvement in the implementation of integrative approaches such as STEAM, concerning the fact that teachers need to be trained in the design and implementation of pedagogical activities that integrate all disciplines of the school curriculum, as highlighted in the work of Pineda (2023) together with Cardona & Rodriguez (2021) by initially recognizing that teachers, according to their professional training, have their own priorities, which hinders the development of collaborative activities, then it is necessary to adapt school curricula to the development of transferable skills over time and not only focused on content, which requires a permanent process of teacher qualification that invites teachers to implement innovative approaches, which can cause anxiety and resistance to change.

Moving forward in this line of analysis, it should be mentioned that competencies related to innovation, such as Innovation and Creativity (33%) and Adaptability and Flexibility (31%), present moderate levels, showing a growing interest in these areas, but still with room for strengthening in the generation of classroom environments that promote experimentation in students along with the search for diverse solutions to academic challenges, as a response to the changing needs of the context. In this regard, Clapp (2019) recognizes that creative thinking is the trigger of innovation and critical thinking allows the student to approach situations or problems from different perspectives, which is fundamental in teaching practice since these skills enrich the formative process of the student providing him with competencies that will allow him to adapt and solve unexpected challenges. Recio (2019) recognizes the importance of curricular flexibility as a response to the needs propitiated by the constantly changing contexts in which students are immersed, thus increasing the relevance and motivation of the learning process.

Similarly, the Competencies in Active Pedagogies (28%) and the Competencies in Learning Assessment (27%) suggest moderate efforts for the design and application of more dynamic methodologies that promote true learning based on experimentation and permanent reflection (Alsina, 2020); In this regard, Asunción (2019) highlights the benefits derived from the implementation of active methodologies, which include the transformation of classroom dynamics while fostering a more participatory environment, where students are encouraged to think critically in order to solve complex situations within the framework of collaborative work. For its part, the evaluation process has always been a subject of pedagogical reflection, since its results affect student motivation and become an indicator of the effectiveness of the formative process carried out by the teacher. In this regard, Camargo-Torres et al. (2023) state that the evolution of educational processes has highlighted the need to transform both teaching and learning, with special attention to evaluation as a fundamental component of the pedagogical process, recognizing the relevance of feedback.

For their part, Inclusion and Diversity Competencies reach 40%, reflecting an important commitment to address student diversity, but with training gaps around special educational needs. In Founes-Méndez et al. (2023) highlight the importance of inclusion processes within pedagogical practice given their ability to

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transform the educational environment, ensuring that all students, regardless of their individual characteristics, have access to quality education, thus promoting equal opportunities within a classroom environment designed to maximize the potential of each student.

Finally, Digital Competencies (25%) show that, although necessary in modern environments, they require greater teacher qualification accompanied by physical resources to facilitate these curricular integration processes (Romero & Díaz, 2022). For their part, Pereda-Loyola & Duran-Llaro (2023) highlight the importance of digital competencies in teaching as an essential pillar in the current educational context. These competencies should include essential ICT skills, such as digital content creation, online communication and collaboration, digital security and problem solving, allowing the teacher to integrate technological tools effectively, while enhancing student motivation and learning. This contrast reveals teaching priorities and areas that require attention for a more comprehensive pedagogical practice.

