

Digital Technology Integration Strengthens Creative Fluency Elaboration and Literacy in Primary School Music Extracurriculars

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Abstract: The accelerating digitalization of education requires a systematic evaluation of how technology reshapes creative learning in primary school music programs. This study employs a Systematic Literature Review guided by the PRISMA 2020 protocol to examine the influence of digital hardware and software integration within primary school music extracurriculars on students' creativity and digital literacy. Forty-eight peer-reviewed articles indexed in Scopus and SINTA, published between 2022 and 2025, were synthesized using thematic analysis and appraised through the Joanna Briggs Institute critical appraisal instrument. The findings indicate that the Digital Enhanced Learning model substantially improves student achievement in the fluency and elaboration dimensions of creativity, while interactive software and electronic instruments reduce the technical barriers commonly associated with conventional instrumental training. A strong positive correlation between digital literacy and elaboration skills demonstrates that technical competence and artistic depth are mutually reinforcing rather than independent constructs. Intervention groups consistently outperform non-intervention groups across all measured creativity and literacy indicators. These results suggest that primary education institutions should adopt structured digital pedagogical frameworks that balance artistic expression with technological proficiency. The study concludes that systematic digital integration in music extracurriculars functions as a strategic bridge toward equipping young learners with the creative and digital competencies demanded by twenty-first century education.

Keywords: digital technology; music extracurricular; creativity; digital literacy; primary school.

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Abstrak: Pesatnya digitalisasi pendidikan menuntut evaluasi sistematis terhadap peran teknologi dalam pembelajaran seni musik di sekolah dasar. Penelitian ini menggunakan pendekatan Systematic Literature Review dengan protokol PRISMA 2020 untuk mengkaji pengaruh integrasi perangkat keras dan perangkat lunak digital dalam ekstrakurikuler musik sekolah dasar terhadap kreativitas dan literasi digital siswa. Sebanyak 48 artikel terindeks Scopus dan SINTA yang terbit antara tahun 2022 hingga 2025 disintesis melalui analisis tematik dan dinilai kualitasnya menggunakan instrumen Joanna Briggs Institute. Hasil kajian menunjukkan bahwa model Digital Enhanced Learning secara signifikan meningkatkan capaian siswa pada dimensi kreativitas fluency dan elaboration, sementara perangkat lunak interaktif dan instrumen elektronik menurunkan hambatan teknis yang biasa ditemukan pada pembelajaran musik konvensional. Korelasi positif yang kuat antara literasi digital dan kemampuan elaboration menunjukkan bahwa kompetensi teknis dan kedalaman artistik saling memperkuat satu sama lain. Kelompok intervensi secara konsisten menunjukkan skor lebih tinggi dibandingkan kelompok non-intervensi pada seluruh indikator kreativitas dan literasi yang diukur. Temuan ini mengimplikasikan perlunya sekolah dasar mengadopsi kerangka pedagogis digital yang terstruktur guna menyeimbangkan ekspresi artistik dengan penguasaan teknologi. Penelitian ini menyimpulkan bahwa integrasi digital yang sistematis dalam ekstrakurikuler musik berfungsi sebagai jembatan strategis untuk membekali siswa dengan kompetensi kreatif dan digital yang dibutuhkan pada abad ke-21.

Kata kunci: teknologi digital; ekstrakurikuler musik; kreativitas; literasi digital; sekolah dasar.

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1. INTRODUCTION

The rapid transformation of Indonesia's educational sector reflects a broader global shift toward technology-mediated instruction across all levels of schooling. According to Marentek (2025), teachers increasingly face the dual challenge of adapting pedagogical practices while managing limited digital readiness within their institutions. This tension is particularly visible in arts-based subjects, where creative expression has traditionally relied on direct physical instruction rather than mediated digital environments. Research conducted by Forsling (2023) further emphasizes that digital literacy competencies must be cultivated collaboratively among educators before they can be effectively transferred to young learners. As national curricula continue to embed technology-driven learning objectives, primary schools are compelled to reassess how digital tools can be meaningfully embedded within extracurricular arts programs. This shift signals a fundamental reconsideration of what constitutes effective and future-oriented arts pedagogy in the primary education context.

Music education, in particular, has become an important site for exploring how software and hardware can reshape creative skill development among children. As explained by Gagic Rexhepi et al. (2024), digital instruments and composition software provide students with structured yet flexible avenues for musical experimentation that were previously inaccessible through conventional teaching alone. Similarly, Sularso et al. (2024) found that digital music technologies expand the pedagogical repertoire available to teachers, enabling more differentiated and engaging instructional strategies. The integration of MIDI controllers, notation software, and electronic keyboards allows students to translate abstract musical ideas into tangible auditory outputs with immediate feedback. According to Gade & Schlemmer (2021), such immediate auditory feedback mechanisms play a critical role in reinforcing cognitive associations between musical concepts and their practical execution. These technological affordances collectively suggest that digital tools are reshaping not only how music is taught but also how creativity itself is cultivated among young learners.

