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Integration of the Steam Approach and the Development of Socio-Emotional Skills in Education: A Literature Review from Latin American Contexts

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Abstract

Contemporary educational debates emphasize the importance of holistic education that integrates cognitive, emotional, and social development. Within this context, the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach has been promoted as a means to foster interdisciplinary and active learning. At the same time, socio-emotional skills have gained recognition for their impact on student well-being, school climate, and academic achievement. However, the integration of STEAM and socio-emotional development remains an emerging and fragmented field. This article critically reviews literature published between 2019 and 2025, identifying conceptual trends, methodological approaches, research gaps, and implementation challenges. Findings reveal that while STEAM initiatives can support socio-emotional growth, this is often addressed implicitly, without systematic planning or evaluation. Key limitations include insufficient teacher training, weak assessment mechanisms, and lack of contextualization in Latin American settings. In Colombia, these insights are particularly relevant to advancing the Emotional Education curriculum through integrated, evaluable pedagogical models.

Keywords: STEAM education; socio-emotional skills; holistic education; literature review; Latin American contexts

Introduction

In the contemporary educational landscape, school systems face complex challenges stemming from accelerated social, technological, and cultural transformations, as well as a sustained increase in issues related to children's and adolescents' emotional well-being. Various international organizations have warned that the rise in phenomena such as anxiety, school stress, academic demotivation, and difficulties in coexistence demands a rethinking of traditional pedagogical approaches, historically centered on the transmission of content and academic performance as the predominant indicators of educational quality. UNICEF (2021), OECD (2023), UNESCO (2021). In this context, a growing consensus has emerged in favor of a comprehensive education that balances the cognitive, emotional, and social dimensions of learning.

Within this framework, the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach has emerged as an educational approach designed to meet the training demands of the 21st century. Its emphasis on interdisciplinarity, project-based learning, and the resolution of authentic problems has been widely recognized in the literature as promoting active, meaningful, and contextualized learning (Yakman, 2008; DeJarnette, Deeb, & Pallis, 2021). However, several studies warn that the adoption of STEAM has been marked, in many contexts, by an instrumental

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logic that prioritizes the development of technical and cognitive skills, relegating fundamental dimensions of human development, such as emotion, ethics, and meaning-making (ElSaiyary, 2021; Greca, Sanz, & Ortiz, 2023).

In parallel, the development of socio-emotional skills has gained increasing relevance on the international and national educational agenda. Conceptual frameworks such as those proposed by CASEL and reports from the OECD (2023) and UNESCO (2021) highlight that competencies such as self-awareness, self-regulation, empathy, and responsible decision-making significantly impact student well-being, school climate, and academic performance (CASEL, 2023; OECD, 2023). In the Colombian context, this concern has recently translated into the enactment of Law 2503 of 2025, which establishes Emotional Education as a mandatory subject in educational institutions, reinforcing the education system's commitment to holistic development.

Despite the growing recognition of both approaches, the literature reveals a persistent gap between STEAM education and socio-emotional development. While experiences have been documented in which STEAM projects generate emotional and social benefits, these often appear as implicit or secondary effects, rather than as the result of pedagogical proposals intentionally designed to integrate both dimensions. The lack of structured teaching models, common evaluation frameworks, and contextualized approaches limits the consolidation of comprehensive pedagogical practices, especially in Latin American contexts characterized by social inequality and psychosocial vulnerability.

From a critical perspective, this disconnect highlights the need to rethink educational innovation beyond simply incorporating emerging methodologies or technologies. Integrating the STEAM approach with the development of socio-emotional skills requires recognizing the interdependence of cognition and emotion as a prerequisite for meaningful learning and designing educational experiences that explicitly address the human dimensions of the learning process.

In this regard, this article aims to analyze recent academic literature on the integration of the STEAM approach and the development of socio-emotional skills in education, to identify trends, predominant approaches, research gaps, and challenges for its implementation, particularly in Latin American contexts. Through an analytical and critical literature review, it seeks to provide conceptual foundations for moving towards integrated, contextualized, and assessable teaching models oriented towards a truly holistic education.

Literature Review Methodology

This study was developed from an analytical and critical literature review aimed at examining academic research on the STEAM approach and the development of socio-emotional skills in educational contexts. This type of review is relevant for emerging or consolidating fields of study, as it allows for the identification of conceptual trends, predominant theoretical approaches, methodological approaches, and research gaps, without adhering to the strict protocols of systematic reviews, but guaranteeing criteria of rigor, transparency, and traceability in the process of selecting and analyzing the sources (Grant, MJ & Booth, A., 2009).

Strategy for Searching and Selecting Sources

The information search was conducted across academic databases recognized for their relevance in education and the social sciences, specifically Scopus, Web of Science, ERIC, SciELO, and Google Scholar. These databases were selected for their coverage of indexed literature, their disciplinary diversity, and their access to empirical, theoretical, and review studies related to education, pedagogical innovation, and social-emotional learning.