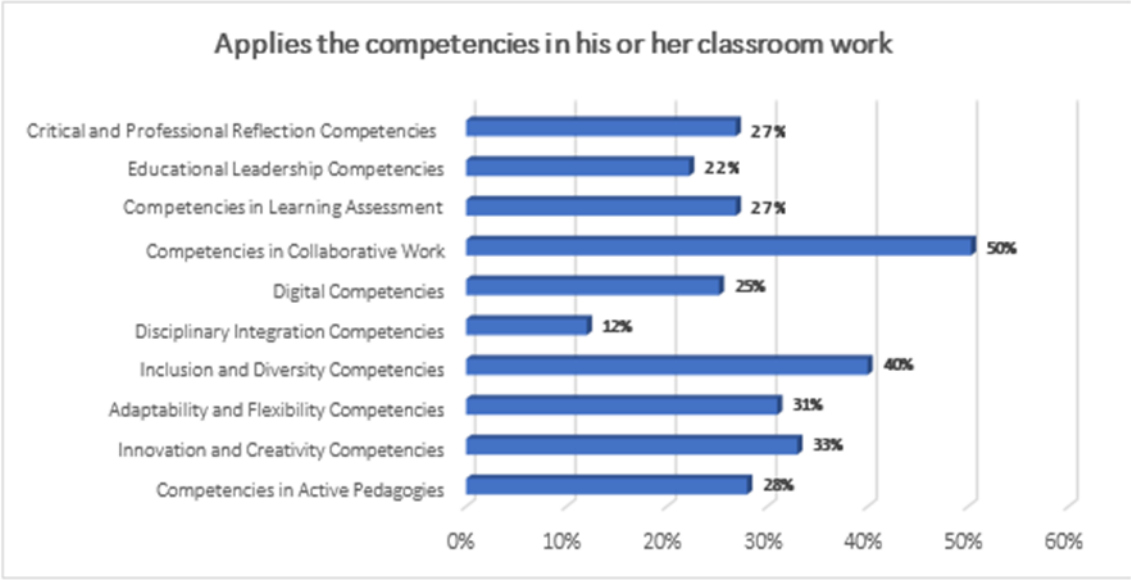

Figure 1. Comparative application of competencies in the classroom

Moving forward with the presentation of descriptive data, we proceeded to determine those characteristics that were correlated, identifying a correlation between gender and the geographic location of the educational institution, given that women are mainly working in educational institutions located in urban environments, while men have been placed in rural schools. In relation to the gender of the teacher, it is noteworthy that parents prefer that their children's preschool teacher be a woman, based on the fact that historically women have been associated with the role of caring and teaching in early childhood, which is complemented with maternal qualities such as patience, tenderness or unconditional love, which could be interpreted as the continuity of the mother, but in another space such as the classroom (Cruz et al., 2021). Now, when analyzing the link between the geographic location of the school and the gender of the teacher, given the social characteristics of public order that our country and specifically our department face, it is to be expected that women do not go to the most remote schools because of the risks to which they are exposed.

It was found that teachers over 50 years of age had mainly postgraduate training at the specialization level, while teachers between 31 and 50 years of age had already completed mainly master's degrees or doctoral studies (in some cases); and finally, one out of every two younger teachers (between 20 and 30 years of age) only have a professional degree, which shows the relationship between age and professional training of practicing teachers. Colombia has shown a remarkable progress in postgraduate training over the years as outlined in the research of Lasso (2020), evidencing a steady growth that reflects the growing demands of various sectors including education, with the need for highly qualified professionals oriented towards research and technological development, but this progress is still insufficient, especially at the doctoral level, considered key to scientific progress.

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Additionally, the possible correlation between the level of education of the teachers and the competencies that stood out with extreme percentages of favorability was analyzed. From the items associated with the competencies in Collaborative Work, it was identified that those teachers who have a master's degree or doctorate demonstrate leadership in interdisciplinary work teams, which facilitates the design of pedagogical intervention activities. In the research by Zambrano-Sandoval & Chacón (2021) it is highlighted that postgraduate training is oriented to the development of transferable, creative and holistic competencies, allowing participants to address complex problems from an ethical and collaborative work approach

Postgraduate training strengthens the teaching profession by updating knowledge, developing research skills and promoting theory-practice integration. It also promotes critical reflection on teaching, facilitates adaptation to technological and social challenges and enhances educational leadership. These processes improve pedagogical quality and guarantee innovative and effective classroom practice (Bailey-Moreno, 2021; Barrios & Herrera, 2016).

