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Integrating STEAM-Based Loose Parts with Local Wisdom in Early Childhood Visual Arts Education for Creativity Development: A Systematic Literature Review

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ABSTRACT

The integration of Science, Technology, Engineering, Arts, and Mathematics (STEAM) with loose parts is widely recognized as an effective approach to fostering creativity in early childhood education; however, it remains unclear how much local wisdom has been incorporated into this approach in visual arts education. Following the PRISMA 2020 guidelines, this systematic literature review mapped and synthesized empirical evidence on the effectiveness of STEAM-based loose parts learning on the creativity of children aged 3–6 years in early childhood visual arts education, and examined the integration of local wisdom. A Scopus search yielded 179 records, narrowed to 90 after filtering, 35 after title/abstract screening, and 11 studies after full-text assessment. The included studies (2020–2026, seven countries) revealed five patterns: (1) structured STEAM curriculum models consistently enhance creativity; (2) loose parts catalyze multimodal artistic expression; (3) informal learning spaces can foster creativity without formal STEAM curricula; (4) digital technology complements rather than replaces physical materials; and (5) local wisdom integration remains critically underexplored, addressed by only one study and by none from Indonesia. These findings confirm a significant research gap and provide a foundation for future research on culturally grounded STEAM-based visual arts education in early childhood.

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INTRODUCTION

Creativity is a fundamental human capacity underlying the ability to imagine, solve problems, and generate novel ideas from an early age (Vygotsky, 2004). Early childhood, particularly the 3–6 year age range, is widely regarded as a golden age for creativity development, as this period coincides with peak neural plasticity and openness to exploration (Runco and Jaeger, 2012). Visual arts education plays a central role in stimulating this creativity, as drawing, painting, and modelling activities provide a form of symbolic expression that other modes of learning cannot fully replicate (Eisner, 2002). Furthermore, enjoyable and autonomous artistic experiences in early childhood have been shown to contribute holistically to children's cognitive, social, and emotional development (Hunter-Doniger, 2021). Strengthening visual arts education from an early age therefore remains an important agenda in contemporary early childhood education practice.

In response to this agenda, the integration of Science, Technology, Engineering, Arts, and Mathematics (STEAM; Yakman, 2008) has emerged as a contemporary approach empirically shown to be effective in fostering early childhood creativity through the integration of the arts with other disciplines. Several experimental studies indicate that STEAM organized through structured instructional models, such as the 5E model integrated with the Engineering Design Process (Nguyen and Vu, 2025) or the 6E model combined with Williams' Creative Thinking Strategies (Hsiao *et al.*, 2026), significantly outperforms conventional approaches in fostering children's creativity. Beyond structured curricula, the use of loose parts, open-ended materials that can be flexibly manipulated (Flannigan and Dietze, 2017; Gull *et al.*, 2019; Nicholson, 1971), has also proven to be an important catalyst for multimodal artistic expression, whether combined with music, visual art, and dramatic play activities (Liao *et al.*, 2025), or through guided play that enhances creativity, social skills, and attention (Jaruchainiwat *et al.*, 2024). Even informal learning spaces such as physical makerspaces equipped with recycled materials have been shown to foster children's creativity and imagination (Mercan *et al.*, 2024).

Despite this evidence of the effectiveness of STEAM and loose parts, the existing literature reveals inconsistent patterns alongside significant research gaps. At the conceptual level, an integrative review of 44 STEAM articles found no single shared interpretation of the "A" in STEAM (Perignat and Katz-Buonincontro, 2019), making the arts component difficult to identify consistently across studies. A scoping review by Su *et al.* (2025) of 26 STEAM studies in early childhood education found highly variable outcome measures, spanning knowledge gains, skill acquisition, and attitudinal change, without a unified assessment framework. Similar inconsistency has been observed in loose parts research; a systematic review by Cankaya *et al.* (2025) of 25 studies revealed that five studies found no association between loose parts and cognitive development, seven did not address the relationship explicitly, and only one study consistently used the term "loose parts." Beyond this methodological inconsistency, the present systematic review identified a more specific gap: of the eleven primary studies analyzed, only one explicitly integrated local wisdom into STEAM-based learning (Chatathicoon *et al.*, 2026), and none originated from an Indonesian context.