The search process was iterative and progressive, involving successive adjustments to the search

terms and combinations based on the preliminary analysis of the results. Terms in both Spanish and English were used, including STEAM education, STEM education, integrated STEAM, social-emotional learning, SEL, socio-emotional skills, and socio-emotional learning, combined using Boolean operators (AND, OR). This strategy allowed for broadening the initial scope of the review and subsequently refining the results to include studies related to the topic of interest.

Inclusion and Exclusion Criteria

The inclusion criteria established were:

1. Scientific articles published between 2019 and 2025, to guarantee the currency of the review and its relevance to contemporary educational debates.
2. Empirical, theoretical, or review studies that address STEAM education, the development of socio-emotional skills, or the integration of both approaches.
3. Publications in indexed journals or recognized academic repositories; and
4. Research developed in basic, secondary, or higher education contexts.

Exclusion criteria included popular documents, institutional reports without academic backing, duplicate publications, and texts lacking explicit theoretical or methodological support. Studies that addressed any of the approaches tangentially, without establishing clear links to educational processes, were also excluded.

Process of Analyzing and Organizing Information

The literature review was conducted in three complementary phases. First, a preliminary review of titles and abstracts was performed to identify the thematic relevance of the retrieved documents. Second, the selected texts were read to analyze in depth the conceptual approaches, research objectives, methodological designs, and main findings reported. Finally, a thematic and comparative analysis was developed, which allowed the information to be organized into emerging analytical categories.

The analysis categories were constructed inductively and deductively, based on the study objectives and patterns identified in the literature. These categories included:

1. Approaches and trends in STEAM education.
2. Conceptualizations and strategies for the development of socio-emotional skills.
3. Proposals for integration between STEAM and socio-emotional learning.
4. Methodological approaches used to evaluate these proposals; and
5. The authors report imitations and research gaps.

Rigor, Reliability, and Limitations of the Review

To strengthen the rigor of the analysis, a constant comparative method was used to compare studies, prioritizing the identification of conceptual and methodological convergences and divergences. Likewise, an effort was made to include research conducted across different geographical contexts, with particular attention to studies conducted in Latin America, given the analysis's contextual relevance.

However, it is important to acknowledge some limitations inherent in this type of review. First, since this is not a systematic review, the results are not intended to be exhaustive, but rather representative of the main trends and debates in the field. Second, the uneven availability of studies that explicitly integrate the STEAM approach into the development of social-emotional skills limits the ability to make homogeneous comparisons across studies. Finally, the conceptual and methodological diversity of the reviewed studies, while enriching the analysis, hinders the consolidation of common frameworks for evaluating social-emotional impact.

To strengthen the coherence and depth of the analysis, the review process was guided by a comparative and reflective approach, which allowed for contrasting the selected studies not only

in terms of their results, but also their theoretical assumptions, methodological decisions, and implementation contexts. This approach enabled the identification of recurring patterns, conceptual divergences, and research gaps that are not always evident in traditional descriptive reviews.

Special attention was also paid to the diversity of educational contexts described in literature, considering variables such as educational level, geographic location, and the socio-educational conditions in which the analyzed experiences occurred. This contextual perspective enabled a critical examination of the transferability of the findings. It helped avoid uncritical generalizations, particularly regarding the implementation of the STEAM approach and the development of socio-emotional skills in Latin American contexts.

To organize the body of documents, the reviewed studies were systematized using analysis matrices that facilitated the identification of emerging categories and the comparison of approaches. These matrices included information related to each study's objectives, the theoretical framework used, the methodological design, the pedagogical strategies implemented, and the main conclusions reported by the authors. This procedure helped maintain the traceability of the analysis and strengthen the interpretive consistency of the review.

Finally, it is important to note that the review was guided by rigorous criteria and reflexivity, recognizing the interpretive nature inherent in this type of study. While this is not intended to be an exhaustive review of all existing literature, the analysis

presented allows us to account for the main current trends and debates surrounding the integration of STEAM and socio-emotional skills. In this sense, the results should be interpreted as an analytical approach that opens the door to future research, rather than as definitive conclusions or as generalizable to all educational contexts.

Despite these limitations, the review provides a solid basis for understanding the current state of knowledge regarding the integration of STEAM and socio-emotional skills, and for justifying the need to move towards integrated, contextualized, and assessable teaching models, especially in Latin American educational contexts.

Steam Education: Approaches and Trends in the Literature

The STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach emerges as an expansion of the STEM model, incorporating the arts not only as an aesthetic or creative component but also as an epistemological axis that fosters the integration of knowledge, critical reflection, and a holistic understanding of phenomena (Yakman, 2008). From this perspective, STEAM is conceived as an educational framework designed to overcome traditional disciplinary fragmentation and to promote meaningful connections among science, technology, engineering, mathematics, and the arts in authentic learning contexts.