As a complement to the competencies in Disciplinary Integration, it was identified that teachers with a master's or doctorate degree affirm that in their pedagogical processes they develop projects that permeate various disciplines, thus enhancing the generation of connections between knowledge that favor the comprehensive education of students.

Further to the analysis of the data collected in the qualitative phase, an initial analysis is proposed that includes codes, subcategories and categories related to the STEAM competencies needed by early childhood teachers as shown in Figure 2, where the main category is located in the center of the scheme, the six subcategories around it in bold and the codes associated with each of these subcategories are listed within each of them.

The implementation of STEAM competencies in the pedagogical practice of early childhood teachers has a profound impact on the education of students, preparing future citizens for a complex and constantly changing world. Each category identified in the analysis of the interviews highlights fundamental aspects that contribute to the success of this educational approach, such as:

- Active Pedagogies. Active methodologies, such as project-based learning, design thinking and the 5E model, transform classroom dynamics by placing the student as the protagonist of his or her learning. These strategies not only develop critical thinking and problem solving, but also enable students to address real-world problems in a meaningful way. For example, by working on projects related to the Sustainable Development Goals, children experience how their actions can impact their environment, learning not only content, but also collaboration and leadership skills.

- Creativity and Innovation. Creativity is at the core of the STEAM approach, where prototyping and divergent and convergent thinking are essential. Teachers foster these skills by encouraging children to imagine and create unique solutions to everyday problems. These competencies allow students to explore beyond traditional boundaries, combining science, technology and art to address challenges holistically. In the context of preschool education, this ability to innovate not only prepares children for the future, but also promotes a resilient and adaptive mindset.

- Inclusion and Gender Perspective. Equity and inclusion are essential pillars of the STEAM approach. Strategies such as teacher awareness and promoting leadership roles for women address historical gaps in STEM areas. In early childhood education, teachers play a critical role in modeling inclusive behaviors and encouraging girls to explore interests in science and technology. This cultural shift from an early age fosters a more equitable view of human potential, preparing all students, regardless of gender, to succeed in traditionally male-dominated fields.

- Social-Emotional Skills. The success of the STEAM approach depends heavily on teachers' ability to create safe environments and foster social-emotional skills such as empathy and collaboration. These skills are essential for developing confident and team-oriented learners. In an environment where mistakes

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are seen as learning opportunities, children learn to manage frustration and collaborate effectively, which enriches not only their educational experience, but also their personal development.

- Context and Transversality. The connection between STEAM projects and the Sustainable Development Goals strengthens the relevance of education to global challenges. By integrating topics such as the environment and social equity into their lessons, teachers inspire in students a deeper understanding of their role as agents of change. In addition, interaction with the productive sector helps students understand how their skills can be applied in the real world, strengthening their motivation and sense of purpose.

- STEAM Tools and Resources. Access to technological tools such as simulators or basic programming software, along with creativity in the use of reusable materials, expand pedagogical possibilities in economically marginalized educational contexts. Teachers who integrate these tools into their classrooms not only awaken students' interest in technology, but also teach them how to use resources sustainably and effectively. These strategies are especially valuable in resource-constrained contexts, where innovation is key to providing meaningful learning experiences.

Taking together, these categories reflect the complexity and richness of the STEAM approach, highlighting how each element contributes to transforming teaching practice in early childhood education. Teachers become facilitators of learning, preparing students not only for a successful academic and professional future, but also to be engaged, creative and empathetic citizens. This integrated approach reinforces the idea that early education is the foundation on which to build a more equitable, innovative and sustainable society.