Building on this gap, the present study aims to conduct a systematic literature review (SLR) to map and synthesize empirical evidence on the effectiveness of STEAM-based loose parts learning on the creativity of children aged 3–6 years in early childhood visual arts education, while identifying the extent to which local wisdom has, or has not, been

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integrated into this approach. In this review, creativity is understood as the capacity to produce ideas, products, or expressions that are both original and effective (Runco and Jaeger, 2012), framed at the level of the everyday, personally meaningful "mini-c" creativity characteristic of young children (Beghetto and Kaufman, 2007; Kaufman and Beghetto, 2009). Because the primary studies predominantly measured children's general creativity (e.g., creative thinking, imagination, and creative expression) during arts-integrated activities rather than a domain-specific construct of visual-art creativity, the term "creativity" is used consistently throughout this review to denote the outcome, whereas "early childhood visual arts education" denotes the learning context in which that creativity is fostered. Following the PRISMA guidelines, this study is expected to provide a comprehensive overview of existing study characteristics while affirming the novelty of this review at the intersection of STEAM, loose parts, and local wisdom—an intersection that remains rarely examined. To achieve this aim, the study is guided by one primary research question (PRQ) and three secondary research questions (SRQs), as follows.

Primary Research Question (PRQ)

How effective is STEAM-based loose parts learning in enhancing children's (3–6 years) creativity in early childhood visual arts education, based on evidence in the existing scientific literature?

Secondary Research Questions (SRQ)

SRQ1. What are the characteristics of published studies (research design, children's age range, country/cultural context, and materials used) on STEAM-based loose parts learning in early childhood visual arts education?

SRQ2. Which dimensions of creativity and forms of engagement are most frequently reported as outcomes of STEAM-based loose parts learning in early childhood visual arts education?

SRQ3. What factors, including the role of local wisdom, teachers, material availability, and policy/curriculum support, are reported as facilitators or barriers to the successful implementation of STEAM-based loose parts learning in early childhood visual arts education?

METHODS

This review followed the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page *et al.*, 2021), which provide a structured and transparent framework for literature identification, screening, eligibility assessment, and inclusion.

Identification

A search was conducted on the Scopus database using the following Boolean string, developed from the PICO framework: TITLE-ABS-KEY((“early childhood” OR “preschool*” OR “young child*” OR “kindergarten” OR “prekindergarten” OR “toddler*”) AND (“loose part*” OR “STEAM educat*” OR “STEAM learn*” OR “STEM educat*” OR “open-ended material*” OR “hands-on material*” OR “play-based learn*” OR “constructivis* learn*” OR “maker* space*”) AND (“creativ*” OR “divergent thinking” OR “artistic develop*” OR “art*

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engagement" OR "originality" OR "imagination" OR "creative expression" OR "creative thinking")). The search was restricted to journal articles published between 2011 and 2026, in English or Indonesian. This initial search yielded 179 records, narrowed to 90 records after applying database filters for publication year, document type, and language. No visual-art-specific terms were included in the search string because the arts component of STEAM is interpreted inconsistently and is frequently not stated in titles, abstracts, or keywords (Perignat and Katz-Buonincontro, 2019); adding such terms would have risked excluding relevant studies. Instead, the visual-art component was applied as an eligibility criterion during screening (Table 1, criterion 2), while creativity, the outcome of interest, was captured through the creativity-related terms in the third block of the string.

Screening

Title and abstract screening of the 90 records was conducted against the inclusion and exclusion criteria summarized in Table 1, resulting in the exclusion of 55 records and the retention of 35 records for full-text retrieval and eligibility assessment.

Table 1. Inclusion and Exclusion Criteria

No	Inclusion criteria	Exclusion criteria
1	Study involves children aged 3-6 years in ECE settings	Population outside the 3-6 age range with no separable data
2	Intervention explicitly involves loose parts and/or STEAM with a visual art component	Intervention lacks a visual-art component (e.g., pure STEM, digital-only, performing arts)
3	Outcome includes a measure of creativity, artistic expression, or engagement in visual art activities	Outcome unrelated to creativity/artistic expression
4	Empirical study design (quantitative, qualitative, or mixed-methods)	Non-empirical work (editorial, opinion, review/bibliometric paper)
5	Published in a peer-reviewed journal, 2011-2026, in English or Indonesian	Published outside 2011-2026; not peer-reviewed; language other than English/Indonesian

Eligibility

Of the 35 records sought for full-text retrieval, 11 (31.4%) could not be accessed due to subscription restrictions on institutional access and were consequently excluded from the review, despite having passed title/abstract screening. Full-text assessment was completed for the remaining 24 records against the criteria in Table 1, resulting in the exclusion of 13 additional records, including studies with strong quantitative evidence of creativity gains that lacked an explicit visual-art component (e.g., pure STEM or performing-arts interventions), in accordance with the review's focus on creativity fostered within early childhood visual arts education.