Despite these technological advances, traditional music instruction continues to present considerable barriers for beginning students, particularly within resource-constrained primary school settings. Bussu & Mangiarulo (2026) observe that the steep technical learning curve associated with conventional instruments often discourages sustained student engagement before creative competencies can fully develop. In a related study, Schiavio et al. (2021) note that ensemble-based instruction, while valuable for social learning, frequently privileges technically proficient students over those still developing foundational skills. Sularso et al. (2024) similarly argue that digital instruments lower these entry barriers by offering simplified interfaces and adaptive learning pathways suited to varying skill levels. This contrast between traditional and digital learning environments highlights a critical pedagogical divide that has yet to be systematically resolved within primary education research. The persistence of this divide underscores the urgency of empirically examining how digital integration specifically influences creative outcomes rather than merely technical proficiency.

A closer examination of existing literature, however, reveals a significant gap concerning the specific relationship between digital music integration and distinct creativity dimensions

such as fluency and elaboration. Desyandri et al. (2025) contend that most prior studies address digital learning models in broad terms without disaggregating their effects on specific creative competencies. Alvanoudi et al. (2023), similarly highlight that those project-based digital learning initiatives in music teacher education rarely extend their analytical focus toward measurable creative outcomes at the primary school level. Raziunaite et al. (2018) further note that interactive digital materials for music project-based learning have been systematically studied for engagement but seldom evaluated against structured creativity frameworks. This absence of granular empirical evidence leaves educators without clear guidance on which specific digital interventions most effectively cultivate fluency, originality, or elaboration in young musicians. Consequently, the field lacks a consolidated synthesis capable of informing evidence-based instructional design for digital music extracurriculars.

Parallel developments in project-based and culturally responsive learning further complicate the picture, as scholars increasingly advocate for models that integrate digital tools with local cultural values. Yang et al. (2023) demonstrate that digital project-based learning enhances student agency and cultural understanding when appropriately scaffolded within arts curricula. Fajriani et al. (2025) similarly argue that culturally grounded digital literacy initiatives strengthen student engagement more effectively than purely technical interventions. Zaki et al. (2024) extend this argument by proposing that integrating local wisdom with project-based learning cultivates the broader twenty-first century skills required in the Society 5.0 era. These converging perspectives suggest that digital integration in music extracurriculars cannot be evaluated in isolation from cultural and pedagogical context. Understanding how these dimensions interact remains essential for constructing a comprehensive framework applicable to Indonesian primary education.

Building upon these identified gaps, this study aims to systematically evaluate how digital technology integration within primary school music extracurriculars influences student creativity and digital literacy. Desyandri et al. (2025) provide a foundational theoretical basis through the SWARA model, while Rudyanto et al. (2023) contribute the Digital Enhanced Learning framework as an empirical benchmark for measuring literacy and creativity outcomes. Paglinawan (2026) further reinforces the relevance of this inquiry by demonstrating that digital integration transforms conventional arts classrooms into dynamic and participatory learning environments. This study specifically investigates whether Digital Enhanced Learning models correlate with measurable improvements in fluency and elaboration, alongside the practical challenges teachers encounter during implementation. The resulting synthesis is intended to provide a comprehensive evidentiary foundation capable of informing future digital pedagogy in elementary arts education. The following literature review establishes the theoretical grounding necessary to interpret these research questions within their broader academic context.

2. LITERATURE REVIEW

2.1 Digital Music Pedagogy in Primary Education

Contemporary music pedagogy in primary education has increasingly been shaped by structured theoretical models designed to integrate technology with meaningful learning

experiences. Desyandri et al. (2025) introduce the SWARA model, comprising the Stimulus, Wondering, Active, Reflective, and Applicative stages, as a framework that unites local cultural values with digital augmentation. Complementing this approach, Rudyanto et al. (2023) propose the Digital Enhanced Learning model, which emphasizes the comprehensive integration of technology across lesson planning, instructional delivery, and assessment processes. Putri et al. (2025) similarly demonstrate that problem-based learning approaches in elementary education benefit from structured digital scaffolding that guides students through progressively complex creative tasks. Sofiyah et al. (2024) extend this discussion by highlighting how local wisdom integration fosters cultural harmony when embedded within digitally mediated music instruction. Collectively, these frameworks indicate that effective digital music pedagogy extends beyond simple tool adoption toward a holistic redesign of instructional systems that connect technical proficiency with contextual meaning.

2.2 Frameworks for Digital Literacy and Creativity

Digital literacy within the context of music education is conceptually structured around four interrelated pillars encompassing digital skills, safety, culture, and ethics. Rudyanto et al. (2023) explain that these pillars collectively enable students to manage information autonomously while navigating digital learning environments with confidence. Creativity, in turn, is commonly assessed through four dimensions, namely fluency, flexibility, originality, and elaboration, each representing distinct cognitive and expressive capacities. Shcholokova et al. (2025) reinforce this framework by demonstrating that digital creativity in music project-based learning manifests differently across these four dimensions depending on the instructional design employed. Pesek et al. (2020) further contribute by illustrating how applied software tools in music education can be calibrated to target specific creative competencies rather than generalized skill development. These converging theoretical perspectives collectively inform the analytical lens applied throughout this systematic review.

