

REVIEW

Generative artificial intelligence in music education and creativity: A review of current developments and future directions

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Abstract

Generative artificial intelligence (AI) is transforming the way music is generated, accompanied, harmonized, pitched, transposed, and generally transformed, created, taught, studied, and evaluated. This is an integrative review that has been structured and synthesized 75 sources from the databases, namely Scopus, Web of Science, IEEE Xplore, ACM Digital Library, Education Resources Information Center (ERIC), APA PsycINFO, Google Scholar, citation searches, and authoritative institutional reports. The literature published between January 1, 2021, and July 7, 2026, was prioritized, while earlier legal, ethical, historical, and theoretical literature was retained when needed for conceptual grounding. The directness of the evidence was coded separately from the evidential weight of the evidence, which included findings from other contiguous technologies, such as automated feedback, intelligent tutoring systems, learning analytics, augmented reality/virtual reality, and online digital audio workstations. The synthesis suggests that activities that are teacher-mediated, process-assessed, culturally responsive, and ethically governed may open up opportunities for generative AI to assist in composition, songwriting, music-theory learning, certain types of feedback on practice, improvisation, and collaborative music-making. Yet, there is a scarcity of direct, controlled, and longitudinal evidence, and issues remain regarding originality, authorship, assessment integrity, cultural bias, data privacy, equitable access, teacher autonomy, and student agency. The review contributes to systematic innovation by connecting the iterative processes of generation, musical evaluation, revision, implementation, and reflection to pedagogical, assessment, and governance frameworks. Generative AI is therefore best understood as a pedagogical and creative tool that is used by a human teacher, not to replace musicianship or the teacher's judgment.

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1. Introduction

Generative artificial intelligence (AI) is an impactful technology in today's learning and creative practice. In the field of music, generative systems are capable of generating

or manipulating phrases, sequences, rhythms, lyrics, arrangements, timbres, accompaniments, and full compositions by using textual/symbolic/acoustic inputs (Agostinelli *et al.*, 2023; Copet *et al.*, 2023; Y. Ma *et al.*, 2024). These changes impact music creation, music education, music learning, music evaluation, and music dissemination. The use of such tools as recording technologies, synthesizers, notation software, digital audio workstations, online resources, and virtual instruments has been a part of music education practices throughout history. Unlike the instruments that primarily capture, edit, or replicate the output of human musicians, generative systems can suggest musical ideas, propose alternatives, extend musical patterns, and engage in iterative human–AI creative processes (Mycka & Mańdziuk, 2025; Wei *et al.*, 2025). The educational value of the product is therefore dependent on the interpretation, evaluation, revision, and ethical use of the product by the students and teachers.

The rate of adoption has been increasing at a much faster pace. Generative AI platforms such as Suno AI, MusicLM, MusicGen, and MIDI-GPT have shifted from mere demonstrations to initial discussions in schools and classroom settings (Choi *et al.*, 2026; Huang, 2024). There are now reports of applications in secondary and tertiary contexts, such as composition, songwriting, and music production. However, pedagogical models for the responsible, educationally productive adoption are less advanced than the technologies themselves (Cheng, 2025).

It is not a question of whether the generative AI tools can create music, but rather, whether and how they can facilitate meaningful musical learning. Music education is not just about the music product, but also about listening to music, interpreting music, embodied practice, learning about music, expressing feelings through music, working with music in groups, improvising with music, and reflecting on music (Berkowitz, 2024; Väkevä & Partti, 2025). The pedagogical potential of generative activities can be used to compare harmonies, test revisions, improvise with generated material, and critically evaluate feedback. However, if the music is accepted without analysis, it may negatively impact musical understanding and student voice.

Yet, generative AI transforms how music is conceived. While creativity has traditionally been considered to involve originality, technique, and intention, as well as an expressive judgment, generative systems introduce machine-induced suggestions into the creative process (Doshi & Hauser, 2024; Moruzzi & Margarido, 2024). Selection, rejection, transformation, synthesis, interpretation, and contextualization are strategies that can prompt a system to produce a chord sequence, melody,

genre imitation, lyric, or accompaniment. Therefore, learning through media must be active rather than passive; education must be meaningful.

In this review, we have combined what has occurred in the field and what is necessary regarding generative AI in the context of music education and musical creativity. The review examines the technological foundations of generative AI, its applications in education, the practices of creativity and authorship, the roles of teachers and learners, assessment, inclusion, ethical risks, and directions for future research. The main thrust of its argument is that generative AI can be educationally beneficial when used with human-centered, ethical, and pedagogically explicit practices (Akgun & Greenhow, 2022; UNESCO, 2023). The thematic domains are shown in Figure 1, and the representative systems and their evidential status are compared in Table 1.

Furthermore, this review not only catalogs digital tools; it also makes a contribution. It proposes thinking of generative AI as an iterative process of innovation in which a musical/pedagogical problem is formulated, various outputs are created, the outputs are subject to musical and pedagogical criteria, selected material is edited and applied, and the results are directly related to reflection. This is a cycle that connects creative experimentation to evidence-informed pedagogical redesign, and can be repeated. At the learner level, this contribution is realized through an iterative process of co-creating the teaching and learning process; at the teacher and curriculum level, through the structured design of tasks and assessment; at the institutional level, through ethical governance and planning for implementation.

We consider generative AI in music education as systems that generate, complete, transform, or co-create musical, lyrical, symbolic, and/or audio content based on human input. This includes Text-to-Music systems, Symbolic Music-Generation models, AI Songwriting systems, Accompaniment-Generation systems, and Multi-modal models for generating or modifying musical content. Technologies considered adjacent to learning activity management systems include learning analytics, automated feedback, augmented reality (AR) and virtual reality (VR) environments, online digital audio workstations, and intelligent tutoring systems, provided they are not directly integrated into a generative music-making process. The evidence collected from these neighboring technologies is presented as information to inform design or implementation, but is not considered evidence of the effectiveness of generative AI in music education.

Table 1 separates direct generative music systems from

Table 1. Comparative summary of direct generative music systems and adjacent music-learning technologies

Tool/system	Technology status and function	Access	Potential educational use	Evidence boundary and limitations
MusicLM	Direct generative music AI; text-to-music generation	Research-facing; limited educational deployment	Demonstration of text-to-audio generation and style comparison	Strong technical evidence; limited classroom evaluation; copyright and training-data transparency concerns
MusicGen/ AudioCraft	Direct generative music AI; text- or melody-conditioned generation	Open-source and research-oriented	Advanced composition, comparison, and prompt-literacy activities	Technically reproducible; requires support and is not validated as a school assessment tool
Suno AI	Direct generative music AI: song, lyric, and vocal-style generation	Accessible commercial web platform	Songwriting, lyric analysis, authorship discussion, and prompt design	Classroom-facing relevance has been reported, but outcome evidence is context-specific; privacy, copyright, and over-reliance concerns remain
MIDI-GPT	Direct generative symbolic music AI; controllable multi-track composition	Specialist and research use	Advanced composition, arrangement, and MIDI analysis	Strong technical control; limited school-level pedagogical evaluation
MuMu-LLaMA	Direct generative/multi-modal music AI	Research-facing	Multi-modal music understanding, generation, and AI-literacy discussion	Technically relevant but not a mature classroom tool; no direct learning-outcome evidence
CoMusT	Direct generative music AI; structured musical prompting	Research-facing	Advanced discussion of prompt reasoning and composition structure	High technical relevance; limited classroom testing
ChatGPT or LLM-based prompt support	Generative text AI; not a music-audio generator by itself	Highly accessible	Lyrics, reflection, theory explanation, prompt design, and process documentation	Requires teacher verification; may produce inaccurate explanations, and does not validate musical quality
Soundtrap	Adjacent online digital audio workstation; not generative AI	Educational accounts	Collaboration, remote ensemble work, and portfolio development	Adjacent evidence only; findings should not be used to support claims about generative AI effects