A structured quality assessment was subsequently applied to the remaining studies using five criteria adapted from established SLR quality-appraisal practice (Table 2): (Q1) is the study's purpose clearly stated; (Q2) is the intervention/method clearly explained; (Q3) are the outcome measures clearly explained; (Q4) are the results presented clearly and supported by adequate data; and (Q5) did the authors identify study limitations. All 11

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retained studies met Q1–Q4; three studies (Q5 = "Partial") provided only limited discussion of study limitations.

Table 2. Quality Assessment of Included Studies

Study	Q1	Q2	Q3	Q4	Q5
Hunter-Doniger (2021)	Yes	Yes	Yes	Yes	Partial
Bureekhampun and Mungmee (2020)	Yes	Yes	Yes	Yes	No
Mercan and Kandır (2022)	Yes	Yes	Yes	Yes	Yes
Mercan *et al.* (2024)	Yes	Yes	Yes	Yes	Yes
Jaruchainiwat *et al.* (2024)	Yes	Yes	Yes	Yes	Yes
Liao *et al.* (2025)	Yes	Yes	Yes	Yes	Partial
Damjanovic and Branson (2025)	Yes	Yes	Yes	Yes	Yes
Habeeb (2025)	Yes	Yes	Yes	Yes	Yes
Nguyen and Vu (2025)	Yes	Yes	Yes	Yes	Yes
Chatathicoon *et al.* (2026)	Yes	Yes	Yes	Yes	Yes
Hsiao *et al.* (2026)	Yes	Yes	Yes	Yes	Partial

Inclusion

Following the eligibility assessment, 11 studies met all inclusion and quality criteria and were retained for synthesis. Figure 1 illustrates the overall PRISMA selection process, from initial identification through final inclusion.

