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STEAM: A Contemporary Concept and a Set of Early Childhood Education

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ABSTRACT

The integration of Science, Technology, Engineering, Arts, and Mathematics (STEAM) in early childhood education is emerging as a key strategy to cultivate essential 21st-century skills for innovation and global citizenship. This narrative review offers an interdisciplinary synthesis of the STEAM movement in the early years, critically examining its conceptual roots, pedagogical practices, and policy implications. Drawing on foundational child development theories and international research, it argues that a well-implemented STEAM model not only supports cognitive growth but also nurtures socio-emotional and creative competencies. Empirical evidence highlights that play-based, inquiry-driven STEAM activities significantly enhance problem-solving, collaboration, and critical thinking. However, the review also identifies substantial implementation challenges, including difficulties in curriculum integration, superficial treatment of the arts, unequal resource access, and the need for a shift in teaching mindsets. To address these, the paper proposes integrating STEAM into national curricula through comprehensive teacher training, fostering community and home-school partnerships, and encouraging culturally responsive practices. Future directions explore STEAM's convergence with artificial intelligence, virtual reality, nature-based learning, and indigenous knowledge systems. Ultimately, the review positions STEAM as a transformative educational movement capable of equipping young learners to become creative, empathetic, and resilient problem-solvers in an increasingly complex world.

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Introduction

In early childhood education, integrating Science, Technology, Engineering, Arts, and Mathematics (STEAM) is more than a passing trend; it represents a vital pedagogical evolution. The goal is to cultivate the foundational skills children need to navigate a world defined by its complexity and interconnectedness. In an era of constant technological change and global-scale challenges, the need for citizens who can think both critically and creatively has never been more acute (Atikah & Biru, 2024; Habibi, 2023). The early years are a time of incredible cognitive and creative expansion, making it a crucial window to introduce learning that is not bound by subject lines but instead prepares children for a lifetime of inquiry and problem-solving (Tshering & Sonam, 2021). This fact is compelling the educational systems everywhere to gaze beyond siloed teaching that takes place in forms past and at global levels to a more global model (Setyowati, 2022). This general trend is precipitated by the necessity of the so-called 21st-century skills, a package of skills that comprises collaboration, communication, and creativity (Kucukaydin et al., 2024). These skills are not cultivated as easily through traditional schooling, and that is why there are documented failures in critical thinking and creative expression in certain educational situations (Setyowati, 2022). The STEAM framework directly addresses these gaps, trying to produce students who are not only knowledgeable but also flexible and up to the challenges of a modern working environment (Rifandi & Rahmi, 2019).

The core element in this change is the strategic insertion of the Arts into the STEM acronym. Making STEM into STEAM would be a philosophical statement, an admission that the "A" cannot be seen as a side note but rather as a major driver of innovation (Johnston et al., 2022). The arts introduce technical disciplines to creativity, human-oriented design, and aesthetic senses, and this has further raised the bar on critical thinking and problem resolution (Papadopoulou, 2024). The combination leads to a deeper learning experience in which the social and emotional aspects are interwoven with scientific and mathematical knowledge, providing a sense of well-rounded personality and readiness to resolve multidimensional learning problems (Pocalana et al., 2024; Wahyuningsih et al., 2020). The research is still in its infancy stage despite the emerging opinion on its usefulness because the actual application of STEAM in early childhood is an emerging field with apparent gaps in the research. Teachers and scholars are still struggling with how to come up with a proper curriculum, how to effectively incorporate the arts meaningfully, and how to make teachers feel ready (Papadopoulou, 2024). It stands out that there is an obvious urge to develop a stronger body of knowledge on the theories, learning activities, and assessment tools that would best serve young learners in STEAM environments (Su et al., 2025). Specifically, the professional development of early childhood educators in this area remains under-researched (Erol & İvrendi, 2025). This review aims to address some of these gaps by providing a critical, interdisciplinary, and forward-looking analysis of STEAM in early childhood education. It synthesizes theoretical underpinnings, practical implications, global trends, and actionable guidance for educators and policymakers alike.

Methodology

This study was conducted as a narrative review to provide a comprehensive, interdisciplinary synthesis of the current status of STEAM in early childhood education. The approach used a multi-stage methodology that included literature identification, selection, and thematic analysis to produce an integrated and critical overview of the subject field.