2.3 Digital Tools, Instruments, and Interactive Platforms

The proliferation of digital instruments and interactive platforms has substantially broadened the technological repertoire available to primary school music educators. Mohammadian et al. (2026) document how music technology education programs increasingly rely on software-based composition tools to scaffold student creativity in structured stages. Abdelnour Nocera et al. (2023) similarly describe collaborative music project platforms that enable students to co-create musical works across shared digital spaces, thereby extending creative engagement beyond individual practice. Carrión-Candel & Colmenero (2022) demonstrate that gamification elements embedded within digital music platforms significantly enhance student motivation and sustained participation. Mena-Guacas et al. (2025) add that emerging technologies more broadly reshape learning environments by enabling personalized pacing and adaptive feedback mechanisms. Together, these studies suggest that the technological infrastructure supporting digital music education has matured considerably, offering diverse pathways for fostering creative engagement among young learners.

2.4 Project-Based and Culturally Responsive Digital Music Learning

Project-based learning has emerged as a dominant pedagogical approach for embedding digital technology within culturally responsive music curricula. Rahmawati et al. (2026) propose a holistic framework that integrates music, culture, and technology within project-based learning structures designed for elementary classrooms. Nadlir et al. (2026) similarly emphasize that harmonizing local wisdom with digital-based project learning strengthens both cultural identity and technical competence among primary students. Robert et al. (2023) extend this perspective through gamified music learning models that embed local cultural values within digitally mediated project structures. Ozkan (2023) further affirms that project-based learning consistently enhances student engagement within arts education, regardless of the specific technological tools employed. These findings collectively suggest that culturally grounded project-based frameworks provide a particularly effective vehicle for sustainable digital integration in primary music education.

2.5 Cognitive and Developmental Foundations of Digital Music Learning

Beyond pedagogical design, cognitive and developmental research provides important theoretical grounding for understanding how digital music engagement influences young learners. Frei-Landau et al. (2023) demonstrate that digital learning environments activate distinct cognitive processing pathways associated with creative problem-solving in children. Chung (2026) similarly highlights that group-based musical engagement fosters collaborative cognitive development that complements individual technical skill acquisition. Savage (2007) contributes further evidence linking educational information technology use to measurable improvements in music learning outcomes across diverse student populations. Goopy et al. (2025) note that regional research within the Asia Pacific context consistently affirms the developmental benefits of structured music education incorporating digital elements. These cognitive and developmental insights collectively reinforce the theoretical rationale underlying the present systematic review.

2.6 Persistent Challenges and Infrastructural Considerations

Despite promising pedagogical and cognitive benefits, persistent infrastructural and implementation challenges continue to constrain the effectiveness of digital music integration. Gorghiu et al. (2025) provide an early but enduring perspective on digital technology integration policy, cautioning that infrastructural investment must accompany pedagogical reform to achieve sustainable outcomes. Falcione et al. (2019) similarly emphasize that technology integration efforts succeed most effectively when teachers assume active facilitative roles rather than passive tool administration. Balakrishnan (2022) adds that design thinking approaches can help educators navigate resource constraints while still fostering creative outcomes. Alsharari & Alshurideh (2021) further observe that longitudinal educational studies frequently reveal delayed but cumulative benefits of sustained technological investment in schooling. Yihan et al. (2025) conclude that general music education continues to require structural support systems capable of sustaining digital integration over time. These considerations collectively frame the methodological and interpretive approach adopted in the following section.

3. RESEARCH METHOD

3.1 Research Design

This study adopts a Systematic Literature Review design guided by the PRISMA 2020 reporting protocol, selected specifically for its capacity to ensure transparent and replicable evidence synthesis across a heterogeneous body of literature. The design enables a structured progression through four sequential stages, namely identification, screening, eligibility assessment, and final inclusion, each governed by explicit and predetermined criteria. Zandra et al. (2025) affirm that systematic reviews in visual and performing arts education benefit substantially from standardized appraisal protocols that ensure comparability across methodologically diverse studies. Following this precedent, the present review applied a PRISMA flow diagram to document the number of records identified, screened, excluded, and ultimately retained at each stage of the selection process. This structured design allows readers to trace a clear and auditable pathway from initial database searching through to the final thematic synthesis presented in the results section.