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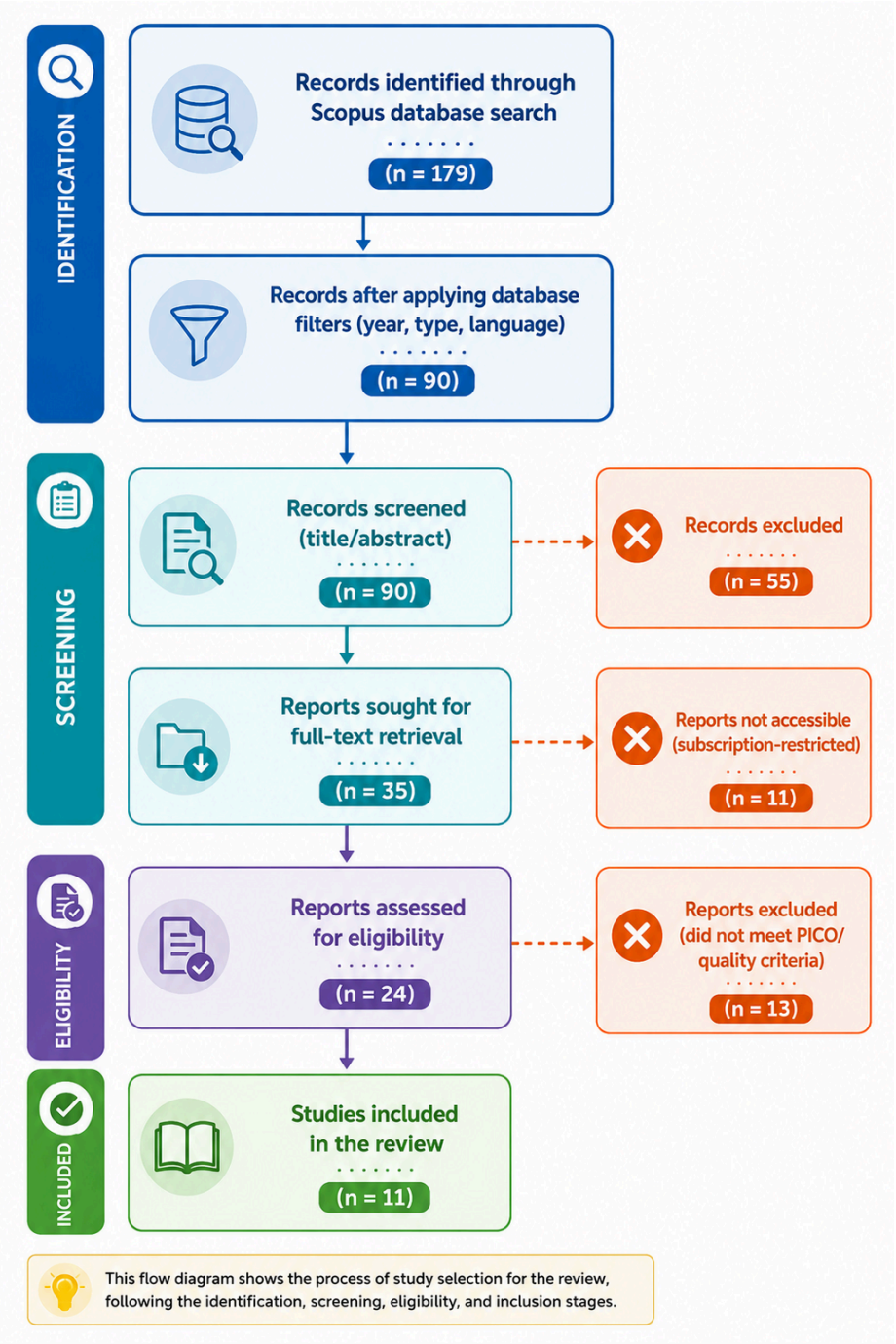

Figure 1. PRISMA flow diagram of the study selection process.

Methodological Limitations of the Search and Screening Process

Two methodological limitations of this review should be noted transparently. First, the literature search was restricted to a single database (Scopus); relevant studies indexed exclusively in other databases (e.g., Web of Science, ERIC) may not have been captured. Second, screening and eligibility assessment were conducted by a single reviewer with AI-assisted support, rather than the dual-reviewer, consensus-based process recommended by PRISMA best practice; no inter-rater reliability statistic (e.g., Cohen's Kappa) could therefore be computed. These limitations are discussed further in the Limitations and Future Research section.

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RESULTS AND DISCUSSION

Characteristics of Included Studies (Addressing SRQ1)

The 11 included studies were published between 2020 and 2026, with a marked concentration (6 of 11 studies, 54.5%) in 2025–2026, indicating that this is a rapidly emerging research area (Figure 2). Studies originated from seven countries: Thailand (3 studies), Turkey (2), Taiwan (2), Germany (1), the United States (1), Kuwait (1), and Vietnam (1) (Figure 2). No study originated from Indonesia or the wider maritime Southeast Asian region.

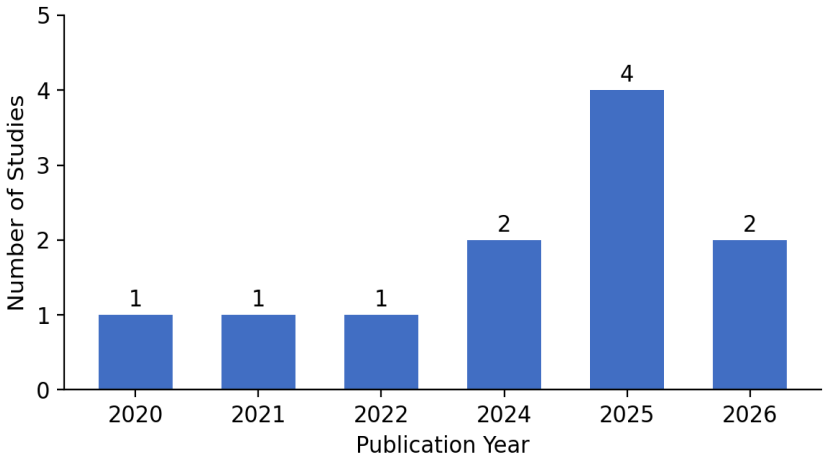

Figure 2. Distribution of included studies by publication year (n = 11)