Abbreviations: AI: Artificial intelligence; LLM: Large language model; MIDI: Musical instrument digital interface.

adjacent educational technologies. Technical capability, classroom usability, and educational effectiveness are treated as different forms of evidence. In particular, findings from Soundtrap, intelligent tutoring systems, learning analytics, automated feedback, or AR/VR environments are not interpreted as direct evidence that generative AI improves music-learning outcomes.

2. Data and methods

2.1. Review design

A structured integrative review design was used for this study. The literature is now emerging, including empirical research, teacher and student perspectives, conceptual/philosophical discussions, technical model papers, legal and ethical scholarship, and policy support, and an integrative approach has been selected. The design allowed these source types to be combined while preserving differences in the directness of the evidence and the strength of the method. The three goals of the review were to find existing cases of generative AI in music education

and creativity, to bring together pedagogical, creative, ethical, and institutional themes, and to establish priorities of research and implementation. The units of analysis were scholarly or authoritative sources. The methodologically diverse corpus lacked many comparable quantitative interventions; statistical meta-analysis was inappropriate and not attempted.

2.2. Information sources and search strategy

The databases in which searches were conducted included: Education Resources Information Center (ERIC), APA PsycINFO, IEEE Xplore, ACM Digital Library, Scopus, Web of Science Core Collection, and Google Scholar. Ethical, governance, and/or policy analyses and authoritative institutional reports, such as those from the United Nations Educational, Scientific, and Cultural Organization (UNESCO), were also considered. The final search was conducted on July 7, 2026. Database searches covered English-language publications from January 1, 2021, through July 7, 2026. Earlier sources were added only

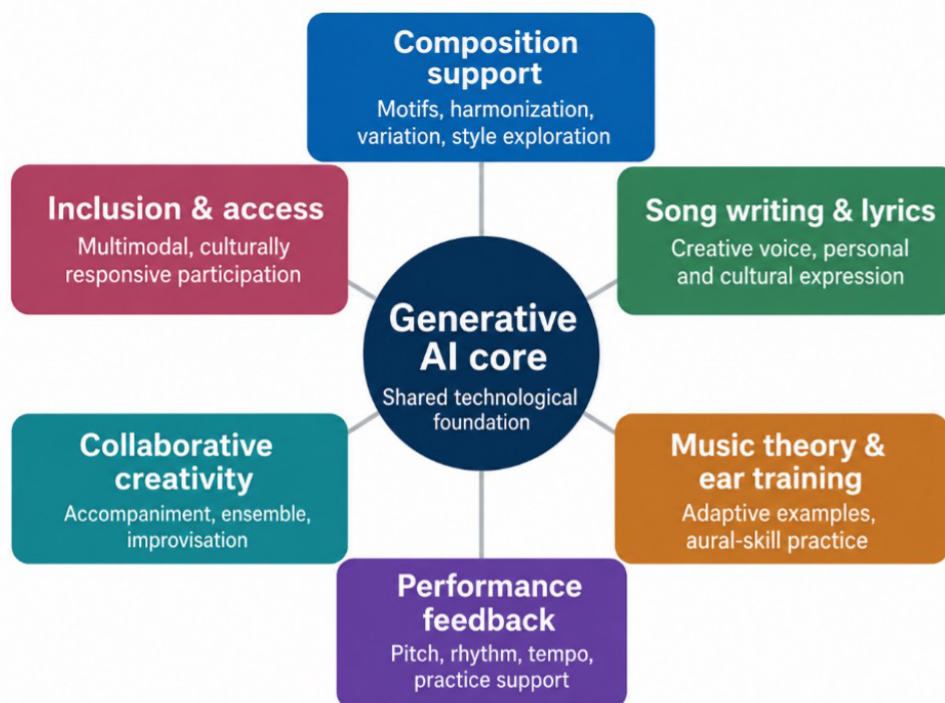


Figure 1. Thematic domains of generative artificial intelligence (AI) in music education. The six principal application areas reviewed in this article radiate from a shared technological core, each with representative pedagogical functions.

when necessary for legal, ethical, historical, or theoretical context. Search syntax was adapted to the field codes and indexing conventions of each database. ERIC and APA PsycINFO were searched separately through EBSCOhost. Boolean searching merged terms of generative AI, music generation, large language models, music education, creativity, composition, assessment, authorship, copyright, and ethics, followed by backward and forward citation searching. Complete database-specific search strings are reported below to support transparency and reproducibility. Search results were exported to a reference-management file, merged, and deduplicated before title-and-abstract screening.

- Scopus: TITLE-ABS-KEY(("generative AI" OR "generative artificial intelligence" OR "AI-generated music" OR "music generation" OR "text-to-music" OR "large language model*" OR LLM* OR "AI songwriting") AND ("music education" OR "music learning" OR "music pedagogy" OR "music classroom" OR "musical creativity" OR composition OR songwriting OR assessment OR authorship OR copyright OR ethics)) AND PUBYEAR > 2020 AND PUBYEAR < 2027
- Web of Science Core Collection: TS=("generative AI" OR "generative artificial intelligence" OR

"AI-generated music" OR "music generation" OR "text-to-music" OR "large language model*" OR LLM* OR "AI songwriting") AND TS=("music education" OR "music learning" OR "music pedagogy" OR "music classroom" OR "musical creativity" OR composition OR songwriting OR assessment OR authorship OR copyright OR ethics) AND PY=(2021-2026)

- ERIC via EBSCOhost: (TI ("generative AI" OR "generative artificial intelligence" OR "AI-generated music" OR "music generation" OR "text-to-music" OR "large language model*" OR "AI songwriting") OR AB ("generative AI" OR "generative artificial intelligence" OR "AI-generated music" OR "music generation" OR "text-to-music" OR "large language model*" OR "AI songwriting") OR SU ("generative AI" OR "artificial intelligence")) AND (TI ("music education" OR "music learning" OR "music pedagogy" OR "music classroom" OR "musical creativity" OR composition OR songwriting OR assessment) OR AB ("music education" OR "music learning" OR "music pedagogy" OR "music classroom" OR "musical creativity" OR composition OR songwriting OR assessment) OR SU ("music education" OR "music instruction"))
- APA PsycINFO via EBSCOhost: (TI ("generative AI" OR "generative artificial intelligence" OR "AI-generated

music" OR "music generation" OR "text-to-music" OR "large language model*" OR "AI songwriting") OR AB ("generative AI" OR "generative artificial intelligence" OR "AI-generated music" OR "music generation" OR "text-to-music" OR "large language model*" OR "AI songwriting") OR SU ("artificial intelligence")) AND (TI ("music education" OR "musical creativity" OR composition OR songwriting OR motivation OR engagement OR self-efficacy OR agency OR assessment) OR AB ("music education" OR "musical creativity" OR composition OR songwriting OR motivation OR engagement OR self-efficacy OR agency OR assessment) OR SU ("music education" OR "musical creativity" OR motivation OR self-efficacy))

For both EBSCOhost searches, the publication-date limiter was set to 2021–2026, and the language limiter was set to English.