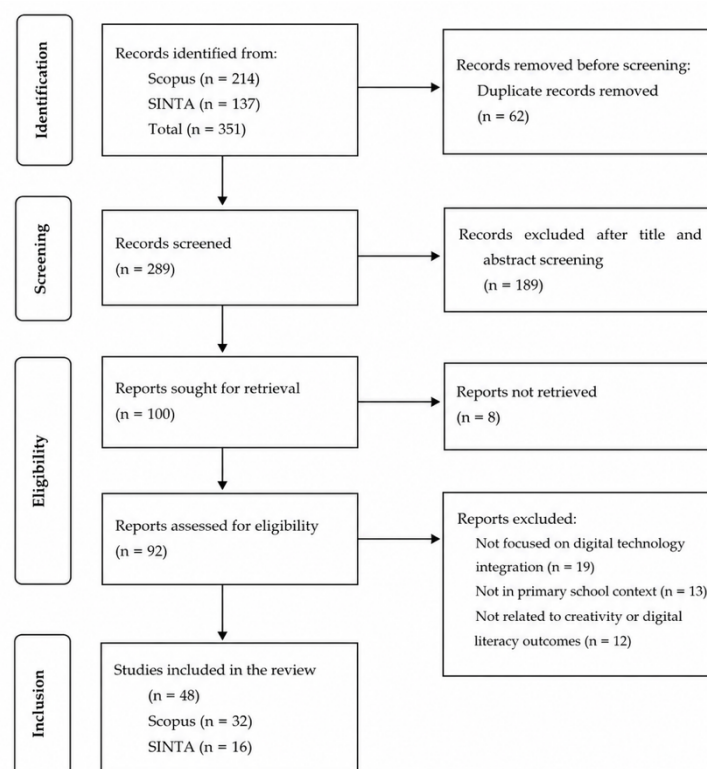


Figure 1. PRISMA 2020 Flow Diagram Illustrating the Identification, Screening, Eligibility, and Inclusion Stages of Study Selection

3.2 Research Sample

The research sample comprises forty-eight peer-reviewed articles selected through purposive sampling based on their empirical focus on digital technology integration within primary school music education. Of these, thirty-two articles originate from Scopus-indexed journals and sixteen originate from SINTA-indexed journals, all published within the 2022 to

2025 timeframe established by the inclusion criteria. This sampling strategy was deliberately designed to balance international theoretical relevance with contextual applicability to the Indonesian primary education setting. Each article was required to provide empirical or conceptual evidence directly relating digital technology use to either creativity outcomes or digital literacy indicators among elementary-aged learners. The distribution of the final sample across databases and thematic focus areas is summarized in Table 1 below.

Table 1. Distribution of Selected Studies by Database and Primary Thematic Focus

Database	Number of Articles	Percentage	Dominant Thematic Focus
Scopus	32	66.7%	Digital pedagogy and creativity
SINTA	16	33.3%	Music education and local wisdom
Total	48	100%	—

The table above indicates that Scopus-indexed studies constitute the majority of the sample and predominantly address digital pedagogy in relation to creativity outcomes. This distribution suggests that internationally indexed research places relatively stronger emphasis on technological and pedagogical dimensions, whereas nationally indexed research more frequently situates digital integration within local cultural contexts.

3.3 Research Instruments

The primary instrument employed for evaluating the methodological quality of included studies was the Joanna Briggs Institute critical appraisal tool, chosen for its established reliability in assessing risk of bias across varied research designs. This instrument enabled the research team to systematically evaluate sampling adequacy, measurement validity, and analytical rigor within each of the forty-eight included articles. In addition to the JBI tool, two supplementary instruments referenced within the synthesized literature were analyzed as standardized metrics for measuring student outcomes, namely the Creativity Evaluation Tool and the Digital Enhanced Learning Questionnaire. The Creativity Evaluation Tool specifically measures the four creativity dimensions of fluency, flexibility, originality, and elaboration, while the Digital Enhanced Learning Questionnaire assesses student proficiency across the four digital literacy pillars of skills, safety, culture, and ethics. Together, these instruments provided a consistent analytical framework through which findings from methodologically diverse studies could be meaningfully compared and synthesized.

3.4 Data Collection Technique

Data collection was conducted through a systematic keyword-based search strategy applied across the Scopus and SINTA databases using combined English and Indonesian search terms, including music education, digital literacy, primary school, and creative fluency. Boolean operators were employed to combine these keywords systematically, ensuring comprehensive retrieval of relevant records while minimizing the inclusion of tangential or unrelated studies. All retrieved records were exported into a reference management system, where duplicate entries were identified and removed before the screening stage. Titles and abstracts were then independently screened against the predetermined inclusion and exclusion criteria, followed by full-text review of all provisionally eligible articles to confirm their

suitability for final inclusion. This sequential and traceable procedure ensured that the final sample of forty-eight articles met consistent standards of topical relevance and methodological quality.

3.5 Data Analysis Technique

Data analysis employed a thematic synthesis approach designed to identify recurring patterns and dominant findings across the included literature concerning digital integration, creativity, and literacy outcomes. Coding categories were developed inductively based on the four creativity dimensions and four digital literacy pillars identified within the literature review, allowing findings from diverse studies to be systematically compared. Statistical consistency across intervention and non-intervention groups reported within the primary studies was further verified through ANOVA testing, ensuring that baseline student abilities were comparable before any technological intervention. Correlational data reported across studies, including the relationship between digital literacy and elaboration performance, were also synthesized to assess the strength and consistency of associations across the sampled literature. This combined qualitative and statistical synthesis approach provided a robust analytical foundation for interpreting the overall relationship between digital integration and student creative performance.

4. RESULT

4.1 Characteristics of Selected Studies

The systematic screening process yielded a final sample of forty-eight peer-reviewed articles distributed across two primary databases and two distinguishable thematic orientations. Scopus-indexed articles predominantly addressed digital pedagogy and creativity, reflecting a stronger international emphasis on technological innovation within music education research. SINTA-indexed articles, by contrast, more frequently emphasized the intersection of music education with local wisdom and cultural preservation. This thematic divergence suggests that international and national research communities approach digital integration in music education from somewhat different conceptual starting points.