An extensive literature search was conducted using leading scholarly databases such as Google Scholar, Semantic Scholar, and Dimensions. The search strategy involved the systematic use of keywords and their synonyms, combined through Boolean operators (AND, OR, NOT) to maximize coverage and relevance. The table below summarizes the combinations of search terms used.

Table 1. *Search terms and Boolean combinations used in literature search*

Keyword Group 1	Boolean Operator	Keyword Group 2	Boolean Operator	Keyword Group 3
"STEAM education"	OR	"STEM education"	AND	"early childhood education"
"preschool"	OR	"kindergarten"	AND	"play-based learning"
"interdisciplinary learning"	OR	"integrated learning"	AND	"21st-century skills"
"teacher professional development"	AND	"curriculum integration"		

Note: NOT operators were not used in this search, as all terms were deemed relevant to the topic scope.

The inclusion criteria were focused on articles from peer-reviewed journals, seminal texts, and relevant policy reports published in the English language, with a focus on research over the last two decades to ensure relevance to current concerns. The selection process inclined towards studies that offered empirical data, theoretical contexts, or critical overviews that were first-hand concerns of the review.

Out of an initial pool of 200 articles retrieved through database searches, 115 relevant studies were selected for inclusion in this narrative review after removing duplicates and excluding those that did not meet the predefined inclusion criteria. The selected literature was synthesized through a thematic synthesis process. All selected articles were analyzed through a systematic reading to identify, classify, and synthesize recurring themes and salient concepts. This process enables the classification of findings into the main themes that form the structure of this review: (1) conceptual and theoretical foundations of STEAM; (2) evidence combined with international trends; (3) the teacher and learning environment; (4) barriers and criticisms pertaining to implementation; and (5) directions forward, including technology, policy, and practice. This process allowed for critical and thorough investigation of the issue at hand, including diverse opinion from international scholarship to formulate a robust argument regarding the importance and future promise of STEAM in early childhood education.

Conceptual Framework: Defining STEAM in Early Years

STEAM offers a modern, holistic vision for early childhood education, one that prepares young learners for the demands of the 21st century by fostering comprehensive development (Cohen & Waite-Stupiansky, 2020; Sydon & Phuntsho, 2021). Grasping its conceptual framework means looking at its history, the developmental theories that give it weight, and how its principles come to life in a preschool classroom. The shift from STEM to STEAM was not accidental; it marks a deep evolution in how we think about education. STEM with its focus on science, technology, engineering, and mathematics originally grew from a strategic push for a more technically skilled workforce. Over time, a new understanding took hold: creativity, design thinking, and artistic expression were not separate from but essential to true innovation in any field. The deliberate integration of the Arts transformed the model, reflecting a new belief that innovation blossoms at the crossroads of analytical and creative thinking. The shift exists in line with a broader educational purpose of holistic and quality teaching for all students (Ata-Akturk & Demircan, 2021; Ogunlade, 2023).

The key principles of STEAM are closely grounded in significant concepts of child development. This hands-on, inquiry-based character of STEAM has a solid foundation in the theory of cognitive development proposed by Jean Piaget, who spoke in favor of experiential, hands-on learning as the means through which children construct knowledge (Cardullo et al., 2024). Similarly, the sociocultural theory developed by Lev Vygotsky, which propounded the aspects of social interactions and collaborative learning, can greatly be aligned with someone in the case of a STEAM project that is based on group work and co-discovery of solutions to problems (Cardullo & Burton, 2024). The additional theoretical basis is the constructionism of Seymour Papert, who claimed that learning is retained when kids are engaged in making something that makes sense to them and is substantial. That is exactly what occurs in STEAM teaching and learning projects based on designing, making, and improving concepts (Gunarti et al., 2020). Fundamentally, STEAM applauds the holistic system and integrates various topics to develop a comprehensive level of skills and awareness in the child (Su et al., 2024; Yeung et al., 2024). Rather than educating on the topics in segregated chunks of time, STEAM asks teachers to create activities that display relationships of knowledge (Atikah & Biru, 2024; Habibi, 2023). This integrated method is key to developing a sophisticated suite of skills, from creative thinking to scientific inquiry (Dubek et al., 2024). In a preschool, each piece of STEAM becomes a hands-on, age-appropriate activity. Science is about simple experiments and nature walks. Technology might be an educational app or a simple robot (Bölükbaş, 2025). Engineering happens with building blocks and design challenges (Gunarti et al., 2020). The arts are about self-expression through painting or music (Wahyuningsih et al., 2020), and math is found in counting games and exploring patterns (López et al., 2021). For example, the following figure shows STEM integrated with entrepreneurial practices (Eltanahy et al., 2020):