- IEEE Xplore and ACM Digital Library: (generative AI OR music generation OR text-to-music OR large language model OR AI-generated music) AND (music education OR learning OR creativity OR composition OR assessment)
- Google Scholar was searched using the phrases "generative AI music education," "AI-generated music classroom," "AI songwriting education," "music generation pedagogy," "generative AI musical creativity," and "AI music copyright education." Results were ranked by relevance, and the first 200 records were screened. Relevant included sources were subsequently used for backward and forward citation searching.

2.3. Eligibility criteria

Sources were eligible when they addressed generative AI in music education, musical creativity, composition, performance, assessment, teacher development, or the ethics and governance of music-education technology. Eligible source types included peer-reviewed journal articles, conference papers, scholarly books or chapters, and authoritative policy or institutional reports required for legal, ethical, or governance analysis. English-language literature from 2021 to the final search date was prioritized. News items, duplicates, promotional or commercial materials, inaccessible full texts, technically focused papers without educational or creative-learning relevance, and sources lacking sufficient methodological or conceptual detail were excluded.

2.4. Study screening and selection

A two-step screening was carried out. Records retrieved were entered into a reference-management file, and

duplicates were removed. Titles and abstracts were then screened for eligibility, and then full texts of potentially relevant articles were reviewed for relevance to generative AI, music education, creativity, assessment, teacher development, inclusion, ethics, and cultural representation. Sources excluded lacked music-education/musical-creativity relevance, addressed general AI in education, did not cover technical development of the model, promoted, not scholarly, not in full text, or did not contain enough information for appraisal. The final corpus was divided into source type, educational context, relationship with technology, directness of evidence, weight of evidence, and thematic relevance.

Screening was performed at the title, abstract, and full-text levels, and was carried out independently by two reviewers. The reviewers first tested their eligibility criteria with a sample of records and adapted the labels of the categories. The conflicts were noted, debated with the review questions and decision rules, and settled through consensus prior to the production of the synthesis dataset. The terms "high" and "some" were deleted from the initial agreement. No chance-corrected agreement coefficient was reported as the paired pre-consensus item-level coding records were not kept in a way that would allow the coefficient to be computed at a later date. This is clearly defined in Section 4.4, and the final consensus-coded classifications are given in Table S1.

At the full-text screening stage, the primary exclusion reason was noted for each excluded source. The distribution of primary reasons for exclusion at the full-text screening stage is summarized in Table 2. These reasons encompassed a lack of focus on music education or musical creativity, the presence of general AI-in-education content that lacked musical relevance, the lack of research into technical music generation that was of educational relevance, promotional or non-scholarly content, absence of full-text materials, lack of methodological or conceptual information, and material published outside the search window that did not have a necessary seminal, legal, ethical, historical or theoretical function.

The flow summary documents how the corpus was identified, screened, and justified. Because the study is an integrative review rather than a statistical meta-analysis, the flow is presented as a transparency mechanism and not as a claim of exhaustive systematic review coverage. The complete literature-identification and screening process, including the arithmetic linking all stages and the 69 full-text exclusion reasons, is presented in Figure S1. The overall identification, screening, eligibility, and inclusion counts are summarized in Table 3.

Table 2. The primary reason for exclusion at the full-text screening stage

Primary reason	Number excluded
Not focused on music education or musical creativity	18
General AI-in-education source without music-specific relevance	15
Technical music-generation paper without educational or creative-learning implications	12
Promotional, commercial, or non-scholarly source	8
Full text unavailable	6
Insufficient methodological, conceptual, or evidential information for appraisal	5
Outside the 2021–2026 search window, and not necessary as a seminal/legal/ethical source	5
Total exclusions	69

Abbreviation: AI: Artificial intelligence.

Table 3. Flow summary of literature identification, screening, eligibility, and inclusion

Stage	Number
Records identified through Scopus	142
Records identified through Web of Science	126
Records identified through IEEE Xplore	57
Records identified through ACM Digital Library	43
Records identified through the Education Resources Information Center	38
Records identified through APA PsycINFO	31
Records identified through Google Scholar	200
Additional sources from citation searching and institutional reports	24
Total records before duplicate removal	661
Duplicates removed	186
Records screened by title and abstract	475
Records excluded at the title/abstract stage	331
Records screened at the full-text stage	144
Sources excluded at the full-text stage	69
Final sources included in synthesis	75

2.5. Data extraction and coding

All the sources included were isolated into a common comparison matrix. Author and year were recorded, as well as country or educational context, educational level, source or study design, participant group (if applicable), music-learning activity or creative application, relationship to technology, reported contribution, limitation or risk, ethical issue, category of evidence directness, category of

evidential weight, and role in the synthesis. This helped to make comparisons between patterns possible without assuming that all sources were homogeneous.

The reviewers independently coded the sources, using a common extraction form. The definitions of source type, technology relationship, evidence directness, evidential weight, and thematic category were refined in a coding pilot. The most common disagreements involved whether

a source provided evidence for direct generative music or adjacent generative-music evidence or general contextual evidence. Disagreements were addressed in each case using the consensus rules specified prior to the analysis, and the consensus-coded dataset was analyzed in the synthesis. As mentioned above, no numerical agreement statistic was reported since reconstructable paired pre-consensus records were not available; instead, this limitation was explicitly reported rather than replaced with an unsupported estimate.

The full extraction matrix for the 75 sources included is given in Table S1. It provides authors, year, type of source, context, focus of technology, evidence-directness category, evidential weight, main contribution, key limitation, and role in the synthesis. The source categories are included in Table 4. The first two categories in Table 4 included 18 sources, and all of these are summarized in the second table (Table 5). These two categories were selected for detailed tabulation because they are closest to classroom practice and provide the most direct evidence for claims concerning educational use, learner experience, and pedagogical implementation; the remaining categories primarily provide technical, legal, ethical, policy, cultural, or conceptual context and are fully documented in Table S1.