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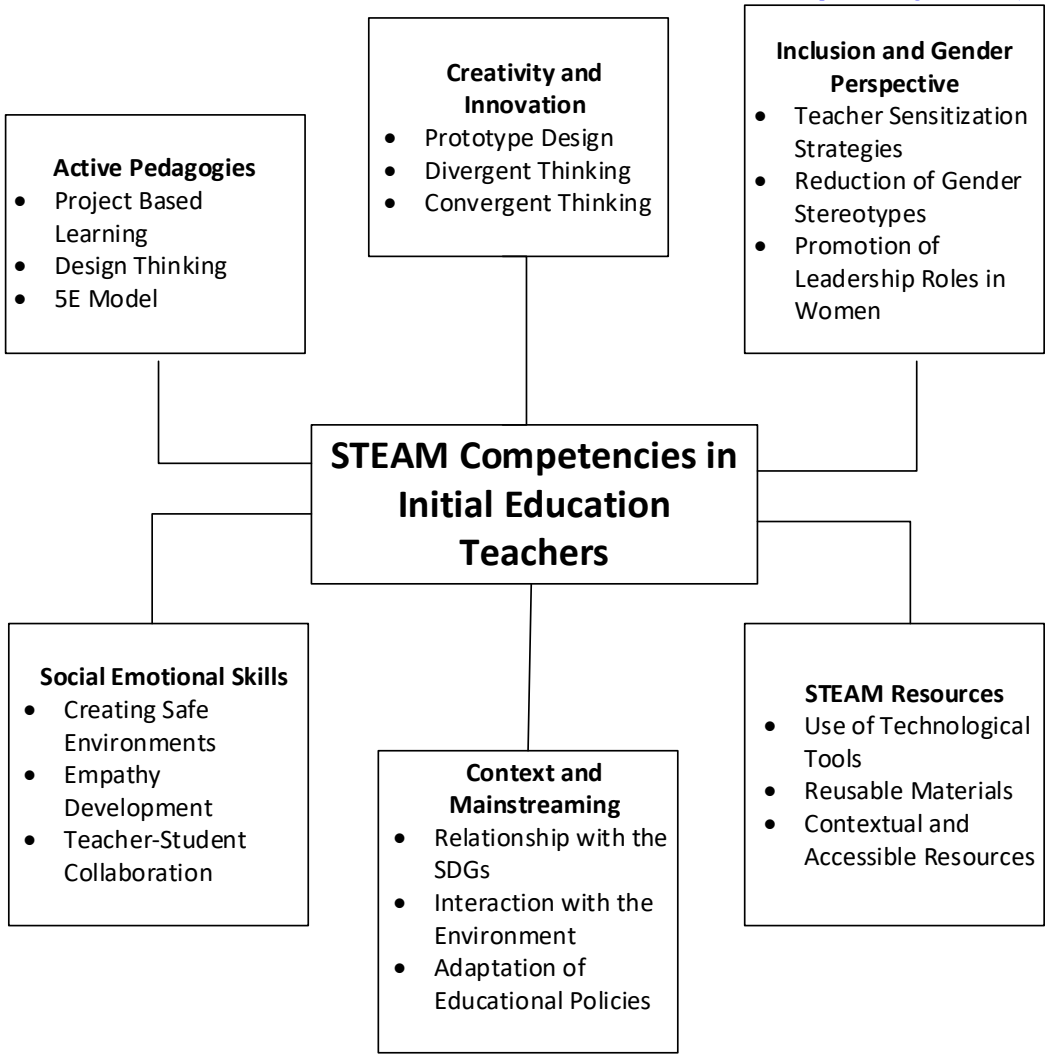

Figure 2. STEAM competencies present in the pedagogical practice of Early Childhood Education teachers

Discussion

When contrasting the competencies derived from this focus group with those mentioned in the work of Prada et al. (2024), it was possible to identify as a novel aspect the importance of socioemotional competencies in this initial cycle of education and their relationship with the STEAM educational approach. The development of socioemotional competencies is essential for the success of the STEAM educational approach, especially in early education, where the foundations of learning and life skills begin to consolidate. Three key areas were identified from this focus group: creating safe environments, developing empathy, and teacher-student collaboration. These competencies not only complement the technical and artistic disciplines integrated into the STEAM educational approach but are also the bridge that connects technical learning to the holistic development of students.