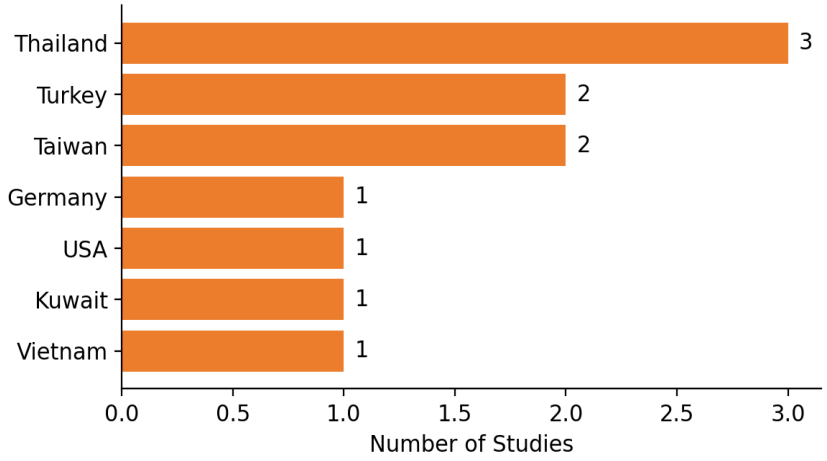

Figure 3. Distribution of included studies by country (n = 11)

Regarding research design, five studies employed (quasi-)experimental designs, four employed qualitative case-study or phenomenological designs, one employed mixed-methods, and one employed a one-group pretest-posttest design. Sample sizes ranged from 7 to 75 children, with quantitative studies generally featuring larger samples (40–75 children) than qualitative studies (7–15 children). The dominant age range was 5–6

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years; only two studies explicitly examined children aged 3–4 years. Table 3 summarizes the full characteristics of the included studies.

Table 3. Characteristics of Studies Included in the Review

No	Study	Country	Design	Sample	Intervention	Outcome
1	Hunter-Doniger (2021)	Germany	Qualitative (case study)	Forest kindergarten children, ≥4 years	Forest kindergarten (nature-based environment)	Creativity (construction of artwork/objects), autonomy, play
2	Bureekhampun and Mungmee (2020)	Thailand	Pre-experimental (one-shot case study)	15 children aged 6, 5 groups	STEAM activity: movable toy robot design	Design feasibility (expert-rated), design thinking pattern
3	Mercan and Kandır (2022)	Turkey	Pre-post experimental	54 children, kindergarten	Early STEAM Education Program (art & design)	Visual-spatial reasoning, design, imagination
4	Mercan *et al.* (2024)	Turkey	Qualitative phenomenology	Teachers & preschool children	STEAM Makerspace (design walls, recycled materials)	Creativity, imagination, self-confidence
5	Jaruchainiwat *et al.* (2024)	Thailand	One-group (outdoor vs indoor)	50 children aged 3-5	Guided play + loose parts	Creative thinking, social skills, attention
6	Liao *et al.* (2025)	Taiwan	Case study	7 children aged 5-6	Music + visual art + drama + loose parts	Creative expression & engagement
7	Damjanovic and Branson (2025)	USA	Qualitative (case study)	15 children aged 3	Programmable robots + low-tech tools	Creative expression, multimodal engagement
8	Habeeb (2025)	Kuwait	Quasi-experimental pre-post	60 children aged 5-6	Origami + digital app (Paperama)	Geometric understanding & creative thinking
9	Nguyen and Vu (2025)	Vietnam	Quasi-experimental	Children aged 5-6	5E-EDP model in STEAM	Creativity (TCT-DP scale)
10	Chatathicoon *et al.* (2026)	Thailand	Mixed-methods, one-group	40 children (1 class)	STEAM + local wisdom (I-WISDOM)	4C Skills: creativity, critical thinking, etc.
11	Hsiao *et al.* (2026)	Taiwan	Experimental vs control	75 children, 5 classes	6E model + Williams' Creative Thinking Strategies	Fine motor skills, visual creativity