2.6. Quality appraisal

The corpus was heterogeneous, and a suitable appraisal was created. Five domains were evaluated for each source: (i) relevance to the questions in the review, (ii) methodological or argumentative transparency, (iii) supporting evidence for the argument, (iv) coherence of evidence and conclusions, and (v) authority of the sources and the quality of the reporting. For each domain, a score of 0, 1, or 2 was allocated: 0 = absent/unmet, 1 = partially met, 2 = clearly met. High evidential weight denotes a score of 8–10 and sufficiently clear methods or argumentation for the source's assigned role. Moderate weight denotes a score of 5–7, and useful but limited evidence. Contextual or limited weight denotes a score of 0–4 or evidence retained only to clarify technical, legal, ethical, cultural, or policy issues. A high-quality technical or legal source may therefore receive high evidential weight while still being considered indirect evidence for claims about educational outcomes. Categorical outcome is provided for each source in Table S1; component scores were not provided for this outcome because they would be misleading when comparing scores across the different types of sources: empirical, technical, legal, policy, and conceptual.

Evidence directness was not combined with evidential weight. Direct evidence included the empirical or applied

research in music education or music learning settings that utilized AI-supported musical activities. Other evidence used in this study included teacher or student perception studies, classroom facing cases, automated feedback, intelligent tutors, learning analytics, AR/VR, online digital audio workstations, and other music technologies that had pedagogical implications but for which no generative music system was tested. Contextual evidence included a wider context of AI in education, creativity, technical, legal, ethical, policy, or philosophical sources. The source's level of directness influenced the claims that could be supported: adjacent sources and contextual sources provided information regarding design, interpretation, ethics, and implementation, but not primarily as evidence of generative AI learning effects.

Study design was not used as an exclusion criterion in the appraisal, since the review was not intended to be a quantitative synthesis but an integrative one. Rather, the evidential weight is the question that determines the contribution of each source to the argument. Studies that were both empirical and classroom-oriented in their approach to music education were the most transparent and therefore were given the highest weight in making claims about learning, creativity, motivation, or assessment. The system capabilities were described using technical model papers, and the sources of the law, ethics, and policy fed into copyright, privacy, governance, and institutional responsibility. The evidence for the general AI applications in education, AR/VR, learning analytics, automated feedback, intelligent tutoring systems, and Soundtrap was clearly limited to claims in the context or adjacent to these applications.

2.7. Evidence synthesis

Data were synthesized thematically. Inductive codes were grouped into technological foundations and AI literacy, educational applications, creativity and authorship, teacher roles, student learning and agency, assessment and integrity, inclusion, and cultural representation. Findings were compared across educational contexts, technology relationships, source types, evidence-directness categories, and evidential-weight categories. Because the evidence was heterogeneous and comparable quantitative interventions were limited, narrative and tabular synthesis were used instead of statistical meta-analysis.

3. Results

Table 5 reports all 18 sources represented by the first two categories in Table 4: 10 direct music-education empirical or applied sources and 8 teacher/student perception, classroom-facing, or pedagogical sources. The table identifies whether each source concerns a direct generative

Table 4. Quality-appraisal summary of the included corpus

Source category	High evidential weight	Moderate evidential weight	Contextual/low directness	Total
Direct music-education empirical or applied sources	6	4	0	10
Teacher/student perception, classroom-facing, or pedagogical sources	3	5	0	8
Technical music-generation papers	5	8	4	17
General AI, creativity, or educational-technology studies	4	7	3	14
Legal, ethical, governance, and policy sources	8	7	1	16
Conceptual or philosophical analyses	2	6	2	10
Total	28	37	10	75

Abbreviation: AI: Artificial intelligence.

music system, broader AI in music education, an adjacent technology, or contextual pedagogical evidence. Reporting all 18 sources provides transparent coverage of these classroom-nearest evidence categories and prevents adjacent evidence from being interpreted as direct proof of generative AI effectiveness.

Table 5 makes the evidence boundary explicit: only sources directly involving generative or AI-supported music activity can inform claims about those applications, and even those claims are expressed cautiously. Sources concerning Soundtrap, intelligent tutoring, general human–AI collaboration, measurement, curriculum marketplaces, or conceptual analysis were retained for adjacent or contextual interpretation only. The remaining 57 sources were fully documented in Table S1 and support technical, legal, ethical, policy, cultural, and conceptual aspects of the synthesis.

3.1. Technological foundations and artificial intelligence literacy

3.1.1. System typology and current platforms

Generative music systems produce, manipulate, or transform musical material by modeling patterns in large datasets (Minaee *et al.*, 2024). Some systems generate symbolic material such as notes, chords, rhythms, and scores, whereas others synthesize audio, continue or harmonize melodies, imitate timbres, or generate lyrics. For educational analysis, four functions can be distinguished: generative functions that create new material; assistive functions for notation, arrangement, or mixing; analytical functions that describe pitch, rhythm, harmony, form, or performance accuracy; and interactive functions that support iterative prompting and revision (Mycka & Mańdziuk, 2025; Wei *et al.*, 2025). Affective music-

generation systems add emotion-conditioned output, although their educational use remains largely untested (Dash & Agres, 2024).

Current platforms combine several of these functions. MusicLM generates music from text descriptions (Agostinelli *et al.*, 2023), MusicGen supports controllable generation from text or melody (Copet *et al.*, 2023), and MIDI-GPT enables structured control over multi-instrument symbolic composition (Pasquier *et al.*, 2025). Advances in neural audio compression underpin direct audio generation (Défossez *et al.*, 2023). Suno AI has been discussed in secondary music education (Choi *et al.*, 2026), while language-model reasoning and structural embeddings are being explored for music understanding and symbolic generation (Rhyu *et al.*, 2024; Zhou *et al.*, 2024). CoMusT and MuMu-LLaMA extend the field toward structured prompting and multi-modal generation (Lam *et al.*, 2025; Liu *et al.*, 2026). These studies establish technical capability, but only a small subset provides direct classroom evidence; therefore, Table 1 separates technical performance from educational validation.

3.1.2. Artificial intelligence literacy as a core competency

Artificial intelligence literacy is an increasingly important competency for music learners. It includes understanding what generative systems can and cannot do, recognizing cultural and stylistic bias in training data, identifying copyright and privacy issues, and evaluating generated output against musical and ethical criteria (Karpouzis, 2024; Ng *et al.*, 2021; Yang *et al.*, 2025). Without this literacy, students may treat generated material as a finished answer rather than provisional material requiring human judgment. Broader AI literacy also requires recognizing

Table 5. Complete summary of direct music-education, applied, perception, pedagogical, and classroom-facing sources ($n = 18$)