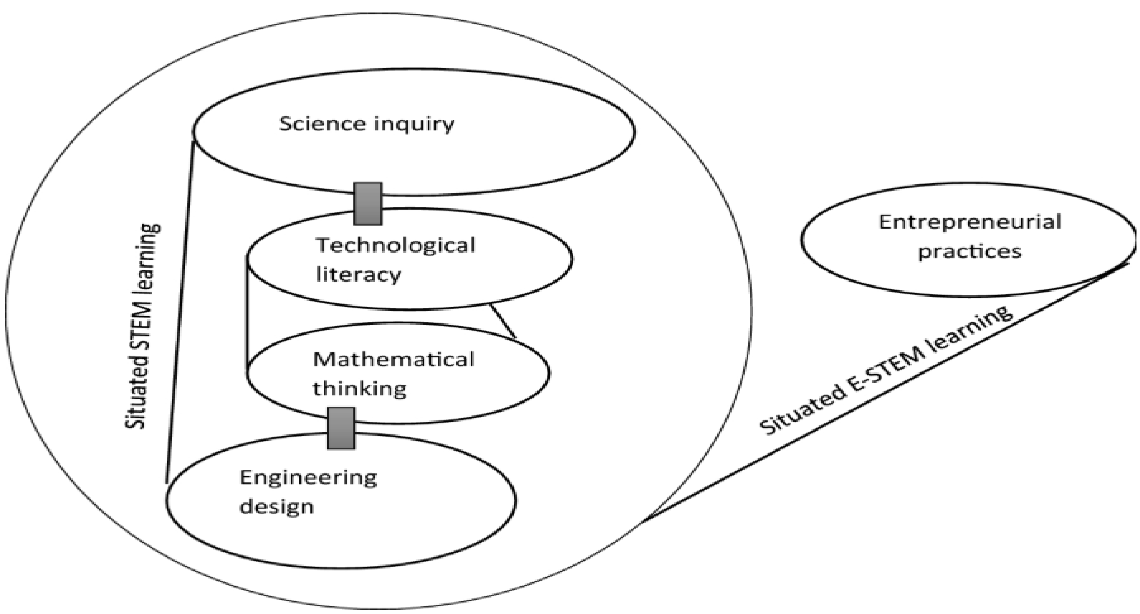

Figure 1: Situated STEM learning (Munawar et al., 2024)

When these elements are combined, children begin to see the world not as a collection of separate facts, but as an interconnected whole (Munawar et al., 2024).

Evidence from the Field: Current Research Trends

Empirical research over the last fifteen years consistently points to STEAM as a powerful pedagogical tool in early childhood education. This body of evidence shows how STEAM helps nurture the critical and creative thinking that children need to thrive (Nho & Thiep, 2024; Tshering & Sonam, 2022). Studies confirm that STEAM is not just a popular idea but an effective method for boosting creativity, problem-solving, and scientific curiosity (Gunarti et al., 2020; Nho & Thiep, 2024). The central aim that emerges from the literature is to give young children a versatile and integrated skill set that prepares them for a future that is anything but predictable (Atikah & Biru, 2024). The physical environment for learning also matters immensely; research shows that nature-based outdoor settings, for example, are highly effective for STEAM concept formation because children can physically engage with their surroundings (Hibana et al., 2024). New lines of inquiry also point to the benefits of introducing coding early on to strengthen cognitive skills (Bela et al., 2024) and using authentic assessment within STEAM projects to support literacy development (Campbell & Speldewinde, 2022).