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Creativity Dimensions and Engagement Outcomes (Addressing SRQ2)

Structured STEAM curriculum models were consistently associated with stronger, more measurable creativity gains than unstructured STEAM exposure. Nguyen and Vu (2025) demonstrated that a 5E model integrated with an Engineering Design Process (5E-EDP) outperformed the standard 5E model in enhancing the creativity (TCT-DP scale) of 5–6-year-old children, indicating that the engineering-design component itself, rather than mere STEAM exposure, drives creativity gains. This finding was corroborated by Hsiao *et al.* (2026), who found that a 6E model integrated with Williams' Creative Thinking Strategies (Williams, 1980) significantly enhanced children's fine motor skills and, notably, explicitly measured "visual creativity," a term rarely made explicit in the broader literature. Notably, the creativity instruments used across the included studies varied considerably, ranging from the TCT-DP scale to Williams' framework, with no study employing the classic Torrance Tests of Creative Thinking (Torrance, 1974) despite their continued prominence in the broader creativity-assessment literature, an inconsistency consistent with the measurement heterogeneity noted by Su *et al.* (2025).

Loose parts, in turn, functioned as a catalyst for multimodal artistic expression rather than a standalone medium. Liao *et al.* (2025) found that integrating music, visual art, and dramatic play with loose parts in preschool in-between spaces enhanced multimodal creative expression, while Jaruchainiwat *et al.* (2024) found that guided play combined with loose parts—rather than unstructured free play—more consistently enhanced creative thinking, social skills, and attention across both outdoor and indoor settings.

Two studies (Hunter-Doniger, 2021; Mercan *et al.*, 2024) offered a complementary perspective: children's creativity in visual arts activities can emerge without a formal STEAM curriculum, provided the learning environment affords sufficient creative freedom. A forest kindergarten setting, without an explicit STEAM structure, was found to elicit creative processes explicitly coded as "the making, engineering, or construction of a work of art, object, or structure" (Hunter-Doniger, 2021), while a physical makerspace equipped with recycled materials fostered creativity, imagination, and self-confidence according to both teacher and child reflections (Mercan *et al.*, 2024).

Finally, two studies (Habeeb, 2025; Damjanovic and Branson, 2025) indicated that digital technology complements, rather than substitutes for, physical hands-on materials. Habeeb (2025) found that origami (physical) combined with the Paperama digital application produced a significantly larger effect on creativity ($r = 0.78$) than either component alone would be expected to, while Damjanovic and Branson (2025) found that programmable robots combined with recycled materials supported creative expression among children with diverse learning needs, framed within a Universal Design for Learning (UDL) approach.

Facilitating and Inhibiting Factors, Including Local Wisdom (Addressing SRQ3)

Only one of the eleven included studies, Chatathicoon *et al.* (2026), explicitly integrated local wisdom into STEAM-based learning for early childhood creativity. This study developed a STEAM learning package (I-WISDOM) themed around "Rice and Farmers," reflecting Thai cultural context, and reported significant gains in creativity and innovation alongside three other 4C skills (critical thinking, communication, collaboration). No comparable study

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addressing local-wisdom integration was identified from any other national context, including Indonesia.

This finding empirically confirms the research gap motivating the present review. Given that Indonesia possesses substantial regional artistic traditions and locally available materials well suited to loose parts pedagogy, this gap represents both a significant limitation of the current evidence base and a concrete opportunity for future primary research grounded in Indonesian cultural contexts. Indeed, emerging Indonesian scholarship on local-wisdom-integrated early childhood curricula more broadly (Suryaningsih *et al.*, 2025) demonstrates both the feasibility and the cultural relevance of such integration, even though this body of work has not yet been extended to creativity in STEAM-based visual arts education specifically.

Beyond local wisdom, other reported facilitating and inhibiting factors included teacher pedagogical competence and confidence in guiding open-ended play (Jaruchainiwat *et al.*, 2024; Liao *et al.*, 2025), the availability and sustainability of physical materials in makerspace settings (Mercan *et al.*, 2024), and inclusive instructional design accommodating diverse learner needs (Damjanovic and Branson, 2025).