Study	Context	Technology relationship	Cautiously stated contribution	Limitations of this review
H. Ma <i>et al.</i> (2025)	Music education/creative learning	Direct AI-music creativity evidence	AI-supported activity may create opportunities for exploration and reflection when learners critique and reshape outputs	Context-specific; does not establish broad effectiveness
Choi <i>et al.</i> (2026)	Secondary music education	Direct generative music classroom use (Suno AI)	May support songwriting tasks and discussion of authorship	Context-specific; no general learning-gain evidence
J. Jiang and Harpaz (2024)	Music learning and psychological development	Music-education evidence; no generative intervention	Music-learning participation was associated with self-efficacy and self-esteem	Cannot be used to infer AI effects
Smailis and Heliades (2025)	Music teachers	AI in music education: teacher-perception evidence	Informs teacher readiness, implementation, and kinesthetic-learning concerns	Perceptions do not establish student outcomes
Tan <i>et al.</i> (2025)	Chinese undergraduate music students	AI interface and acceptance evidence	Anthropomorphic features were associated with acceptance of AI systems	Acceptance is not equivalent to learning effectiveness
Väkevä and Partti (2025)	Music-education theory	Direct conceptual generative AI music evidence	Frames human–AI collaboration, agency, and musical creativity	Conceptual rather than empirical
T. Wang and Zhang (2025)	Music-creativity context	Direct correlational AI evidence	AI accessibility was associated with musical creativity through psychological mediators	Correlational mediation cannot establish causality
X. Wang and Li (2024)	Music students	AI readiness; not tool-specific	AI readiness and self-efficacy were associated with academic performance	Does not isolate a generative music system
Yu <i>et al.</i> (2023)	Music education	Applied review of AI applications	Maps potential pedagogical uses and implementation issues	Secondary evidence; no controlled intervention
Zhuang and Li (2026)	Collaborative music creation	Direct generative AI collaboration evidence	Collaborative AI-supported creation may support student creativity	Controlled and longitudinal validation remains limited
Chen (2025)	Music students	AI tools; direct classroom-facing empirical evidence	Reported associations with motivation, engagement, creativity, and perceived learning	Effects depend on design; causality is not established
H. Jiang <i>et al.</i> (2024)	Children's music creativity	Music-education measurement evidence; no AI intervention	Provides a validated approach to measuring creative practice	Does not test generative AI
Kim and Lee (2025)	Digital content creation	Contextual human–AI collaboration evidence	Students reported stronger agency when they directed, selected, and revised outputs	Not music-specific
Knapp <i>et al.</i> (2023)	Online music learning	Adjacent technology evidence (Soundtrap)	Structured online pedagogy may support participation	Soundtrap is not a generative AI system
Milhano (2025)	Pre-service music-teacher education	Classroom-facing AI and creative-project evidence	Teacher preparation should connect AI use with musical, ethical, and pedagogical aims	Early-stage teacher-education context
Naayini (2025)	General education	Adjacent intelligent-tutoring evidence	Provides contextual principles for personalization	Not music-specific and not direct generative AI evidence
O'Leary and Bannerman (2025)	Online music curriculum marketplaces	Adjacent institutional/digital-platform evidence	Highlights the need for curation and quality standards	Does not test generative AI learning outcomes
Treß (2025)	Music-education theory and critique	Conceptual music-technology evidence	Supports critical reflection on machine musical assumptions and human judgment	Conceptual rather than empirical

Abbreviation: AI: Artificial intelligence.

that generative tools operate within machine learning, data, cloud, and commercial infrastructures rather than as neutral, standalone classroom resources (Triantafyllou, 2025).

Evidence from general creative tasks suggests that generative AI may increase individual novelty while reducing diversity among outputs (Doshi & Hauser, 2024). Although this finding is not music-education-specific, it raises a relevant contextual concern: widespread use of similar platforms and prompts may produce stylistically convergent classroom work. Teachers should therefore examine representational tendencies and include underrepresented musical traditions when evaluating generated material (Gottschalk & Weise, 2023; Karpouzis, 2024).

3.2. Educational applications in music classrooms

3.2.1. Composition support and the blank-page problem

One of the most common areas where generative AI is applied in music teaching is in composition. Generative systems can offer learners motifs, harmonic starting points, variations, or stylistic alternatives to help them overcome the “blank-page” problem (Han, 2025; H. Ma *et al.*, 2025). When students start with an intention and then criticize, redesign, and personalize the created content, it most logically has educational value. There are not enough existing studies to support generalizations about opportunities to scaffolded exploration; claims about improvements in composition ability are only context-specific (T. Wang & Zhang, 2025; Zhuang & Li, 2026).

Therefore, the design of a task is crucial. Yu *et al.* (2023) offered suggestions on how AI can be applied to create personalized content, analyze melody and rhythm, and enhance classroom innovation; Xu (2024) and Han (2025) shared ideas of adaptive or technical methods for scaffolding composition. Applied and technical studies are not, on their own, measures of learning effectiveness. They still hold to a pedagogical idea: material generated should not be an “answer” that is taken for granted without musical reasoning, but rather something that can be explained, modified, and analyzed.

3.2.2. Songwriting, lyrics, and creative voice

Artificial intelligence can help with songwriting; it could also provide valuable opportunities for experimentation; however, it could result in students being superficially involved, merely copying and pasting generated lyrics or music without alteration. Sometimes, when the output is accepted, personal expression or cultural identity may be undermined. Even though Chen (2025) has found some

correlations between the use of AI tools and music students’ motivation, engagement, creativity, and perceived learning, causality cannot be inferred. Therefore, students should be asked to explain, revise, and personalize the material they produce when writing a song rather than being presented with their final product.

3.2.3. Music theory instruction and ear training

Cadences, modulations, chord progressions, counterpoint, formal structures, and voice leading are only a few of the examples that may be given for music-theory analysis, and they can all be varied in generative systems. All such materials can be used to compare, identify errors, and discuss stylistic alternatives (Zhou *et al.*, 2024). The educational claim is an opportunity for guided analysis, rather than automatic evidence of improved theoretical knowledge resulting from the creation of examples.

The adaptive exercise generation and intelligent tutoring are not synonymous with generative music systems, but are neighbors. Sajja *et al.* (2024) and Yarlagadda (2025) reported principles of personalization applicable to the design of aural-skills activities, but this does not necessarily mean that generative AI improves ear training. All exercises that are generated by a dictation, interval, rhythm, or chord quality exercise must be verified by the teacher because the output of such exercises can be plausible, but not musically or pedagogically correct.

3.2.4. Performance feedback and practice support

Automated performance feedback should not be confused with generative music-making. Information on pitch, rhythm, articulation, dynamics, or tempo can be delivered using analytical systems, or practice material or accompaniment can be delivered using generative systems (Cui, 2023). However, there are two related but distinct types of evidence: applied evidence, as presented in Ventura (2022), and perception-based evidence, as presented in Smailis and Heliades (2025), that do not prove that generative music systems have a positive impact on performance outcomes.

While automated measurement is possible for expressive features such as tone, nuance, phrasing, stage presence, culture, and intentionality, these features remain underdeveloped (Berkowitz, 2024). Practice with AI feedback may thus be used to supplement the technical aspects of the music in certain areas, while the interpretative/expressive aspects remain the responsibility of the teacher and musician.