The influence of STEAM activities is not limited to cognition; studies show significant positive effects on children's socio-emotional and creative growth as well. When Social and Emotional Learning (SEL) is woven into STEAM curricula, it supports the whole child, improving social skills, self-awareness, and emotional regulation (Trina et al., 2024). The creative benefits are also clear, with research linking STEAM-based learning to more flexible, innovative, and detailed thinking (Başaran et al., 2024). Game-based learning, a natural fit for STEAM, is increasingly recognized as a powerful way to build cognitive skills like memory and attention (Alotaibi, 2024; Borg et al., 2018). The link between cognitive and emotional growth is reinforced by findings that executive function training can boost a young child's emotional intelligence (Pumyoch & Srikoon, 2024). Even foundational components like early mathematics have been shown to directly improve problem-solving abilities and memory (Chen, 2024).

Looking around the world, case studies reveal how different regions are applying STEAM principles. In South Korea, there is a strong research focus on using technology to build digital literacy from a young age. In the United States, studies often emphasize how quality early childhood education builds a strong foundation in literacy and numeracy (Little et al., 2020), with large-scale surveys tracking the factors that contribute to school readiness (Ghandour et al., 2024). Australian research highlights the crucial role of well-trained educators and has explored the developmental needs of all children, including the most vulnerable (Cashmore et al., 2024; Harper et al., 2024). And while the literature may not label it as "STEAM," the Scandinavian focus on high-quality, inquiry-based pedagogy offers a strong philosophical parallel (Klippen et al., 2024).

STEAM education also holds unique potential for creating more equitable learning opportunities for underserved communities. Research indicates that high-quality early childhood programs can be a powerful force for closing educational gaps for children from disadvantaged backgrounds (Boca et al., 2023). For example, initiatives that support small child care providers in low-income areas have shown they can improve the quality of care and learning for all children (Zeng et al., 2021). Teacher education is also evolving, with a growing emphasis on preparing future educators to develop culturally inclusive pedagogies that honor students' home languages and local knowledge (Son, 2024).

At the heart of it all are play, inquiry, and exploration. While play-based learning is a requirement in many curricula, its actual implementation and value can differ (Pyle et al., 2017). Yet, research makes a strong case that free play fuels creativity, especially when teachers act as thoughtful facilitators (Tok, 2022). Structured inquiry sequences also offer a clear path for integrating different disciplines and building investigative skills (Karta & Rasmini, 2022). Simple interventions, like providing unstructured "loose parts" for outdoor play, have been shown to increase physical activity and literacy (Houser et al., 2019). Through these kinds of hands-on, playful experiences, children can tackle complex ideas, connect learning to their own lives, and build a foundation for holistic well-being (Adbo & Carulla, 2020; Joisten et al., 2021; Panjeti-Madan & Ranganathan, 2023).

Role of Teachers and Environment in STEAM

For STEAM to genuinely thrive in early childhood education, the teacher and the environment must collaborate effectively. In this model, the teacher transitions from being a mere provider of information to becoming a skilled facilitator of learning. The environment, in turn, is no longer a passive backdrop but an active "third teacher" that provokes and guides learning (İnan, 2022). This dynamic partnership is what makes it possible to cultivate the kind of creativity, critical thinking, and problem-solving skills needed for the 21st century (Cohrssen & Garvis, 2021).

In a STEAM classroom, the teacher acts as a guide for discovery, helping children navigate their way through interconnected learning experiences (Edwards & Ren, 2016). Instead of delivering siloed lessons, they design activities that spark curiosity, demand collaboration, and invite hands-on exploration. This approach helps children build a deeper and more integrated picture of their world (Cohrssen & Garvis, 2021). Taking a socio-constructivist view, teachers empower children to be the architects of their own knowledge, building understanding through social interaction and direct experience (Larimore, 2020).

This new way of teaching requires a profound mindset shift, one that must be nurtured through high-quality, ongoing professional development (Hennessy et al., 2022). Good training helps teachers obtain confidence and expertise to combine various subjects and use technology in a meaningful way (McChesney & Clarkin-Phillips, 2020). An important aspect of it is to develop the digital competence of the teachers themselves and to learn how to apply new tools consciously and with expertise (Martinez-Soto & Prendes-Espinosa, 2023). In addition to technical competencies, it is also essential that this professional learning enables a strong sense of diversity, equity, and inclusion, so that each child feels aligned and powerful in the classroom (Lang et al., 2024). Lifelong learning helps teachers maintain their association with up-to-date research and optimal practices in a fast-evolving sector (Dorresteijn et al., 2025).