CONCLUSION

This systematic literature review synthesized evidence from 11 studies, drawn from an initial pool of 179 Scopus records, on the effectiveness of STEAM-based loose parts learning for children's creativity in early childhood visual arts education. The findings indicate that (1) structured STEAM curriculum models consistently produce stronger creativity outcomes than unstructured exposure; (2) loose parts most effectively catalyze creativity when combined with multiple modes of artistic expression under guided play; (3) informal, autonomy-supporting learning environments can foster creativity independent of formal STEAM structure; (4) digital technology and physical materials operate synergistically rather than competitively; and, most critically, (5) the integration of local wisdom into STEAM-based visual-arts pedagogy for young children remains a substantially underexplored area globally, with no evidence identified from the Indonesian context. These findings affirm both the significance and the novelty of pursuing culturally grounded, STEAM-based, loose parts pedagogy as a direction for future early childhood visual arts research and practice, particularly in culturally rich national contexts such as Indonesia.

LIMITATIONS AND FUTURE RESEARCH

This review is subject to several limitations. First, the search was restricted to a single bibliographic database (Scopus); future reviews should extend coverage to additional databases such as Web of Science and ERIC. Second, screening and eligibility decisions were conducted by a single reviewer with AI assistance rather than through an independent dual-reviewer consensus process; future reviews should incorporate a second independent human reviewer and report inter-rater reliability. Third, 11 of 35 full-text records (31.4%) could not be retrieved due to institutional access restrictions, which may have excluded relevant evidence, particularly on loose parts pedagogy. Fourth, the decision to apply a strict requirement of an explicit visual-art component in the intervention, which excluded several STEM-only studies with strong creativity outcomes, including the most-cited record identified in the initial search, was finalized during, rather than prior to, full-text screening;

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future reviews should pre-register such definitional decisions (e.g., via PROSPERO or OSF) to minimize the risk of post-hoc bias. Notwithstanding these limitations, the review's central finding, a marked absence of local-wisdom integration in STEAM-based early childhood visual-arts research, is less to be substantially altered by these methodological constraints, and provides a well-motivated foundation for future primary research.

REFERENCES

Beghetto, R. A., and Kaufman, J. C. (2007). Toward a broader conception of creativity: A case for "mini-c" creativity. *Psychology of Aesthetics, Creativity, and the Arts, 1*(2), 73-79. https://doi.org/10.1037/1931-3896.1.2.73

Bureekhampun, S., and Mungmee, T. (2020). STEAM education for preschool students: Patterns, activity designs and effects. *Journal for the Education of Gifted Young Scientists, 8*(3), 1201-1212. https://doi.org/10.17478/jegys.775835

Cankaya, O., Martin, M., and Haugen, D. (2025). The relationship between children's indoor loose parts play and cognitive development: A systematic review. *Journal of Intelligence, 13*(5), Article 52. https://doi.org/10.3390/jintelligence13050052

Chatathicoon, S., Thinwiangthong, S., Leelalawan, D., Sranamkam, T., Malila, C., Khonyai, S., Woranetsudathip, N., and Wongpongkham, N. (2026). Enhancing 21st-century learning skills in early childhood through a local wisdom-integrated Science, Technology, Engineering, Arts, and Mathematics (STEAM) learning package to support Sustainable Development Goals (SDGs): A bibliometric and mixed-methods study. *ASEAN Journal of Educational Research and Technology, 5*(3), 361-378.

Damjanovic, V., and Branson, S. (2025). Empowering diverse learners: Integrating tangible technologies and low-tech tools to foster STEM engagement and creativity in early childhood education. *Education Sciences, 15*(8), Article 1024. https://doi.org/10.3390/educsci15081024

Eisner, E. W. (2002). *The arts and the creation of mind*. Yale University Press.

Flannigan, C., and Dietze, B. (2017). Children, outdoor play, and loose parts. *Journal of Childhood Studies, 42*(4), 53-60. https://doi.org/10.18357/jcs.v42i4.18103

Gull, C., Bogunovich, J., Levenson Goldstein, S., and Rosengarten, T. (2019). Definitions of loose parts in early childhood outdoor classrooms: A scoping review. *International Journal of Early Childhood Environmental Education, 6*(3), 37-52.