Table 2. Distribution of Selected Studies by Database, Focus, and Publication Year

Year Range	Database	Primary Focus	Count
2022–2025	Scopus	Digital Pedagogy and Creativity	32
2022–2025	SINTA	Music Education and Local Wisdom	16

The distribution presented in Table 2 confirms that Scopus-indexed studies constitute two-thirds of the total sample. This imbalance indicates that empirical investigation of digital creativity outcomes remains more extensively developed within internationally indexed literature than within nationally indexed sources. Consequently, subsequent thematic synthesis draws proportionally more heavily upon Scopus-based evidence when characterizing creativity-specific findings. A dedicated synthesis of findings related to local wisdom and cultural integration, drawn primarily from the SINTA-indexed studies, is presented separately in subsection 4.9 to ensure balanced representation of both thematic orientations.

4.2 Baseline Equivalence Between Study Groups

Before evaluating the effects of digital intervention, baseline equivalence between the intervention and non-intervention groups was statistically verified using one-way ANOVA procedures reported across the synthesized primary studies. This verification step was essential to ensure that any subsequent performance differences could be reasonably attributed to the digital intervention rather than pre-existing disparities between groups. The resulting F-value and associated significance level are presented in Table 3 below.

Table 3. ANOVA Results for Baseline Equivalence Between Study Groups

Study Group	df	F-Value	p-Value ($\alpha = 0.01$)	Decision
Intervention vs. Non-Intervention	(1, 289)	4.29	0.13	Accept Ho

The non-significant result presented in Table 3 confirms that both groups began the study with statistically comparable levels of baseline ability. This equivalence strengthens the internal validity of subsequent comparative findings by ruling out pre-existing group differences as an alternative explanation. Accordingly, any performance gains observed in the intervention group can be more confidently attributed to the digital learning intervention itself.

4.3 Digital Literacy Indicators

Digital literacy among the students examined across the sampled studies was consistently evaluated using four interrelated indicator categories reflecting distinct technical and cognitive competencies. These categories encompass network usage, technical device operation, computer literacy, and information retrieval skills, each representing a progressively more complex form of digital engagement. The specific indicators associated with each category are summarized in Table 4 below.

Table 4. Categorization of Digital Literacy Indicators Identified Across the Synthesized Literature

Aspect	Indicators
Network	Downloads music clips, creates or edits picture files, uses messaging applications
Technical	Operates additional mobile device functions, manages appliance reservation functions
Computer	Demonstrates awareness of desktop icons, operates hardware power functions
Information	Reads online news, retrieves information through designated educational websites

The four indicator categories presented in Table 4 collectively provide a comprehensive operational framework for interpreting how students interact with digital tools within their broader learning environment. Network and technical indicators primarily capture functional digital skills, whereas computer and information indicators reflect more cognitively demanding forms of digital engagement. This layered structure suggests that digital literacy development in young learners progresses hierarchically from basic operational competence toward more sophisticated information processing abilities.

4.4 Dimensions of Creativity Assessed

Creativity outcomes reported across the synthesized studies were consistently assessed using four established dimensions relevant to musical and artistic expression, namely fluency,

flexibility, originality, and elaboration. Each dimension captures a distinct cognitive and expressive capacity, ranging from the rapid generation of ideas to the systematic refinement of complex creative solutions. These four dimensions and their corresponding behavioral indicators are summarized in Table 5 below.

Table 5. Dimensions of Creativity Assessed in the Synthesized Studies

Aspect	Indicator
Fluency	Producing ideas, summarizing answers, critiquing situations
Flexibility	Planning different answers, organizing and attributing situations
Originality	Producing new and unique musical concepts
Elaboration	Differentiating ideas, planning procedural problem-solving

Among the four dimensions summarized in Table 5, fluency and elaboration emerged as the two dimensions demonstrating the most pronounced improvement following digital intervention across the sampled studies. Flexibility and originality also showed measurable gains, though these improvements were comparatively smaller in magnitude than those observed for fluency and elaboration. This pattern suggests that digital tools may exert a disproportionately strong influence on the generative and expansive aspects of creativity relative to its more evaluative and novelty-oriented dimensions.

4.5 Comparative Performance Between Intervention and Non-Intervention Groups

Comparative performance data between intervention and non-intervention groups reveal consistent advantages associated with digital integration across all measured creativity and literacy indicators. Students exposed to digital learning interventions achieved higher mean scores than their non-intervention counterparts on every dimension assessed, including fluency, flexibility, originality, elaboration, and overall digital literacy. The magnitude of this advantage varied across dimensions, with the largest observed gap occurring within the elaboration indicator. The complete comparative results are presented in Table 6 below.

Table 6. Mean Comparison of Creativity and Literacy Scores Between Groups

Group	Fluency (M)	Flexibility (M)	Originality (M)	Elaboration (M)	Literacy (M)
Intervention	12.61	11.96	10.86	11.82	17.50
Non-Intervention	11.03	11.29	10.46	10.57	16.24

The results summarized in Table 6 confirm that the intervention group consistently outperformed the non-intervention group across every measured dimension without exception. The elaboration gap of 1.25 points represents the largest observed difference among the creativity dimensions, followed closely by fluency with a gap of 1.58 points. This consistent pattern of advantage across all five indicators provides strong descriptive evidence supporting the effectiveness of digital technology integration in primary school music extracurriculars.