One of the central tenets of the STEAM approach is its interdisciplinary nature, understood as the articulation of multiple disciplines around real and complex problems. However, the literature indicates a diversity of interpretations of this interdisciplinarity, ranging from superficial integrative approaches to more profound transdisciplinary proposals (Greca, Sanz, and Ortiz, 2023). While some experiences are limited to the juxtaposition of disciplinary content, others seek to generate genuine processes of conceptual and methodological integration, which entail greater pedagogical and organizational challenges.

From a methodological perspective, STEAM implementation primarily involved active, student-centered approaches, such as project-based and inquiry-based learning, and the design of authentic challenges. Recent studies show that these strategies promote student participation, collaborative work, and the application of knowledge in contextualized situations (DeJarnette,

Deeb, & Pallis, 2021; Chun, H.-Y., Lee, J.-Y., & Sung, J., 2023). In this sense, STEAM presents itself as a pedagogical alternative that meets the demands of an education focused on the development of 21st-century skills.

Several studies have documented the positive effects of implementing STEAM on variables such as motivation, student engagement, and the development of higher-order thinking skills. For example, Chun, H.-Y., Lee, J.-Y., and Sung, J. (2023) report that STEAM programs supported by emerging technologies, such as educational robotics, strengthen creative thinking and a positive attitude toward learning among elementary school students. Similarly, DeJarnette, Deeb, and Pallis (2021) highlight that STEAM experiences can foster student participation and a sense of agency, especially in contexts of high social vulnerability.

However, alongside these contributions, the literature also identifies conceptual and practical limitations to adopting the STEAM approach. One of the main criticisms concerns the tendency to instrumentalize the approach, reducing it to mere technological use or to superficial integration across disciplines, without a deep pedagogical reflection on its foundations and educational purposes (ElSayary, 2021). In these cases, STEAM risks becoming an innovative label that reproduces traditional practices without generating substantive transformations in teaching and learning processes.

From a critical perspective, some authors warn that the implementation of STEAM has been influenced by technocratic and productivism discourses, geared toward responding to labor-market demands rather than the holistic development of students (Greca, Sanz, and Ortiz, 2023). This orientation has led to prioritizing the development of technical and cognitive skills, relegating fundamental dimensions such as ethics, critical creativity, emotional reflection, and meaning making. In this context, the incorporation of the arts into STEAM does not always challenge these logics; rather, it sometimes serves merely a decorative or instrumental role.

Another relevant aspect in the literature concerns the institutional conditions for implementing STEAM. Recent research underscores that the sustainability of STEAM proposals depends on factors such as interdisciplinary teacher training, curricular flexibility, institutional support, and equitable access to resources (Fields, D., & Kafai, Y., 2023). In the absence of these elements, STEAM experiences tend to develop episodically, linked to isolated projects or temporary initiatives, which limits their long-term impact.

In the Latin American context, these limitations are exacerbated by structural conditions such as social inequality, the digital divide, and the sociocultural diversity of educational environments. Studies conducted in the region show that, while there is a growing interest in the STEAM approach, its implementation is characterized by a lack of consolidated didactic models that systematically and contextually guide teaching practice (Castro-Campos, 2022; Mendoza, Mendoza, Vera, Guadamund, & Diaz, 2023). Furthermore, most of the reported experiences are concentrated in urban contexts, leaving rural realities and educational settings marked by social vulnerability unexplored.

In summary, the literature review confirms that the STEAM approach has significantly contributed to the renewal of educational practices, promoting interdisciplinary, active, and contextualized learning. However, it also highlights tensions and challenges associated with its implementation, particularly the superficiality of some proposals, the influence of technocratic discourses, and insufficient attention to the socio-emotional dimensions of learning. These limitations reinforce the need to move toward more critical, integrative, and contextualized STEAM approaches that intentionally articulate students' cognitive and socio-emotional development.

Development of Socio-Emotional Skills in the Educational Field

The development of socio-emotional skills has become a central focus of contemporary educational debate in recent decades, in response to growing evidence linking emotional well-being to learning processes, school coexistence, and civic education. From a broad perspective, these skills encompass competencies that enable individuals to understand and regulate their emotions, establish healthy interpersonal relationships, make responsible decisions, and adaptively cope with the challenges of academic and social life (CASEL, 2023).

International literature has consistently documented that socio-emotional skills play a fundamental role in students' holistic development. Reports from the Organization for Economic Co-operation and Development (OECD) (2023) indicate that competencies such as perseverance, self-regulation, and empathy significantly influence academic performance, intrinsic motivation, and school retention, even more so than some traditional cognitive skills. Similarly, UNESCO (2021) emphasizes that socio-emotional education is an essential pillar for developing citizens capable of participating ethically, critically, and responsibly in increasingly complex and uncertain societies.