3.2.5. Collaborative creativity and ensemble learning

Generative AI could produce content for shared activities,

such as backing tracks, accompaniment arrangements, improvisation suggestions, or sketch and outline arrangements. In a good group assignment, students can discuss, analyze, and redesign this material rather than assuming that the system is a more or less independent collaborator (Väkevä & Partti, 2025; Zhuang & Li, 2026). There is current evidence to support that this type of activity is a plausible way to achieve collaboration or ensemble learning, but no consistent evidence of gains.

Kim and Lee (2025) reported non-music-specific evidence that can be drawn out of context, suggesting that clear human roles could enhance perceived agency in digital content creation. Instead of using a Generative AI system, Knapp *et al.* (2023) looked at another adjacent music website, Soundtrap. Such results are used to shape tasks and participation, but not as concrete evidence of the impact of generative AI on education. The pedagogical contributions proposed by the structured approaches described in Table 6 are thus expected and have to be validated in the classroom.

The following framework is an author-developed synthesis derived from recurring codes in the reviewed literature. It should not be interpreted as a validated empirical model. Rather, it organizes evidence-supported

pedagogical recommendations and identifies how generative AI can be incorporated into music education while preserving student agency, teacher mediation, and ethical transparency.

3.3. Generative artificial intelligence and musical creativity

3.3.1. Redefining the creative process in music education

Creativity in music education is commonly associated with imagination, exploration, risk-taking, technical control, emotional expression, and meaningful aesthetic choice (H. Jiang *et al.*, 2024). Generative AI complicates this account by introducing machine-produced material into the creative process. Human activity may shift toward directing, selecting, transforming, and interpreting generated alternatives (Doshi & Hauser, 2024; Moruzzi & Margarido, 2024). Similar director–editor roles have been discussed in generative art and design (Taylor *et al.*, 2024), but evidence from those fields remains contextual rather than music-education-specific.

T. Wang and Zhang (2025) reported a chain-mediation model linking AI accessibility, self-efficacy, emotional intelligence, and musical creativity. Because the study is

Table 6. Pedagogical models for generative AI integration in music education: structured processes and anticipated contributions

Pedagogical model	Process description	Anticipated pedagogical contribution
Generate–analyze–revise	Students generate AI output, analyze it against musical criteria, then revise to improve or personalize it	May turn generated material into an object for analysis and support critical listening and compositional judgment
Comparison-based learning	Compare AI-generated music with human compositions across cultural traditions and periods	May promote analytical comparison and reduce uncritical acceptance of automated outputs
Project-based creation	Students create soundtracks, songs, or multimedia works using AI as one element and document the process	May integrate composition, technology, performance, collaboration, and documented process evidence
Generate and critique loops	Iterative AI prompt refinement based on musical feedback; students explain each revision	May support prompt literacy, iterative revision, and use of musical vocabulary
Human–AI improvisation	AI provides responsive accompaniment or call-and-response patterns for improvisational practice	May create structured opportunities to practice timing, phrasing, and melodic development
Differentiated task design	AI generates exercises at multiple difficulty levels simultaneously for mixed-ability classes	May facilitate differentiated instruction, learner autonomy, and self-paced practice

Abbreviation: AI: Artificial intelligence.

correlational, the findings indicate association rather than causal enhancement. Habib *et al.* (2024) similarly suggested that task design and guidance shape how generative AI relates to student creativity, but their broader educational evidence should be applied cautiously to music education.

Generative systems may support divergent exploration by producing versions of a simple idea in different moods, meters, genres, or harmonic settings. Comparing and revising these versions may help students examine how musical ideas can be developed (Zhuang & Li, 2026). However, claims that such activities develop creative flexibility require controlled validation. J. Jiang and Harpaz (2024) reported associations among music-learning participation, self-efficacy, and self-esteem but did not test AI; the study is therefore used only as contextual evidence regarding the psychological dimensions of music learning. Figure 2 presents the resulting synthesis as a proposed co-creative cycle rather than a validated causal model.

3.3.2. Originality, authorship, and the human contribution

Generative environments complicate originality and authorship. A student may transform AI-produced material through informed musical decisions, but educationally

meaningful authorship depends on demonstrable human intention, selection, revision, and responsibility (Mazzi, 2024; Ramos-Zaga, 2025). Process documentation is, therefore, necessary to distinguish active cocreation from unacknowledged reproduction. Figure 2 is developed from coded themes related to student agency, prompt design, critical listening, revision, disclosure, and process-based assessment. The figure, therefore, represents a synthesis framework rather than an experimentally tested model.

Increasingly, these issues are being addressed in legal scholarship. Samuelson (2023) explored the challenges that generative AI poses to copyright doctrine, and that courts have yet to decide what constitutes a copyrightable original work; similarly, broader analyses of copyright issues in the digital age highlight that copyright enforcement and licensing are still evolving to meet generative technologies (Peukert & Windisch, 2024); Savage *et al.* (2024) suggested that the probabilistic nature of AI-generated music should be a factor in the assessment of similarity. Sturm *et al.* (2019) also raised questions regarding copyright law and engineering practice in AI music generation that were left unanswered. For teaching, the implication is that students should be aware of the ongoing debate over legal issues related to authorship and ownership of AI-generated

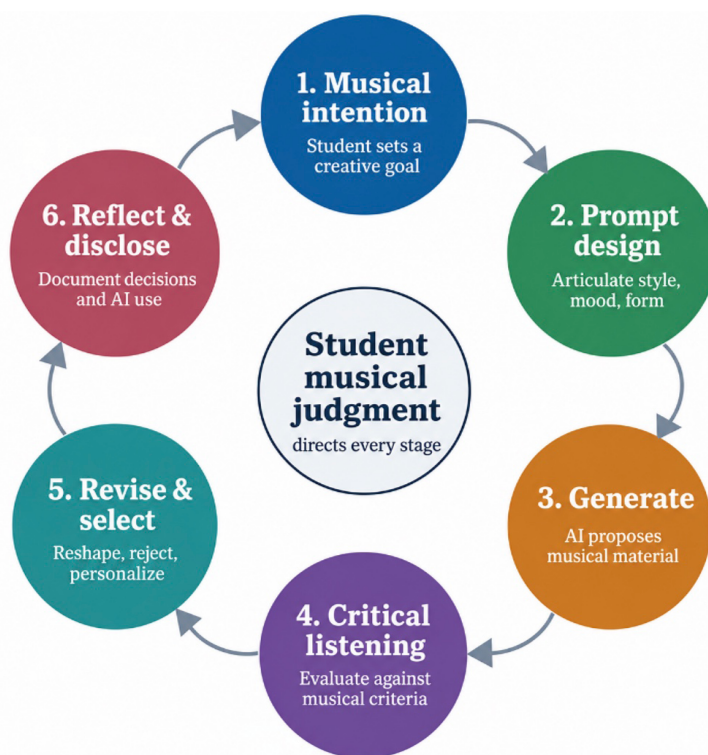


Figure 2. The human-centered co-creative cycle in artificial intelligence (AI)-supported music learning. Student musical judgment directs each of the six stages, transforming generative tools from answer machines into dialogue partners.

output when they use AI-generated content in published or submitted work.