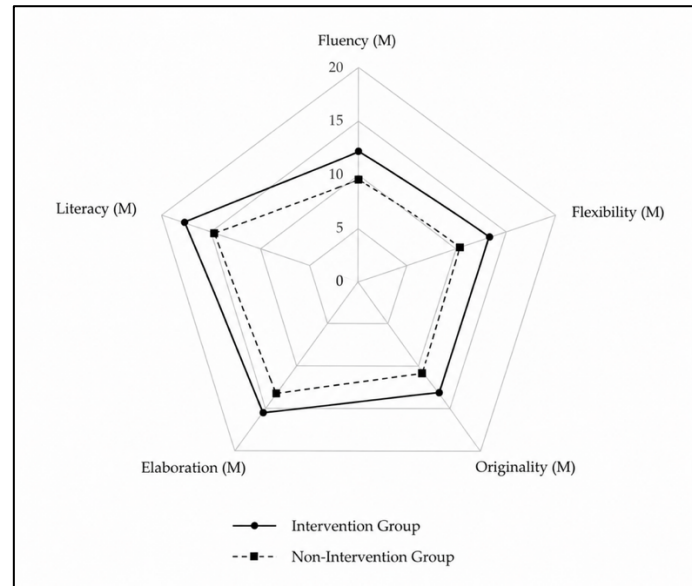


Figure 2. Radar Chart Comparing Mean Creativity and Literacy Scores Between Intervention and Non-Intervention Groups

The radar visualization referenced in Figure 2 illustrates the proportional advantage held by the intervention group across all five measured dimensions simultaneously. This visual representation allows for immediate identification of the dimensions exhibiting the greatest disparity between groups, particularly elaboration and fluency. The consistent outward expansion of the intervention group's profile relative to the non-intervention group visually reinforces the numerical findings presented in Table 6.

4.6 Correlation Between Digital Literacy and Creative Elaboration

Beyond descriptive comparisons, the relationship between digital literacy proficiency and creative elaboration performance was further examined through correlational analysis synthesized across the sampled studies. This analysis was undertaken to determine whether higher digital literacy specifically predicts stronger elaboration outcomes, rather than merely co-occurring with general creativity improvements. The resulting correlation is visualized in Figure 3 below.

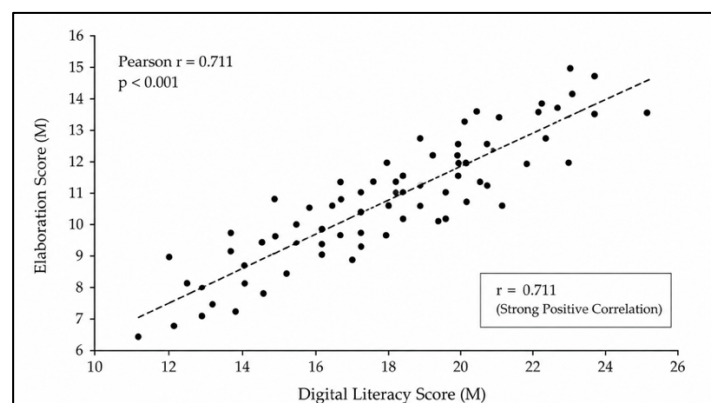


Figure 3. Scatter Plot Illustrating the Correlation Between Digital Literacy and Elaboration Scores

The correlation figure referenced above visually reinforces a statistically meaningful relationship between digital literacy proficiency and elaboration performance among sampled students. A Pearson correlation coefficient of 0.711 was identified between these two variables, indicating a strong positive association according to conventional correlation strength benchmarks. This finding suggests that as students' digital literacy proficiency increases, their capacity to differentiate ideas and systematically solve complex creative problems correspondingly strengthens. The strength of this correlation provides compelling evidence that digital literacy functions as a meaningful cognitive resource supporting elaborative creative processes rather than as an incidental byproduct of technology exposure.

4.7 Inferential Statistical Testing for Fluency and Elaboration

To further substantiate the descriptive and correlational trends observed in the preceding subsections, inferential statistical testing was conducted specifically for the fluency and elaboration dimensions. This analysis was necessary to confirm whether the observed mean differences between groups reached statistical significance rather than reflecting random variation. The resulting F-values and significance decisions are presented in Table 7 below.

Table 7. ANOVA Results for Fluency and Elaboration Dimensions

Creativity Dimension	F-Value	Significance
Fluency	9.28	Significant
Elaboration	10.39	Significant

Both dimensions presented in Table 7 demonstrated statistically significant differences favoring the intervention group, with elaboration exhibiting a marginally higher F-value than fluency. This result confirms that digital tools meaningfully enhance students' capacity to generate and expand upon complex musical ideas, rather than producing improvements attributable to chance variation alone. The consistency between these inferential results and the descriptive patterns presented in Table 6 further strengthens confidence in the overall validity of the synthesized findings.