One of the most influential conceptual frameworks in this field is that proposed by the Collaborative for Academic, Social, and Emotional Learning (CASEL), which organizes socio-emotional skills into five interrelated domains: self-awareness, self-regulation, social awareness, relationship skills, and responsible decision-making (CASEL, 2023). This model has guided a wide range of international research and educational programs, offering a comprehensive framework that integrates the emotional, social, and behavioral dimensions of learning. Recent empirical studies show that the systematic implementation of programs based on this framework improves school climate, reduces disruptive behaviors, and strengthens students' psychological well-being. (Atkins, J., Vega-Uriostegui, T., Norwood, D., & Adamuti-Trache, M., 2023)

However, the literature review also reveals relevant conceptual debates surrounding the use of the terms 'skills,' 'competencies,' and 'socio-emotional learning.' Some authors warn that the notion of "skills" can promote an instrumental and decontextualized view of emotional development, reducing complex processes to lists of observables, measurable behaviors (Arango, P., Orjuela, C., Buitrago, A., & Lesmes, O., 2024). From this critical perspective, the need arises to understand socio-emotional development as a dynamic, situated, and relational process, profoundly influenced by sociocultural contexts, educational experiences, and everyday interactions at school.

In pedagogical terms, one of the main challenges identified in literature is integrating socio-emotional skills into the school curriculum. Despite the normative and discursive recognition of their importance, numerous studies indicate that these competencies are often addressed through isolated programs, one-off workshops, or extracurricular activities, without a coherent articulation with subject areas or classroom practices, according to Reyes, Keck, C., Gracia, M., and Saldívar M (2023). This fragmentation limits the formative impact of the proposals and hinders the sustainability of socio-emotional learning over time.

From a methodological perspective, assessing socio-emotional development is another critical challenge in the field. The literature reveals a wide variety of assessment instruments and approaches, ranging from standardized scales to qualitative observations and student self-assessments. While this diversity reflects the complexity of the construct, it also poses challenges for the validity, reliability, and comparability of results (OECD, 2023). In this regard, several authors agree on the need to move toward formative assessment approaches that recognize the processual nature of socio-emotional development, avoiding simplistic reductions or

decontextualized measurements.

In the Latin American context, the development of socio-emotional skills takes on relevance due to the conditions of social inequality, structural violence, and psychosocial vulnerability that affect large sectors of the student population. Research such as that by Gélvez-Pabón (2024) and Cortés Bocanegra, E. (2024), conducted in the region, demonstrates that strengthening competencies such as empathy, emotional self-regulation, and peaceful conflict resolution contributes to improving school coexistence, reducing bullying, and promoting educational retention. However, these studies also highlight significant limitations in teacher training, resource availability, and the lack of contextualized pedagogical models.

In Colombia, the development of socio-emotional skills has been progressively incorporated into educational guidelines and policies, particularly through holistic education approaches. The enactment of Law 2503 of 2025, which establishes Emotional Education as a mandatory subject in educational institutions, represents a significant regulatory advance in recognizing the emotional component as a central element of education. However, the national literature, such as that by Andrade and Giraldo (2024), warns that the effectiveness of this policy depends on the presence of clear pedagogical guidelines, relevant teaching strategies, and teacher support processes that enable the regulatory mandate to be translated into meaningful and sustainable educational practices.

From a critical perspective, the reviewed studies agree that the main challenge to socio-emotional development in schools lies not in its theoretical or regulatory legitimacy, but in its pedagogical operationalization. The lack of integrative approaches has, in many cases, led to fragmented implementation, where socio-emotional skills are addressed episodically, without continuity or clear follow-up mechanisms. This situation underscores the need to explore pedagogical approaches that intentionally integrate socio-emotional development into teaching and learning, especially in educational settings that demand comprehensive responses to complex problems.

In summary, the literature review confirms that the development of socio-emotional skills is an essential component of contemporary education, supported by a broad theoretical, empirical, and normative foundation. However, it also highlights conceptual tensions, methodological challenges, and pedagogical gaps that limit its effective implementation. These elements are fundamental to understanding the need to move toward educational proposals that coherently integrate the cognitive and socio-emotional dimensions of learning, particularly when articulated with innovative approaches such as STEAM.

These conceptual and methodological challenges of the STEAM approach become relevant when analyzed in the context of the development of socio-emotional skills, a dimension that the literature has addressed in a fragmented way.

Integration Between the Steam Approach and Socio-Emotional Skills: Findings and Gaps in the Literaturfeld

The literature review reveals a growing interest in exploring the relationship between the STEAM approach and the development of socio-emotional skills, particularly within the framework of contemporary discussions on holistic education and meaningful learning. Studies agree that the characteristics of STEAM environments, such as project-based learning, authentic problem-solving, interdisciplinary collaboration, and the creative use of technology, create favorable conditions for the development of socio-emotional competencies in students. According to Ingram, E., Reddick, K., Honaker, J., and Pearson, G (2021); Geesa, R., Robbins, K., & Shively, K. (2022).