A safe environment, where children feel emotionally protected, is essential to foster creativity and a willingness to experiment, as students must feel free to make mistakes and learn from their mistakes, an intrinsic aspect of the STEAM approach. Without a safe environment, fear of failure can limit their active participation and ability to innovate.

Empathy, on the other hand, allows teachers to understand the needs of their students and model this skill for them. In STEAM projects, this competency translates into the ability to approach problems from

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diverse perspectives and develop inclusive solutions, promoting both technical learning and social engagement.

Finally, collaboration between teachers and students not only improves classroom dynamics, but also teaches essential skills such as teamwork and communication. In the context of STEAM, these interactions foster the collective construction of knowledge and critical thinking pillars to face the challenges of the 21st century.

Therefore, socioemotional competencies are not a complement, but an indispensable component of the STEAM approach, which ensures not only the acquisition of technical knowledge, but also the development of individuals with integrity and prepared to transform their environment.

Conclusion

As a general conclusion, it could be affirmed that derived from this research, the STEAM educational approach is a real opportunity to transform early education, as long as the structural and cultural barriers faced by current educational systems are overcome, which must be based on the commitment of teachers, institutions and public policies, so that this approach would hopefully cease to be a utopia and become a tangible reality that prepares children for a complex and interconnected future.

It should be noted that the STEAM educational approach is positioned as a transformative pedagogical tool capable of integrating disciplines in an interdisciplinary and practical way, which allows it to promote essential 21st century skills such as critical thinking, creativity and digital literacy, essential to face the challenges of a globalized and technologically advanced world.

Early childhood represents a strategic period to implement STEAM due to the innate curiosity, creativity and desire for exploration characteristics of children at this stage. Through hands-on, playful activities, the STEAM approach enables the development of cognitive, social-emotional and creative skills from an early age, laying the foundation for lifelong learning.

With respect to socioemotional competencies, such as the creation of safe environments, empathy and teacher-student collaboration, these are indispensable elements for the success of the STEAM approach, since these skills promote meaningful learning by allowing students to experiment, work in teams and address problems from inclusive perspectives, strengthening their integral development.

In the process of implementing the STEAM approach, significant barriers are faced, including the lack of specialized teacher training, insufficient resources and the rigidity of traditional curricula, which limits the ability to effectively integrate disciplines in the classroom, especially in contexts with limited resources. Then, teacher qualification is key to overcoming barriers in STEAM implementation, requiring specialized training in active pedagogies, digital competencies and interdisciplinary integration, allowing teachers to design learning experiences that enhance students' capabilities, maximizing the impact of the STEAM approach.

Finally, the STEAM approach not only promotes technical learning, but also fosters values such as equity and sustainability. By including gender perspective and attention to diversity, STEAM becomes a tool to transform initial education into an inclusive, innovative space aligned with the demands of the 21st century.

Suggestion

From the results obtained from this pedagogical research, some recommendations are derived, among which we highlight as a starting point, the strengthening of teacher training in three basic topics such as interdisciplinary integration, the didactic and pedagogical use of technology, and the implementation of active methodologies both in the initial teacher training and in practicing teachers. But this teacher qualification process must be complemented with the adaptation of collaborative learning spaces from preschool education.

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Teacher training with spaces that encourage critical thinking and exploration are strengthened with the development of projects that connect the various STEAM disciplines for the understanding of real situations specific to the student's social context, which would be expected to awaken the interest of the infant, while promoting safe environments for participation where collaborative work, empathy and respect for differences are the foundations of the process.

All the above mentioned would contribute to the generation of teachers' networks where experiences are shared around the STEAM educational approach framed in public policies that really aim at the holistic formation of the human being for the development of those transferable and functional competences in time, demanded by today's society.

Declarations

Author Contributions. M.E.P.T.: Literature review, conceptualization. F.J.R.M.: methodology, data preparation for analysis. R.P.N.: data analysis and results, review editing and writing, preparation. All authors have read and approved the published on the final version of the article.