4.8 Overall Instructional Effectiveness

The overall effectiveness of digital integration was further reflected in an aggregate teaching and learning effectiveness rating of 3.94 reported across music and arts subjects within the sampled literature. This rating indicates a generally high level of perceived instructional quality associated with digitally integrated music programs among both teachers and students. Statistical trends accompanying this rating further indicate that while student engagement levels were consistently high, technical infrastructure remained a variable factor influencing overall program performance across different school contexts. This pattern suggests that instructional effectiveness, while strongly supported by digital integration, remains partially contingent upon the availability of adequate technological infrastructure. Collectively, the findings presented across these nine subsections establish a coherent and multidimensional empirical foundation for the interpretive discussion presented in the following section.

4.9 Cultural and Local Wisdom Dimensions in the Selected Studies

Given the emphasis on culturally responsive learning introduced in the Introduction, this subsection presents a dedicated synthesis of findings from the sixteen SINTA-indexed studies that examined local wisdom within digital music education. These studies indicate that cultural content is commonly embedded into project-based digital modules through local songs, traditional instruments represented in digital form, and community narratives incorporated into lesson materials. Rahmawati et al. (2026) report that combining project-based learning with cultural elements strengthens both student engagement and technical skill acquisition. Nadlir et al. (2026) add that harmonizing local wisdom with digital-based project learning supports the development of cultural identity alongside digital competence. Sofiyah et al. (2024) explain that embedding local wisdom into digitally mediated instruction fosters social harmony among students during collaborative music activities.

A second pattern identified across these studies concerns the role of cultural framing in shaping creativity outcomes, particularly originality. Zaki et al. (2024) find that integrating local wisdom with project-based learning cultivates broader twenty-first-century skills relevant to the Society 5.0 era. Robert et al. (2023) document that gamified learning models embedding local cultural elements support the development of both music literacy and creativity among elementary students. Fajriani et al. (2025) report that culturally grounded digital learning strengthens student understanding of cultural diversity concepts.

Table 8 summarizes the thematic distribution of cultural findings identified across the SINTA-indexed studies.

Table 8. Thematic Findings on Local Wisdom Integration Across SINTA-Indexed Studies

Theme	Representative Studies	Key Finding
Cultural content embedding	Nadlir et al. (2026); Rahmawati et al. (2026); Sofiyah et al. (2024)	Local wisdom values are incorporated into digital project modules to strengthen cultural identity alongside technical competence
Cultural framing and creativity	Zaki et al. (2024); Robert et al. (2023)	Embedding cultural elements within digitally mediated project structures supports the development of twenty-first century skills and creativity
Cultural engagement	Fajriani et al. (2025)	Culturally grounded digital learning strengthens student engagement and understanding of cultural concepts

These findings show that local wisdom functions as a contextual layer that supports the digital pedagogy findings reported in subsections 4.1 to 4.8. The pattern observed in this subsection provides an empirical basis for the discussion of cultural and pedagogical integration presented in section 5.

5. DISCUSSION

The intervention group demonstrated significantly higher fluency scores compared to the non-intervention group, indicating that digital tools substantially enhance students' capacity to generate musical ideas. This improvement can be traced to the immediate auditory and visual feedback mechanisms embedded within digital instruments, which allow students to iterate rapidly without the procedural delays characteristic of traditional instruction. According to

Gagica Rexhepi et al. (2024), digital resources make instructional material more accessible by reducing the technical prerequisites typically required before creative experimentation can begin. This finding aligns closely with Sularso et al. (2024), who similarly observed that digital music technologies expand the pedagogical repertoire available for fostering rapid idea generation among young learners. However, this result contrasts with earlier perspectives emphasizing mechanical repetition as the primary pathway toward musical competence, suggesting a meaningful pedagogical shift has occurred. Taken together, these findings confirm that digital tools function as effective accelerators of creative fluency within primary school music extracurriculars.

The strong positive correlation between digital literacy and elaboration performance further reveals that technical competence and creative depth are mutually reinforcing rather than independent constructs. This relationship likely emerges because proficient digital navigation provides students with expanded cognitive resources for exploring and refining complex musical ideas. Rudyanto et al. (2023) directly support this interpretation, reporting a comparable correlation between digital literacy and elaboration outcomes within their own empirical analysis. This pattern is further corroborated by Paglinawan (2026), who found that digital tool integration significantly enhances the overall quality of student artistic output. In contrast, Bussu & Mangiarulo (2026) suggests that technical skill development in traditional instrumental settings often proceeds independently of broader creative elaboration, highlighting a divergence between digital and conventional pedagogical pathways. This divergence indicates that digital environments may uniquely integrate technical and creative development in ways that conventional instruction does not consistently achieve.

The successful realization of SWARA model principles through digital tools further illustrates how structured pedagogical frameworks benefit from technological augmentation. Interactive digital platforms provided the stimulus necessary to connect abstract musical concepts with real-world applications, particularly during the reflective and applicative stages of instruction. Desyandri et al. (2025) affirm this pattern, noting that digital portfolio sharing effectively supports the reflective and applicative components of the SWARA framework. This result is consistent with findings from Yang et al. (2023), who demonstrated that digital project-based learning similarly enhances student agency during reflective and applied learning stages. Conversely, Ozkan (2023) cautions that project-based approaches without adequate digital scaffolding can inadvertently reduce student engagement during more abstract instructional phases. This contrast underscores the importance of deliberate digital integration rather than incidental technology use within structured pedagogical models.