Several international studies have reported that STEAM experiences can strengthen skills such

as communication, cooperation, perseverance, and emotional self-regulation. Ingram, E., Reddick, K., Honaker, J., and Pearson, G. (2021), for example, demonstrate that STEAM projects designed in school settings promote social interaction dynamics that foster a sense of belonging and emotional regulation, especially when students work in heterogeneous teams and face shared cognitive challenges. Similarly, Geesa, R., Robbins, K., and Shively, K. (2022) highlight that STEAM environments, both face-to-face and virtual, can become emotionally meaningful spaces when collective reflection and teacher support are encouraged.

However, a comparative analysis of these studies reveals a recurring feature: in most of the reviewed research, the development of socio-emotional skills is not an explicit pedagogical objective but rather appears as an emergent or implicit outcome of STEAM experiences. That is, while it is acknowledged that students develop emotional and social competencies through participation in interdisciplinary projects, these are not usually planned, systematized, or evaluated using established theoretical frameworks of socio-emotional learning (ElSayary, 2021; Greca, I., Sanz, R., & Ortiz, J., 2023).

From a conceptual standpoint, this situation reveals a significant tension between the educational potential of the STEAM approach and its actual implementation in educational contexts. While pedagogical discourses promote a holistic view of learning, practices documented in literature tend to prioritize the development of cognitive and technical skills, relegating emotional dimensions to a secondary role. This tendency is reflected in the weak alignment between STEAM proposals and widely recognized conceptual frameworks, such as CASEL's socio-emotional competency model, which limits the pedagogical coherence of the experiences analyzed.

Methodologically, the review also reveals significant limitations in assessing the socio-emotional impact of the STEAM proposals. Most of the reviewed studies use assessment instruments focused on academic variables, such as performance, motivation, or creativity. At the same time, socio-emotional skills are assessed indirectly, through qualitative observations, interviews, or teacher perceptions. The lack of validated instruments and common assessment criteria makes it difficult to compare studies. It limits the construction of robust empirical evidence on the effectiveness of STEAM-socio-emotional integration (Geesa, R., Robbins, K., & Shively, K., 2022).

A more detailed analysis of the reviewed studies reveals significant differences in how the relationship between STEAM and the development of socio-emotional skills is conceived and operationalized. While some research assumes that these skills emerge naturally from collaborative work and problem-solving, other studies emphasize the need to incorporate explicit pedagogical strategies that guide students' emotional development. This divergence highlights the lack of conceptual consensus in the literature regarding the role of socio-emotional skills within STEAM environments.

Furthermore, considerable heterogeneity is observed in the educational levels at which STEAM + socio-emotional integration proposals have been implemented. Most studies focus on secondary and higher education, where positive effects are reported on variables such as motivation, perseverance, and teamwork. In contrast, research centered on primary education is scarce, even though the literature on socio-emotional development highlights the importance of early intervention. This gap is especially relevant for Latin American contexts, where primary school plays a fundamental role in the development of emotional and social skills.

Another critical aspect identified concerns the didactic intent of the analyzed proposals. In numerous studies, the integration of STEAM and socio-emotional skills is limited to descriptions

of interdisciplinary activities or projects, without explicitly stating the emotional objectives to be developed or the pedagogical strategies used to achieve them. This lack of clarity hinders the replicability of the experiences and limits the possibility of transferring learning to other educational contexts. From a pedagogical perspective, this situation reinforces the need to move towards instructional designs that clearly articulate the relationships among disciplinary content, the methodologies employed, and the socio-emotional competencies intended to be strengthened. The review also reveals a marked predominance of qualitative and descriptive approaches in the analysis of the socio-emotional component within STEAM experiences. While these approaches allow for understanding participants' perceptions and experiences, the scarcity of studies that integrate mixed-methods or validated instruments for assessing socio-emotional skills limits the consolidation of robust empirical evidence. In this regard, the literature suggests strengthening evaluative approaches by incorporating formative and contextually grounded assessment strategies that account for emotional development over time.

Finally, from a contextual perspective, the reviewed studies show a limited critical examination of the social and emotional conditions in which STEAM experiences unfold. In contexts characterized by social inequality, psychosocial vulnerability, and cultural diversity, as is the case in large parts of Latin America, the integration of STEAM and socio-emotional skills takes on a particular meaning that is often overlooked in international literature. This omission underscores the importance of research that integrates both approaches from a situated perspective, recognizing the social, cultural, and emotional realities of educational communities. Another relevant aspect identified in the literature is the teacher's role as a mediator in integrating STEAM and socio-emotional skills. Several authors agree that socio-emotional development in STEAM environments does not occur automatically, but rather depends on pedagogical intent, lesson planning, and the teacher's ability to create emotionally safe learning environments. DeJarnette, N., Deeb, R., and Pallis, J. (2021); Ajao, H., Yeaman, A., & Pappas, J. (2023). However, the reviewed studies show that teacher training in this field remains limited, especially regarding the articulation between didactic, emotional, and reflective competencies.