Powerful STEAM environments can be created based on rich blueprints offered by well-known educational tenets such as Reggio Emilia and Montessori (Strong-Wilson & Ellis, 2007). Reggio Emilia is considered to be one of the most famous approaches, with its concept of the environment as the third teacher that demonstrates how a well-designed and organized space is capable of sparking both curiosity and critical thinking (Ilan, 2022). It employs artistic expression as one of the main instruments of critical thinking, and this is the best fit for STEAM (Fernandez-Santin & Feliu-Torruella, 2020). The Montessori approach, whose subsequent principles are child-guided investigation and self-correcting, tactile materials, can also be discussed to have profound philosophical origins, with a major focus on the active learning worldview of STEAM (Beach, 2024). The similarity between the two models lies in the view of the child as a competent and active participant in his or her learning, which is the core of true STEAM practice and has been attributed to improved school readiness and creative development (Becker et al., 2023; Cutcher, 2013; Fyffe et al., 2024). All these are affected by the physical space and the contents of the space, along with the digital tools. A STEAM learning environment needs to be thoughtfully laid out to foster exploration and cooperation (Badshah et al., 2023). This involves providing a diverse array of open-ended materials, including building blocks, art supplies, and natural objects that children can utilize in numerous ways. When used intentionally, digital tools can enhance these experiences. Robotics can be a vehicle for creative literacy, while immersive technologies can enhance physical learning in new ways (Wang, 2024). The key is balance. Technology should always complement and extend, never replace, the irreplaceable learning that comes from hands-on, sensory experiences (Bölükbaş, 2025; Parker et al., 2024).

Barriers and Critiques

While STEAM is celebrated for its potential to build 21st-century skills (Belbase et al., 2022; Gunarti et al., 2020), the road to putting it into practice effectively is not without obstacles. To ensure STEAM lives up to its promise, we must critically examine the real-world challenges related to curriculum, pedagogy, equity, and institutional support.

One of the biggest hurdles is achieving true curriculum integration and finding meaningful ways to assess it. Genuine transdisciplinary work is far more than a checklist of subjects; it requires a thoughtfully designed curriculum where disciplines are woven together to create a cohesive learning experience (Ismiati, 2024; Li, 2024). Too often, teachers struggle to move beyond fragmented activities, which prevents them from unlocking the full synergistic power of STEAM (Wang & Lin, 2025). Assessment is just as tricky. Traditional tests, designed to measure knowledge in a single subject, fall short of capturing the complex skills at the core of STEAM, such as collaborative problem-solving and design thinking. The field is still working to develop better tools for this task (Karta & Rasmini, 2022).

A common and fair criticism is that the "A" in STEAM often becomes a superficial add-on—a bit of art to decorate a science project rather than a core part of the learning process. For STEAM to be authentic, the arts must serve as a catalyst for creativity, a method for critical thinking, and a means of communication (Wang & Lin, 2025). This means going beyond crafts and engaging in activities where artistic practice truly informs the work in science and engineering (Vošnjak & Devetak, 2023). As an example, students may use music to discover mathematical patterns and want to depict their findings in detail using scientific illustrations (Pocalana et al., 2024). To change this by replacing it with a new practice that involves educators viewing and utilizing the arts as a strong cognitive instrument, these educators need to be trained to do so.

STEAM implementation is plagued by the long shadow of equity and access to resources (Milara & Orduña, 2024). A quality STEAM program is usually rich in access to technology, diverse materials, and flexible learning space resources, which are not utilized by every school or center (Parker et al., 2024). These funding imbalances represent a major disparity that leaves kids in underfunded communities' way behind (Munawar et al., 2024). The process of filling this gap will presuppose specific policy shifts and innovative, community-oriented interventions that utilize low-cost materials and the knowledge of the people in the area (Hao & Guohua, 2024).