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References

Alava, K. L., & Salas Valero, L. S. (2024). STEAM strategies with robotics to enhance collaborative learning in children aged 6 to 8 years (Bachelor's thesis). Universidad Politécnica Salesiana, Guayaquil.

Alonso, P., Soto, N., & Sotelino, A. (2022). Working gender equality in Early Childhood Education from teacher training. University Pedagogy Notebook, 19(38), 94-108. https://doi.org/10.29197/cpu.v19i38.465

Alsina, A. (2020). Mathematical connections through STEAM activities in Early Childhood Education. UNIÓN, Iberoamerican Journal of Mathematics Education, 16(58), 168-190.

Arteaga, E. M. (2018). Importance of collaborative work in children at the initial level (Specialisation thesis) National University of Tumbes, Sullana.

Asunción, S. (2019). Active methodologies: tools for teacher empowerment. Docentes 2.0 Journal, 19(1), 65-80.

Bailey-Moreno, J. (2021). Contributions of graduate studies in university teacher education. IE REDIECH Journal of Educational Research, 12, e1253. https://doi.org/10.33010/ie_rie_rediech.v12i0.1253

Barrios, D. M., & Herrera, J. D. (2016). Postgraduate training in research and the teaching profession. Voces y Silencios. Latin American Journal of Education, 7(1), 32-64. https://doi.org/10.18175/vys7.1.2016.03

Berger, K. S. (2007). Developmental psychology. Childhood and adolescence. España: Ed. Médica Panamericana.

Camargo-Torres, M. D., Chong-Barreiro, M. C., Cáceres-Mesa, M. L., & Moreno-Tapia, J. (2023). Educational assessment and school motivation in higher education. Metropolitan Journal of Applied Sciences, 6(3), 191-197. https://doi.org/10.62452/ect2h384

Cardona, H. L., & Rodríguez, N. (2021). STEAM approach. A possibility for teacher training in Early Childhood Education. (Bachelor's thesis) National Pedagogical University, Bogotá D.C.

Castañeda, H. (2024). Discovering the Power of STEAM: An Innovative Look at Early Education in the Caribbean Region of Colombia. LOGINN Scientific and Technological Research, 8(1), 1-15.

Castillo, C. Y., López, M. F., & Vanegas, C. (2024). Strengthening the concerted participation of families of children aged 5 to 6 years through a project under the STEAM approach (Master's thesis). Los Libertadores University Foundation, Bogotá D.C.

Castro-Zubizarreta, A., García-Lastra, M., & Del Río, O. M. G. (2024). STEAM Approach and Early Childhood Education: A Systematic Literature Review. ESSAYS. Journal of the Faculty of Education of Albacete, 39(1), 16-34.

Clapp, E. P. (2019). Creativity as a participatory and distributed process: Involvement in classrooms v. 149). Madrid: Narcea editions.

Cruz, A., Hugo, A., & Ruiz-Ruiz, M. F. (2021). Dad's and mom's perceptions of male teachers in Peruvian early education. Educare, 25(3), 1-19. http://doi.org/10.15359/ree.25-3.33

Delgado, A. C. (2018). Neuroscience and psychology. Tempus Psychological, 1(2), 127-144.

Fernández, M., & Redondo, N. (2024). Pedagogical proposal for the development of STEAM and sustainability competencies in children in Early Childhood Education. European Public & Social Innovation Review, 9, 1-17. https://doi.org/10.31637/epsir-2024-1098

Founes-Méndez, N. F., Esteves-Fajardo, Z. I., & Tamariz-Nunjar, H. U. (2023). Teaching competencies in inclusive education. Koinonía Interdisciplinary Refereed Journal, 8(1), 71-86. https://doi.org/10.35381/r.k.v8i1.2608

García, O. (2023). O enfoque educativo steam para a educación infantil tendencia ou pertinencia? (Doctoral dissertation). Universidade de Vigo, Ourense.