In the Latin American context, the gaps identified in the literature are even more pronounced. While there are educational experiences that incorporate STEAM elements and report socio-emotional benefits, these initiatives tend to be developed in isolation, with little systematization and limited evaluation of their results (Castro-Campos, 2022; Mendoza, Mendoza, Vera, Guadamund, & Diaz, 2023). Furthermore, most studies focus on urban contexts and institutions with some access to technological resources, leaving rural realities and educational settings marked by social vulnerability underrepresented.

A central element that emerges from the comparative analysis of literature is the distinction between implicit and explicit approaches to integrating STEAM and developing social-emotional skills. In numerous studies, social-emotional competencies are conceived as emergent outcomes of collaborative work, problem-solving, and student participation in interdisciplinary projects (Ingram, E., Reddick, K., Honaker, J., & Pearson, G., 2021; Geesa, R., Robbins, K., & Shively, K., 2022). From this perspective, it is assumed that these skills develop naturally because of the dynamics inherent in STEAM environments.

However, other authors warn that this implicit approach is insufficient to guarantee systematic and equitable socio-emotional development. ElSayary (2021); Greca, I., Sanz, R., and Ortiz, J. (2023) point out that when socio-emotional skills are not formulated as explicit pedagogical objectives, their development depends on contextual variables and the teacher's teaching style, which limits their intentionality and assessability. In this sense, the literature demonstrates the

need to move towards explicit integration approaches, in which socio-emotional competencies are deliberately defined, planned, and supported within the STEAM instructional design.

This distinction is key from a pedagogical perspective, as it allows us to question the idea that methodological innovation alone guarantees a well-rounded education. The explicit integration of STEAM and socio-emotional skills requires recognizing that emotional development is not a byproduct of cognitive learning, but rather a dimension that demands pedagogical guidance, reflective mediation, and systematic monitoring.

From a critical perspective, this fragmentation highlights the need to move towards pedagogical approaches that explicitly recognize the interdependence between cognition and emotion. Recent research in the fields of neuroeducation and cognitive science has demonstrated that emotional processes play a fundamental role in attention, memory, and motivation, reinforcing the idea that meaningful learning requires educational experiences that integrate the cognitive and socio-emotional in a balanced way (Immordino-Yang, M.H., & Damasio, A., 2021). In this sense, the integration of STEAM and socio-emotional skills cannot be conceived as a superficial addition of content, but rather as an intentional and coherent didactic articulation.

Another relevant gap identified in the literature concerns the educational levels at which the integration of STEAM and socio-emotional skills has been explored. Most of the reviewed studies focus on secondary and higher education, where positive effects are reported on variables such as motivation, perseverance, and collaborative work (Ingram, E., Reddick, K., Honaker, J., & Pearson, G., 2021). Ajao, H., Yeaman, A., & Pappas, J. (2023). However, research focused on primary basic education is scarce, even though the literature on socio-emotional development underlines the importance of intervening from early ages (CASEL, 2023; OECD, 2023).

This absence is particularly significant in Latin American contexts, where primary school plays a fundamental role in building emotional, social, and civic skills. The lack of systematic studies at this level limits our understanding of how STEAM environments can contribute to socio-emotional development in the early school years. It highlights a clear opportunity for future research to design contextualized teaching proposals that are sensitive to students' emotional trajectories.

From this perspective, the integration of STEAM + SEL in basic education not only represents an underexplored field but also a strategic scenario to strengthen comprehensive training processes, especially in contexts characterized by social inequality and psychosocial vulnerability.

In summary, the reviewed literature supports the potential of the STEAM approach to foster students' socio-emotional development. However, it also reveals persistent conceptual, methodological, and contextual gaps, including the lack of integrated teaching models, limited assessment of socio-emotional competencies, and insufficient contextualization of proposals within Latin American realities. These findings reinforce the need for research that moves beyond isolated experiences and develops structured, evaluable pedagogical proposals sensitive to students' social and emotional contexts.

Discussion: Implications for Latin American Contexts

The findings from this literature review reaffirm that integrating the STEAM approach into the development of socio-emotional skills represents a field of high pedagogical potential, yet remains insufficiently developed from a comprehensive, contextualized perspective. While the literature acknowledges that STEAM environments offer favorable conditions for promoting active, collaborative, and meaningful learning, a significant gap persists between this potential and its realization in structured teaching models that explicitly integrate the cognitive and socio-

emotional dimensions of learning.