Authorship issues in music education have implications beyond the legal realm and extend into philosophy and education. Berkowitz (2024) delved into the concept of “AI and musicking” and concluded that music’s meaning is “embodied, intentional, social, and human.” With the advent of Generative AI, Bozkurt (2024) explored the concepts of cocreation, authorship, and academic integrity, concluding that disclosure and transparency are critical to upholding academic and educational integrity. Similarly, Militsyna (2023) explored the threshold required for human creativity to be deemed essential for a work to be protected under European Union law when created with the help of AI.

3.3.3. Improvisation, metacreation, and reflective practice

Generative systems may supply call-and-response material, stylistically coherent backing tracks, riffs, or scale suggestions for improvisational practice (Trefß, 2025). These affordances may create opportunities to explore timing, phrasing, and melodic development, but they do not reproduce the embodied listening, social engagement, and co-adaptation of human ensemble improvisation.

Generative activity may also prompt metacreative reflection on the creative process itself. Comparing human and machine-generated material can support questions about expression, consonance, stylistic meaning, cultural context, and what is absent from a generated work (Trefß, 2025; Väkevä & Partti, 2025). The value lies in teacher-guided critical inquiry rather than in the mere technical generation of alternatives.

3.4. Teacher roles and professional development

3.4.1. Emerging pedagogical roles for music educators

Generative AI changes the work of music teachers without reducing the need for teacher expertise. Responsible use requires musical knowledge, pedagogical judgment, and ethical oversight to guide, interpret, evaluate, and contextualize generated material. Teachers remain responsible for connecting AI-supported activity with musical concepts, cultural interpretation, technical development, and expressive intention (Milakis *et al.*, 2025; Milhano, 2025).

Velander *et al.* (2024) examined teachers’ understanding of AI literacy in Swedish schools, while Bearman and Ajjawi (2023) described a shift from knowledge transmission toward critical mentorship. These studies are not direct evidence of generative-music outcomes, but they inform

the following teacher roles:

- **Curator:** Selecting appropriate, age-suitable, pedagogically valuable, culturally sensitive, and privacy-compliant AI tools from an expanding marketplace that varies enormously in educational quality.
- **Prompt designer:** Teaching students to write prompts that specify style, mood, instrumentation, form, difficulty level, or learning purpose—because prompt design requires musical thinking and the articulation of aesthetic intent.
- **Process assessor:** Evaluating not just final musical products but the decision-making trails that led to them, using draft comparisons, reflection statements, annotated revisions, and oral explanations.
- **Ethical guide:** Leading discussions about acceptable AI use, copyright, authorship, cultural appropriation, academic integrity, and the responsible sharing of generated content.
- **Creative collaborator:** Demonstrating to students how musicians can engage with AI as a generative partner within a human-directed creative workflow.

3.4.2. Professional development needs and institutional support

Training music teachers for generative AI requires more than just operational training. Professional development should be linked to pedagogical, curricular, assessment, ethical, culturally responsive, and inclusive practices, as well as to tool use (Milhano, 2025; Velander *et al.*, 2024). Teachers should have time to try tools, develop lessons, and assess students’ products against clear musical criteria, as well as time to discuss their products with one another and how well students have had a voice in their learning, and how well they have created evidence of learning.

Support from institutions is also required. A lack of infrastructure, policy support, training time, and technical support can lead to inconsistent implementation and an extra burden on teachers (Bearman & Ajjawi, 2023). Music teachers, techs, curriculum developers, administrators, and students all play critical roles in the successful integration of sustainable practices. The evidence from O’Leary and Bannerman (2025) is consistent with evidence from other authors and offers further support for developing curation standards for the online curriculum marketplace, though it does not directly demonstrate the impact of generative AI on learning.

3.5. Student learning, motivation, and agency

There is mixed evidence regarding motivation and agency, and this mostly relates to association. X. Wang

and Li (2024) reported positive relationships between AI readiness, self-efficacy, and academic performance, while Chen (2025) found relationships with academic motivation and engagement, creativity, and perceived learning. Tan *et al.* (2025) demonstrated that music students' acceptance of the AI system was influenced by interface features. The results are not proof of causal learning effects, but they suggest that task design, the learner's interpretation, and the encounter with the interface can affect engagement. The study by J. Jiang and Harpaz (2024) is used only as contextual evidence that participation in music learning is associated with psychological development.

Kim and Lee (2025) found that students who produced digital content with AI by directing, selecting, rejecting, and editing AI-generated content had higher perceived agency. Due to the non-musical nature of the study, it does not provide evidence with implications for an outcome claim, but it does provide evidence for a design principle: The material generated by AI should be provisional—students should have the clear authority to decide what to use.

Cao *et al.* (2025), Naayini (2025), and Yarlagadda (2025) address issues of adaptive systems and intelligent tutoring. These are not direct evidence of generative music systems; rather, they are related educational technologies. Their findings apply only to the process of personalization and implementation; the teacher–student relationship, however, is the source of motivation and of the interpretation of the music.

Potential risks include over-dependence, a lack of tolerance for gradual skill development, and a lack of depth in listening, notation, ensemble rehearsal, and sustained revision. The general impression gleaned from the literature on ChatGPT is that an interactive tool can either facilitate or impede learning, depending on the design of the task (Baidoo-Anu & Ansah, 2023). Therefore, repeated practice, embodied engagement in music, and long-term revision should be maintained in music education, not delegated to AI.

3.6. Assessment, integrity, and ethical frameworks

3.6.1. Process-based assessment approaches

One of the key issues in centralized assessment is the separation of student learning from an AI system's output capabilities. If a polished composition, recording, or analysis can be produced in a short time, a final product assessment alone may not accurately reflect the student's musical understanding (Perkins *et al.*, 2024; Sanz-Tejeda *et al.*, 2026).

Process-based assessment is more defensible. Students

can record the instruments used, the prompts entered, the outputs generated, the musical decisions made, the revisions made, and the reasons for each. Musical reasoning can be made visible, including through reflection statements, comparative drafts, annotated scores, rehearsal logs, prompt histories, and oral defenses (Bozkurt, 2024; Slimi, 2026).

To develop assessment rubrics for AI-supported music education, the originality of the human framing, the quality of critical revision, musical coherence and intention, the evaluation of generated material, the disclosure of the use of AI, the connection to the concepts of the course, and the metacognitive reflection should be taken into account. Prior to students working on the task, rubrics should be provided to clarify acceptable and educationally productive uses.

3.6.2. Academic integrity and disclosure policies

Academic integrity policies should be able to distinguish between helping and cheating. Perkins *et al.* (2024) distinguished between the creation and use of AI-generated content and the use of AI as a brainstorming tool, for practicing writing skills, for receiving feedback from AI, or for engaging in exploratory writing with documentation. Music education policies should be sufficiently clear to make the same distinction and to outline disclosure requirements.