García, O., Raposo, M., & Martínez, M. E. (2022). STEAM in Early Childhood Education: a content analysis of the official curriculum. Teachers, Journal of Curriculum and Teacher Training, 26(3), 505-524. https://doi.org/10.30827/profesorado.v26i3.21571

Juvera, J., & Hernández, S. (2021). STEAM in childhood and the gender gap: a proposal for non-formal education. EDU REVIEW. International Education and Learning Review International Journal of Education and Learning, 9(1), 9-25. https://doi.org/10.37467/gka-revedu.v9.2712

Laso, S., & Hernández, A. (2023). Integrating STEAM in the Early Childhood Education classroom. Response to the environmental crisis. Journal of Science Education, 24(2), 8-15.

Lasso, L. A. (2020). Analysis of postgraduate training at the Master's and Doctoral level in Colombia between 2010 and 2018. Espacios Magazine, 41(48), 161-176.

López, M. V., Córdoda, C. M., & Soto, J. F. (2020). STEM/STEAM education: Implementation models, didactic strategies and learning environments that enhance skills for the 21st century. Latin American Journal of Science Education, 7(1), 1-16.

Pereda-Loyola, R. A., & Duran-Llaro, K. L. (2023). Teaching digital competence as a challenge in virtual learning environments. Koinonía Interdisciplinary Refereed Journal, 8(supl.2), 467-484. https://doi.org/10.35381/r.k.v8i2.2887

Pineda, D. Y. (2023). STEAM approach: Challenges and opportunities for teachers. International Journal of Pedagogy and Educational Innovation, 3(1), 229-244. https://doi.org/10.51660/ripie.v3i1.115

Prada, R., Peñaloza, M.E., & Rodríguez, J. (2024). Development and validation of an instrument to assess STEAM competencies of the initial education teacher. In Desafíos de la Innovación Docente e Investigación en Educación, Artes y Humanidades (pp. 1-8). ASUNIVEP.

Raposo-Rivas, M., García-Fuentes, O., & Martínez-Figueira, M. E. (2022). Educational robotics from STEAM areas in early childhood education: A systematic review of the literature (2005-2021). Revista Prisma Social, (38), 94-113.

Journal of Ecohumanism
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DOI: https://doi.org/10.62754/joe.v4i1.6358

Recio, S. (2019). Robotic experiences in infants and toddlers. RIITE Inter-University Journal of Research in Educational Technology, (7), 73-84. http://doi.org/10.6018/riite.399641

Redó, N. A. (2012). The gender variable in the measurement of stress and Burnout in early childhood and elementary school teachers. Vivat Academy, (119), 1-13.

Rodrigues-Silva, J., & Alsina, Á. (2023). STEAM education and playful learning at all educational levels. Magazine Prâksis, 1, 188-212. https://doi.org/10.25112/rpr.v1.3170

Rodríguez, C. (2024). STEAM projects in the learning of preschool children.

Romero, A. M., & Díaz, G. (2022). Design of a maker-steam methodology for the development of digital, technological and logical thinking skills in early education. In E. Serna, Revolución Educativa en la Nueva Era (vol. 2, pp. 681-689). Medellín: Antioquia Research Institute.

Santillán-Aguirre, J. P., Jaramillo-Moyano, E. M., Santos-Poveda, R. D., & Cadena-Vaca, V. D. C. (2020). STEAM as an active learning methodology in higher education. Polo del Conocimiento: Scientific-professional Journal, 5(8), 467-492.

Silva-Hormazábal, M., Jefferson, R. S., Alsina, Á., & Salgado, M. (2022). Integrating mathematics and science: a STEAM activity in Primary Education. UNIÓN- Iberoamerican Journal of Mathematics Education, 18(66), 1-20.

Zambrano-Sandoval, H., & Chacón, C. T. (2021). Research competencies in graduate education. Qualitative analysis. Education Magazine, 45(2), 1-31. https://doi.org/10.15517/revedu.v45i1.43646