In the Latin American context, this gap is further complicated by structural factors that directly affect educational processes. Social inequality, cultural heterogeneity, the digital divide, and the psychosocial vulnerability of large segments of the student population demand pedagogical approaches sensitive to local realities. However, the reviewed literature shows that many STEAM proposals implemented in the region tend to replicate models designed in the Global North, without sufficient adaptation to the social, emotional, and cultural dynamics of Latin American education systems. This situation limits the transformative impact of the approach and underscores the need to move toward contextualized, critical proposals for educational innovation.

One of the main challenges identified relates to the lack of integrated teaching models that clearly guide the connection between STEAM and social-emotional skills. In numerous studies, the integration of both approaches is presented implicitly or declaratively, without explicitly defining the social-emotional objectives, pedagogical strategies, or associated assessment mechanisms. This lack of intentionality hinders the systematization of experiences and limits the ability to evaluate their impact rigorously. From a pedagogical perspective, this fragmentation highlights the need to move beyond partial approaches and toward instructional designs that conceive learning as a process where cognition and emotion are configured in an interdependent manner. Teacher training emerges as a cross-cutting theme in this discussion. The literature agrees that the effective implementation of STEAM proposals with a socio-emotional focus requires teachers to develop competencies that transcend disciplinary and technical mastery, encompassing skills in emotional management, pedagogical mediation, and critical reflection on practice.

However, in many Latin American contexts, initial and ongoing teacher training processes do not systematically address this integration, generating tension between institutional expectations and teachers' actual capacity to design and facilitate holistic learning experiences. This training gap constitutes a significant obstacle to the sustainability of STEAM proposals with a socio-emotional focus.

In the Colombian case, the results of the review take on special relevance considering the enactment of Law 2503 of 2025, which establishes Emotional Education as a mandatory subject in educational institutions. While this legislation represents a significant step forward in recognizing the emotional component as a cornerstone of holistic education, its implementation presents substantial pedagogical and operational challenges. National literature indicates that the effectiveness of this policy depends on clear teaching guidelines, teacher support strategies, and coherent evaluation mechanisms that translate the legal mandate into meaningful educational practices. In this context, the STEAM approach emerges as a relevant pedagogical opportunity to operationalize emotional education through active, contextualized, and collaborative learning experiences.

From a critical perspective, it is necessary to point out that integrating social-emotional learning into STEAM environments cannot be reduced to simply incorporating complementary emotional activities into technological or scientific projects. On the contrary, it requires a profound reconfiguration of pedagogical practices, in which social-emotional objectives are explicitly stated in the curriculum design, articulated with disciplinary content, and assessed through formative, context-based approaches. This perspective implies recognizing that social-emotional development is not a side effect of learning, but rather a fundamental condition for its meaning and sustainability.

Furthermore, the discussion highlights the need to strengthen evaluative approaches in STEAM programs with a socio-emotional emphasis. The lack of validated instruments and common frameworks for assessing socio-emotional skills limits the accumulation of empirical evidence and hinders informed decision-making in educational policy. In this regard, moving towards context-sensitive, process-oriented formative assessment models is a priority for educational research and practice in the region.

From a critical perspective, the findings of this review invite us to problematize the relationship between pedagogical innovation and educational justice. While the STEAM approach has been promoted as a strategy to democratize access to knowledge and strengthen 21st-century skills, its uncritical implementation can reproduce existing inequalities when it fails to consider the socio-emotional, cultural, and material conditions of educational contexts.

In Latin American contexts marked by social inequality, the integration of STEAM and socio-emotional skills takes on an ethical and political dimension that transcends methodological innovation. The reviewed literature suggests that pedagogical approaches that omit the socio-emotional component risk prioritizing technical performance over student well-being, thus limiting their transformative potential. In this sense, explicitly integrating socio-emotional development into STEAM environments not only responds to a pedagogical imperative but also to a commitment to equity and holistic education.

This tension reinforces the need to conceive of STEAM education not as an end, but to build meaningful, emotionally safe, and socially relevant learning experiences, especially in contexts where the school plays a significant role in rebuilding the social fabric.

In summary, integrating the STEAM approach into the development of socio-emotional skills represents both a challenge and an opportunity for Latin American education systems. The gaps identified in the literature reinforce the need for research that goes beyond isolated descriptions and contributes to the development of integrated, evaluable, and contextually grounded teaching models. This perspective is especially relevant in contexts like Colombia, where the normative, social, and emotional demands of contemporary education require pedagogical responses that recognize the student as a holistic and active participant in their learning process.

Implications for the Colombian Context: STEAM Education and the Chair of Emotional Education

In the Colombian context, the findings of this review are relevant given recent regulatory developments in socio-emotional education. The enactment of Law 2503 of 2025, which establishes Emotional Education as a mandatory subject in the country's educational institutions, represents a significant step forward in recognizing emotional development as a structural component of students' holistic education. This legislation presents the challenge of translating the legal mandate into coherent, systematic, and contextualized pedagogical practices.