Findings related to local wisdom integration, as synthesized in subsection 4.9, add an important contextual layer to the digital pedagogy patterns discussed above. The SWARA model itself situates local cultural values as a starting stimulus before digital augmentation, indicating that cultural grounding and technological integration are designed to operate together rather than as separate program components. Rahmawati et al. (2026) and Nadlir et al. (2026) both report that combining project-based digital learning with local wisdom content strengthens cultural identity while sustaining technical skill development among elementary students. This pattern is consistent with the fluency and elaboration gains discussed earlier, suggesting that

culturally grounded digital tasks can support the same creative dimensions identified through the broader synthesis. Zaki et al. (2024) extend this observation by linking local wisdom integration to the development of twenty-first-century skills relevant to the Society 5.0 era, positioning cultural context as a meaningful complement to the technological competencies emphasized throughout this review. These findings indicate that culturally responsive digital pedagogy forms an integral part of the same instructional ecosystem examined in the preceding discussion of fluency, elaboration, and digital literacy.

Persistent infrastructural limitations, including unstable internet connectivity and insufficient device access, emerged as a recurring barrier constraining consistent digital program implementation. These limitations were particularly pronounced in schools lacking one-to-one device availability, where lesson continuity was frequently disrupted. Sularso et al. (2024) similarly identify limited technological access as an ongoing consideration affecting equitable implementation of digital music programs. This finding parallels observations by Marentek (2025), who reports that teacher readiness and infrastructural capacity jointly determine the success of technology integration efforts. In contrast, Mena-Guacas et al. (2025) suggest that emerging adaptive technologies can partially offset infrastructural constraints by enabling more flexible, low-bandwidth learning modalities. This contrast suggests that while infrastructural challenges remain significant, emerging technological solutions may gradually mitigate their impact over time.

The observed transition of teacher roles from traditional authority figures toward facilitators of personalized digital learning represents a further significant outcome of this synthesis. Teachers increasingly utilized digital tools to monitor individual student progress and deliver targeted feedback addressing specific creative weaknesses. Sularso et al. (2024) confirm that teachers report increased instructional efficacy when digital software diversifies their available teaching methods. This finding is consistent with Falcione et al. (2019), who similarly emphasize that successful technology integration depends on teachers assuming active facilitative roles rather than passive administrative functions. Nevertheless, Yihan et al. (2025) caution that this facilitative shift requires sustained professional development support, without which digital integration efforts risk superficial implementation instead of a transformative one. This tension indicates that the facilitator role, while promising, remains contingent upon adequate institutional and professional support structures.

6. CONCLUSION

The integration of digital technology within primary school music extracurriculars demonstrates a clear and consistent positive relationship with the development of student creativity and digital literacy. Systematic synthesis of forty-eight peer-reviewed studies confirms that digital intervention meaningfully enhances the fluency and elaboration dimensions of creative performance among young learners. These improvements are further reinforced by a strong positive correlation between digital literacy proficiency and students' capacity to elaborate upon complex musical ideas. Collectively, these findings establish digital technology integration as a substantive pedagogical strategy rather than a peripheral instructional enhancement.

Primary education institutions should prioritize strengthening digital infrastructure and expanding device accessibility to ensure the sustainable delivery of technology-enhanced music programs. Sustained professional development for teachers remains equally essential to support their evolving role as facilitators of personalized, technology-mediated creative learning. Policymakers are encouraged to allocate targeted resources toward closing the digital divide between urban and regional school contexts to prevent widening educational disparities.

This study is subject to several limitations that should be acknowledged. First, as a systematic literature review, the findings rely entirely on secondary data reported within the forty-eight included articles, so the accuracy of the synthesized statistical results depends on the methodological rigor of the original studies rather than on primary data collected directly by the researchers. Second, the sample was restricted to articles indexed in Scopus and SINTA and published between 2022 and 2025, which means relevant studies published in other databases, in different languages, or outside this timeframe were not captured in the synthesis. Third, the thematic imbalance between Scopus-indexed studies focusing on digital pedagogy and SINTA-indexed studies focusing on local wisdom means that findings related to cultural integration are based on a comparatively smaller subset of the total sample, limiting the extent to which conclusions on this theme can be generalized. Finally, variation in how individual studies measured creativity and digital literacy constructs introduces a degree of conceptual heterogeneity that, despite the use of standardized coding categories during synthesis, may affect the direct comparability of results across studies.

Future research is encouraged to address these limitations through several directions. Primary empirical studies employing longitudinal designs would help clarify whether the fluency and elaboration gains identified in this review are sustained over time rather than reflecting short-term intervention effects. Further research is also needed to examine the flexibility and originality dimensions of creativity in greater depth, given that this review found comparatively smaller effects for these two dimensions relative to fluency and elaboration. In addition, future studies should more deliberately investigate how local wisdom integration interacts with digital pedagogy across a larger and more balanced sample, particularly within Scopus-indexed research, to strengthen the evidentiary basis for culturally responsive digital music education. Comparative studies across regions with differing levels of technological infrastructure would likewise offer valuable insight into how contextual factors moderate the effectiveness of digital integration in primary school music programs. Through coordinated infrastructural, pedagogical, and policy support, primary schools can more effectively harness digital technology to cultivate a new generation of creative and digitally literate learners.

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