Habeeb, K. M. (2025). Integrating digital tools with origami activities to enhance geometric concepts and creative thinking in kindergarten education. *Education Sciences, 15*(7), Article 924. https://doi.org/10.3390/educsci15070924

Hsiao, H.-S., Chen, J.-C., Chen, J.-H., Chen, Y.-X., and Chung, G.-H. (2026). Incorporating the 6E model integrated with creative thinking strategies into STEAM education: Enhancing children's fine motor skills, hands-on performance, and learning behaviors. *Early Childhood Education Journal, 54*(4), 2167-2188. https://doi.org/10.1007/s10643-025-01981-0

DOI: https://doi.org/10.17509/ecepa.v3i1
e-ISSN 3046-451X

Hunter-Doniger, T. (2021). Early childhood STEAM education: The joy of creativity, autonomy, and play. *Art Education, 74*(4), 22-27. https://doi.org/10.1080/00043125.2021.1905419

Jaruchainiwat, P., Khayankij, S., Hemchayart, W., and Tamrongath, U. (2024). Promoting young children's creative thinking, social skills, and attention using guided play and loose parts. *Kasetsart Journal of Social Sciences, 45*(1), 121-128. https://doi.org/10.34044/j.kjss.2024.45.1.13

Kaufman, J. C., and Beghetto, R. A. (2009). Beyond big and little: The Four C model of creativity. *Review of General Psychology, 13*(1), 1-12. https://doi.org/10.1037/a0013688

Liao, M.-Y., Chen, L.-C., and Huang, P.-Y. (2025). A case study on integrating arts activities with the loose parts in preschool's in-between spaces. *International Journal of Music Education, 43*(4), 54-74. https://doi.org/10.1177/02557614241299055

Mercan, Z., Gözüm, A. İ. C., Bilir, B., and Özcan, M. (2024). STEAM makerspace: Reflections from teachers and children. *International Online Journal of Education and Teaching, 11*(1), 41-65.

Mercan, Z., and Kandır, A. (2022). The effect of the Early STEAM Education Program on the visual-spatial reasoning skills of children: Research from Turkey. *Education 3–13, 51*(7), 1129-1144. https://doi.org/10.1080/03004279.2022.2075906

Nguyen, M.-T., and Vu, K.-T. T. (2025). The effectiveness of the 5E-EDP model in STEAM education to develop the creativity of children aged 5–6 in preschool: A quasi-experimental study in Vietnam. *Asia-Pacific Journal of Research in Early Childhood Education, 19*(2), 181-207. https://doi.org/10.17206/apjrece.2025.19.2.181

Nicholson, S. (1971). How NOT to cheat children—The theory of loose parts. *Landscape Architecture, 62*, 30-34.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, Article n71. https://doi.org/10.1136/bmj.n71

Perignat, E., and Katz-Buonincontro, J. (2019). STEAM in practice and research: An integrative literature review. *Thinking Skills and Creativity, 31*, 31-43. https://doi.org/10.1016/j.tsc.2018.10.002

Runco, M. A., and Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal, 24*(1), 92-96. https://doi.org/10.1080/10400419.2012.650092

Su, J., Yim, I. H. Y., Wegerif, R., and Chu, S. K. W. (2025). STEAM in early childhood education: A scoping review. *Research in Science and Technological Education, 43*(2), 495-511. https://doi.org/10.1080/02635143.2023.2296445

Suryaningsih, N. M. A., Poerwati, C. E., and Cahaya, I. M. E. (2025). Weaving cultural threads: Integrating local wisdom into Indonesia's early childhood curriculum for character building and cultural preservation. *PPSDP International Journal of Education, 4*(2), 1619-1629. https://doi.org/10.59175/pijed.v4i2.732

Torrance, E. P. (1974). *Torrance Tests of Creative Thinking: Norms-technical manual, verbal tests, Forms A and B, figural tests, Forms A and B*. Xerox.

Vygotsky, L. S. (2004). Imagination and creativity in childhood. *Journal of Russian and East European Psychology, 42*(1), 7-97. https://doi.org/10.1080/10610405.2004.11059210

Williams, F. E. (1980). *Creativity Assessment Packet (CAP) manual*. DOK Publishers.

Yakman, G. (2008). STEAM education: An overview of creating a model of integrative education. In *Proceedings of PATT19 Conference: Pupils' Attitudes Towards Technology* (pp. 335-358). International Technology Education Association.

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