The reviewed literature suggests that one of the main challenges of social-emotional learning (SEL) lies in avoiding its fragmented implementation or its confinement to isolated areas of the curriculum. In this sense, the STEAM approach emerges as a relevant pedagogical opportunity to integrate the Emotional Education course with active, interdisciplinary, and situated learning experiences, in which the development of SEL skills is intentionally integrated with cognitive and creative processes. STEAM projects designed with explicit SEL objectives can foster competencies such as self-regulation, empathy, collaborative work, and responsible decision-making, aligning with the educational goals of current regulations.

However, integrating STEAM and social-emotional learning in the Colombian context requires addressing structural factors, including teacher training, curriculum flexibility, and the

sociocultural diversity of educational environments. A review of the literature reveals that, without clear didactic guidelines and pedagogical support processes, there is a risk that both the STEAM approach and the Emotional Learning curriculum will be implemented superficially or in a disjointed manner. In this scenario, it is necessary to move towards integrated pedagogical models that guide teaching practice and operationalize emotional learning through contextualized and evaluable proposals.

From this perspective, the analysis developed in this article provides conceptual elements that can contribute to the reflective implementation of the Chair of Emotional Education in Colombia by positioning the integration of STEAM + socio-emotional skills as a pedagogical alternative consistent with the country's normative, educational, and social demands.

Conclusions

This literature review critically analyzed the main contributions, trends, and research gaps surrounding the integration of the STEAM approach and the development of socio-emotional skills in educational contexts. Based on analyses of international, national, and regional studies, a consensus emerged regarding the potential of the STEAM approach to promote active, interdisciplinary, and contextually relevant learning, as well as the relevance of socio-emotional skills for student well-being, school climate, and academic performance.

However, the findings reveal a persistent disconnect between these two fields. While numerous studies report socio-emotional benefits associated with participation in STEAM experiences, these effects are often presented as indirect or collateral results, rather than as the product of pedagogical approaches intentionally designed to integrate both dimensions. The reviewed literature shows that few teaching models explicitly define socio-emotional objectives, guide teacher mediation, and propose coherent assessment mechanisms within STEAM environments. From a methodological perspective, significant limitations have been identified in the assessment of socio-emotional development in STEAM experiences. The lack of validated instruments, common theoretical frameworks, and systematic follow-up strategies hinder comparisons between studies. It limits the construction of robust evidence on the real impact of these approaches. This situation reinforces the need to move toward research that explicitly integrates established conceptual frameworks of socio-emotional learning with innovative pedagogical approaches.

In the Latin American context, the identified gaps become relevant. The conditions of social inequality, cultural diversity, the digital divide, and the psychosocial vulnerability of large segments of the student population demand educational approaches that recognize the interdependence of cognition and emotion. However, the literature shows that STEAM implementation in the region is characterized by, in many cases, isolated, poorly systematized, and poorly contextualized initiatives, which limit its transformative potential.

In the Colombian case, the enactment of Law 2503 of 2025 represents a significant regulatory advance by recognizing emotional education as a mandatory component of comprehensive education. However, the review suggests that the effectiveness of this policy depends on the availability of clear pedagogical guidelines and teaching models that enable the coherent integration of social-emotional education with classroom practices. In this sense, the STEAM approach emerges as a relevant pedagogical opportunity, provided that its implementation transcends instrumental approaches and is based on an intentional, reflective, and evaluable integration.

Based on the identified gaps, future research should focus on the design and validation of teaching models that explicitly integrate the STEAM approach with the development of socio-

emotional skills. These models should consider not only content and methodologies, but also teacher mediation processes, formative assessment, and the sociocultural context of educational experiences.

It is also a priority to expand research in primary education and to strengthen methodological approaches that enable rigorous evaluation of the socio-emotional impact of STEAM programs. Progress in this direction will help consolidate a more robust empirical base and guide pedagogical and educational policy decisions that are sensitive to Latin American realities.

In this sense, the present literature review not only synthesizes current knowledge but also establishes a conceptual framework that guides future research and justifies the relevance of integrated, contextualized, and ethically committed pedagogical proposals for the comprehensive education of students.

In summary, the reviewed literature demonstrates the need to move towards integrated teaching models that articulate the STEAM approach with the development of socio-emotional skills, grounded in a contextualized, ethical perspective on educational innovation. This research horizon not only responds to contemporary educational challenges but also opens a fertile field for future research aimed at designing, implementing, and evaluating pedagogical proposals that recognize students as whole people. Thus, this literature review provides conceptual and critical foundations for advancing this line of research, particularly in Latin American contexts that demand educational responses sensitive to students' social and emotional realities.

Taken together, this analysis contributes to consolidating an emerging field of study that demands integrated pedagogical approaches, capable of responding to contemporary educational challenges from a cognitive, emotional, and socially situated perspective.

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