Lastly, a lack of progress can be caused by the personal unease or inexperience of the teachers and institutional inertia (Wang & Lin, 2025). Most early childhood teachers are not ready to cover such courses as engineering or coding because they received almost no formal education in those subjects (Zhang et al., 2023). This may cause resistance to change or a compulsion toward the old teaching methodologies that fail in tandem with STEAM (Heimer & Winokur, 2015). At a senior level, strict curriculum requirements or an absence of administrative assistance can dampen even the most committed educators (Wang & Shih, 2022). What we need is complete professional development (Ata-Akturk & Demircan, 2020; Lines et al., 2024) and a school culture aimed at promoting interdisciplinary typecasting and allowing educators to take creative risks (Snyder and Snyder, 2023).

STEAM, Technology, and the Future of Learning

Being an innovative way of education, STEAM is closely related to the development of technology. Science, Technology, Engineering, Arts, and Mathematics are regarded as important factors related to the early seeding of 21st-century skills (Ba\SEL Stockton Raymond Stockton Ray naron et al., 2024; Ismiati, 2024). Technology, in this case, is not another discipline; it is a potent instrument that not only can extend the learning process in miraculous ways but also poses a series of ethical issues and problems that we have to ponder rationally (Oh & Lee, 2025). The potential of introducing AI, robotics, and coding to the preschool classroom is quite encouraging, yet we need to be cautious about the ethics of the matter (Oh & Lee, 2024). We should be cautious about the dangers despite the intelligence tools being innovative and productive in creative thinking and learning (Viberg et al., 2024). The need for privacy of data, algorithm bias, and excessive focus on technology are not hypotheticals (Han et al., 2020). We cannot allow these tools to be designed and used in a manner that will facilitate inequality and make harmful stereotypes relevant (Oh & Lee, 2024). Moreover, the skills that need to be taught, such as coding, cannot be prioritized over other similarly essential directions, such as social-emotional development and physical play (Kucukaydin et al., 2024). What should be aimed at is that with the application of technology, human interaction and creativity be enhanced and not replaced.

EdTech may be a two-sided blade. It may hugely intensify STEAM learning or accidentally inhibit it. Properly applied, EdTech can make interactive simulations and personified learning opportunities accessible that are otherwise impossible to achieve.

If used poorly, however, it can get in the way of deep, hands-on learning (Pocalana et al., 2024). Too much screen time without enough tangible activity can stunt the growth of critical thinking and problem-solving skills (Başaran et al., 2024). The digital divide also remains a serious problem, threatening to widen existing inequalities (Malay et al., 2024). To get the most out of EdTech, it must be integrated as one part of a rich and varied pedagogical toolkit, and teachers need high-quality professional development to learn how to use it effectively (Yoel et al., 2020). Future concepts like metaverse education may offer multi-sensory learning, but they will demand even more careful ethical and pedagogical planning (Saha et al., 2024).

STEAM education is, by its very nature, about preparing children for the future by building new kinds of literacies. This goes beyond just digital skills to include the "4Cs"creativity, critical thinking, communication, and collaboration that are essential for navigating the modern world (Christidi & Christopoulou, 2022; Rodrigues-Silva & Alsina, 2023; Yoel et al., 2020). STEAM encourages children to think flexibly and innovatively, which are the cornerstones of a creative mindset (Viberg et al., 2024). Learning to code, for example, is as much an exercise in logical and creative problem-solving as it is a technical skill (Küçükaydın et al., 2024). And these are the competencies that are going to enable children to get used to change all the time and become engaged members of a world that is better via active contributions to it (Boafo et al., 2024).

One of the most effective methods to make STEAM future-oriented is linking it to the concept of global citizenship, which can be examined through the prism of sustainability and the Sustainable Development Goals (SDGs) developed and promoted by the UN. By involving children as contributors in such projects (that need to address e.g., climate change or social justice), we can cultivate their responsibility and make them feel empowered to be forces of change (Setyowati et al., 2022; Wearne & Riedy, 2024). It is possible that children should discover the concepts of environmentally responsible behavior in a robotics project or by conducting regional environmental sustainability discussions (Kalogiannidou et al., 2021). This connection can be even stronger when adopting models that clearly establish connections between STEAM and sustainability competencies, as has been done in certain programs in Japan (Yi et al., 2024). It is not only a form of teaching science but also a method of producing empathy, ethical decision-making, and a lifetime dedication to the creation of a more just and sustainable future (Setyowati, 2022).

Policy and Practice Recommendations

We require a coordinated effort on both policy and practice to take STEAM out of highs and lows and make it a dependable practice in early childhood classrooms. The suggested curriculum and teacher support, learning and cultural environment must address the effectiveness and the accessibility of STEAM education, so that it can reach and be accessible to all (Quinn & Hobbs, 2024; Wahyuningsih et al., 2020). To begin with, early childhood national and state curricula should be redesigned purposefully to encrypt STEAM values. It entails a shift toward a new paradigm in which students learn without dividing them into disciplines and have a multi-disciplinary approach (Jin et al., 2024; Su et al., 2025). The curriculum must promote experimental, playful learning which helps to stimulate children to learn through explorations, experiments and self-discovery (Anh, 2024; Khalfaoui et al., 2021). As one example, policies might support engineering challenges and outdoor exercise or incorporate computer age-appropriate computational thinking to develop a base of digital literacy (Meitei et al., 2024; Yeung et al., 2024; Zhipeng, 2024).

No matter how excellent any curriculum is, the teacher who taught the curriculum definitely matters (Hu & Yelland, 2019). It is thus necessary to make these teacher training programs and professional development more valuable and inform the educators with the knowledge, skills, and confidence to teach STEAM adequately (Hubelbank et al., 2024; Larimore, 2020). Such training must also be applied, interdisciplinary approaches, project-based education, and inquiry learning that spur the natural curiosity of the children must also be trained (Krahe et al., 2023; Trina et al., 2024). The certification requirements of teachers are to be revised based on those skills and school shall aim to provide their staff with continuous professional development in order to ensure the staff is on the edge of the filed (Bolukbas, 2024; Cohrssen & Garvis, 2021; Sarker & Ullah, 2023).

Learning environments and schools ought to invest in the development of stimulating learning ecosystems. This can imply the establishment of separate STEAM labs or makerspaces as co-working spaces where students can run their project-based learning. Partnerships within the community are also invaluable. They should facilitate inviting local scientists, artists, and engineers into the classroom as mentors through policies (Klippen et al., 2024). Simultaneously, it is vital to create close relationships between parents and schools to make the learning process not only school-oriented. This could be achieved by arranging family STEAM nights, parent workshops, and even at home by introducing easy activities that help children recall what they need to learn (Capio et al., 2023; Gunn et al., 2020). A supportive network composed of joint efforts provides children with an opportunity to flourish (Zeng et al., 2021).

Lastly, STEAM instruction must be culturally aware. It must accept, appreciate, and develop the differences of all children (Hartman & Dani, 2020). Educators should be taught to use culturally appropriate examples and contexts in instruction so that the information would be, in a sense, meaningful (Steed & Kranski, 2022). This implies that they should take time to know and absorb the cultural knowledge and learning styles of the children into the curriculum (Kye, 2023). For example, the study of building traditions in other cultures introduces students to the principles of engineering subjects and instills a sense of cultural pride. Being culturally receptive also presupposes addressing the concerns of equity and social justice directly, making children of all backgrounds feel that they can be innovative and change agents (Bennett et al., 2018; Dajani & Meier, 2019; Jongen et al., 2017; Kintner-Duffy et al., 2022).

The establishment of such a positive and inclusive classroom environment is a critical aspect of enabling all children to achieve their full potential (Yang et al., 2021).

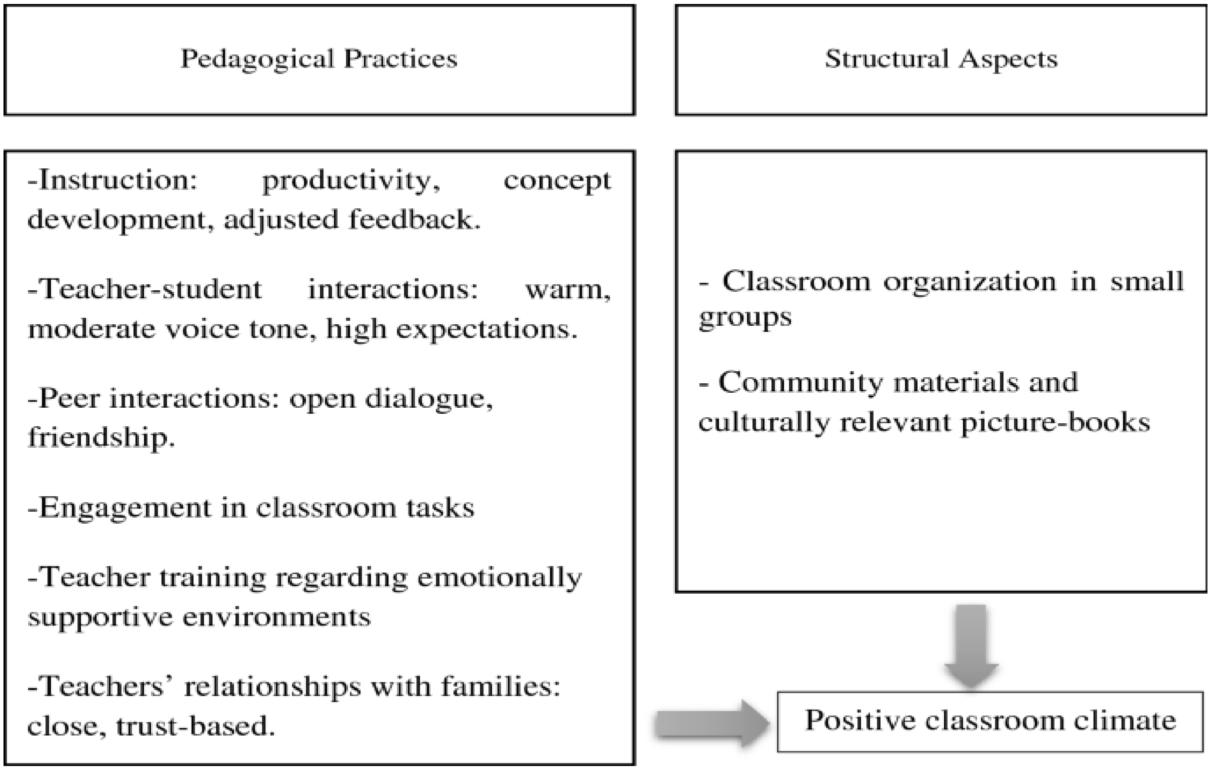

Figure 2. *Positive Classroom Climate (Yang et al., 2021)*

Limitations

This review has some limitations due to its narrative nature. It does not follow a strict method for selecting studies, so some important research may be missed. The findings are based on available literature but may not give a full picture. Also, there may be some personal bias in how the information is presented.

Conclusion and Future Directions

This review has underscored how STEAM holds a deep possibility of transforming early childhood learning. It has been highlighted that STEAM supports the fundamental learning years of a child, embracing and fostering critical thinking, creativity, and collaboration skills that are vital to child development by integrating various subjects through practical, fun, and inquiry-based experiences. The international empirical data is overwhelming: well-executed STEAM not only develops cognitive skills but also promotes socio-emotional development. Its success is attributed to dedicated teachers, inclusive teaching, supportive environments, and equitable provision of resources. However, challenges lie ahead, such as the superficial integration of the arts and disparities in seed funding and training, which are laced with inequality. We require continuous investment in research as well as practice to remain on the path of progress. Future research ought to explore the establishment of superior means of determining the level of interdisciplinary learning and also fathom the expansion of methods to provide high-quality STEAM in disadvantaged areas. We should also be more culturally responsive by creating frameworks that appreciate and apply different ways of knowing. Going forward, the future of STEAM education depends on its capability to become versatile and not obsolete. Emerging technologies such as virtual and augmented reality present enticing opportunities for making immersive learning possible. Meanwhile, nature-based STEAM practices can connect children to the real world and lead to the development of pronounced environmental responsibility. We must make an effort to incorporate native knowledge systems that offer invaluable insights into ecology, community, and innovation. Adopting these directions involves some degree of pluralism a vision for the future of education that includes diversity, facilitates global citizenship, and empowers young learners not only to respond to and adjust to the future but also to shape it themselves.

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