The uncertainty can be diminished by clear institutional guidance, which can help responsible practice. Thorp (2023) noted that an AI system does not assume the author's responsibility, and similarly, a student-composer must maintain the musical and academic integrity of their submitted work. Process documentation is an integrity strategy recommended by Slimi (2026), although evidence across disciplines should not be used as direct evidence of effectiveness within music classrooms.

The use of AI-detection tools should not be the primary means of academic-integrity determinations because false positives could wrongly result in them being castigated (Perkins *et al.*, 2024). Commonly available defensible assessment designs are in-class composition, iterative drafting of text, live explanation of musical decisions, observation, and individualized oral defense. Table 7 illustrates the main ethical issues, risks, and educational responses.

The framework in Table 7 is a synthesis of common pedagogical and ethical themes developed by the authors. It is not an empirical model and has not been validated. It is intended to facilitate decision-making regarding copyright, authorship, cultural bias, privacy, equity, and academic integrity while maintaining student agency,

Table 7. Ethical dimensions of generative AI in music education: Challenges, educational responses, and key sources

Dimension	Core challenge	Educational response	Key sources
Copyright and IP	Training data includes copyrighted material; generated outputs may infringe	Teach copyright frameworks; require disclosure; guide safe use	Sag (2023); Samuelson (2023); Savage <i>et al.</i> (2024)
Authorship and originality	Human contribution threshold unclear; co-creativity complicates attribution	Process documentation; rubric criteria for human contribution	Mazzi (2024); Militsyna (2023); Ramos-Zaga (2025)
Cultural bias	Training data privileges dominant commercial genres; marginalizes local traditions	Critical AI literacy; diverse repertoire; bias-analysis tasks	Karpouzis (2024); UNESCO (2023)
Data privacy	Student recordings and compositions uploaded to commercial platforms	School-approved tools only; privacy-policy review; consent procedures	Akgun and Greenhow (2022); UNESCO (2021)
Digital equity	Paid AI tools create access disparities between students	Institutional provision; free-tier alternatives; device-access policies	Gottschalk and Weise (2023); UNESCO (2023)
Academic integrity	AI-generated submissions may misrepresent student learning	Process rubrics; in-class tasks; oral-defense requirements	Bozkurt (2024); Perkins <i>et al.</i> (2024)

Abbreviations: AI: Artificial intelligence; IP: Intellectual property.

teacher mediation, and transparency in the use of evidence.

3.7. Inclusion, equity, and culturally responsive practice

3.7.1. Accessible pathways to music-making

Generative AI may create additional pathways into composition and production for learners with different levels of instrumental experience or physical access. Visual, audio, and multi-modal interfaces may reduce some participation barriers, but direct evidence in disability-inclusive music classrooms remains limited (Milakis *et al.*, 2025). Claims should therefore concern design opportunities rather than established accessibility outcomes.

Lampropoulos and Evangelidis (2025) examine learning analytics, AR/VR, and metaverse environments, while Sajja *et al.* (2024) examine intelligent assistants in higher education. These are adjacent technologies. Their findings are used only to inform multi-modal and accessible design and should not be interpreted as evidence that generative music systems improve inclusion or music-learning outcomes.

3.7.2. Cultural representation and bias in generative systems

The risk of cultural narrowing is also a problem for generative music systems. The digitalization of training material might reinforce a particular bias toward Western popular, jazz, and classical genres, which may be the

most prevalent in society and therefore be reproduced in the training process (Karpouzis, 2024). It is difficult to determine the extent of this bias because limited information about training corpora is available, especially for indigenous and regional, folk, non-Western, and community-specific musical traditions.

UNESCO (2021, 2023) identified cultural diversity and equitable access as core principles of responsible AI governance. Gottschalk and Weise (2023) showed that inequitable access to technology and skewed access to content can exacerbate inequities. Similarly, Merchán-Sánchez-Jara *et al.* (2022) highlight the importance of stakeholder involvement in digital systems involving music education. These sources are used to inform governance and design but do not directly address the learning effects of generative AI.

Teachers have the opportunity to explore cultural assumptions in outputs; compare outputs with other musical traditions; and engage community musicians and/or cultural knowledge holders, as appropriate. The educational impacts of such activities need to be empirically measured, as they can help promote important AI literacy.

4. Discussion

Findings should be interpreted according to the strength, directness, and evidential weight of the supporting evidence. While some direct research has examined generative AI in music education (Chen, 2025; Choi *et al.*, 2026; H. Ma *et al.*, 2025), much of the available literature

remains technical (Agostinelli *et al.*, 2023; Copet *et al.*, 2023), conceptual (Berkowitz, 2024; Väkevä & Partti, 2025), legal, ethical, or policy-oriented (Akgun & Greenhow, 2022; Samuelson, 2023; UNESCO, 2023), perception-based (Smailis & Heliades, 2025; Tan *et al.*, 2025), or concerned with adjacent music-learning technologies (Knapp *et al.*, 2023)

The review does not, therefore, make any blanket claims regarding the benefits of generative AI on music learning and creativity. It outlines the possibilities and limitations of generative systems in facilitating selected learning processes, including teacher-mediated, process-oriented learning, culturally responsive learning, and ethically informed pedagogy.

4.1. Curriculum integration and implementation frameworks

4.1.1. Structured curriculum progression

The implementation of generative AI should be gradual and strategically planned to serve educational purposes rather than being added as a random piece of technology to the system (Cheng, 2025). A three-level progression of the curriculum is suggested. At a basic level, students explore the concept of generative AI, how it creates music, its current limitations, and authorship and bias as they are introduced through comparison, basic prompts, and discussion.

At the intermediate level, students compose, apply theory, revise, and document practices with support from AI. At the advanced level, students carry out critical or experimental projects to explore algorithmic creativity, representational bias, alternative tool designs, or the assumptions underlying particular systems. There is a requirement for evidence of human musical judgment

rather than just generation, for each level.

This three-level progression and the intended development of musical understanding, ethical reflection, and expressive judgment throughout the curriculum are shown in Figure 3. We developed an institutionalized combination of the four elements of AI literacy, scaffolded composition, critical engagement, and advanced creative inquiry. It suggests a sequence of implementation that would be recommended for testing in future classroom studies.

Generative AI activities may also create opportunities to support digital literacy, creative problem-solving, collaboration, cultural awareness, ethical reasoning, and information literacy (Amankwah-Amoah *et al.*, 2024; Zawacki-Richter *et al.*, 2019). These broader claims remain contextual and should not displace musical understanding, embodied practice, or expressive growth.

4.1.2. Implementation considerations and risk mitigation

Implementation decisions should address equity, privacy, curricular sequencing, teacher preparation, and access. Tool selection should avoid widening socioeconomic disparities, and systems that collect student recordings or compositions should be reviewed for compliance with data protection standards. Learners also need sufficient prior musical knowledge to evaluate generated material critically.

Mondal *et al.* (2023) cautioned against institution-wide adoption without adequate regulatory, pedagogical, and organizational frameworks. Barenboim *et al.* (2024) examined the kinds of musical understanding that generative systems represent. Together, these sources support risk-aware implementation, but neither establishes

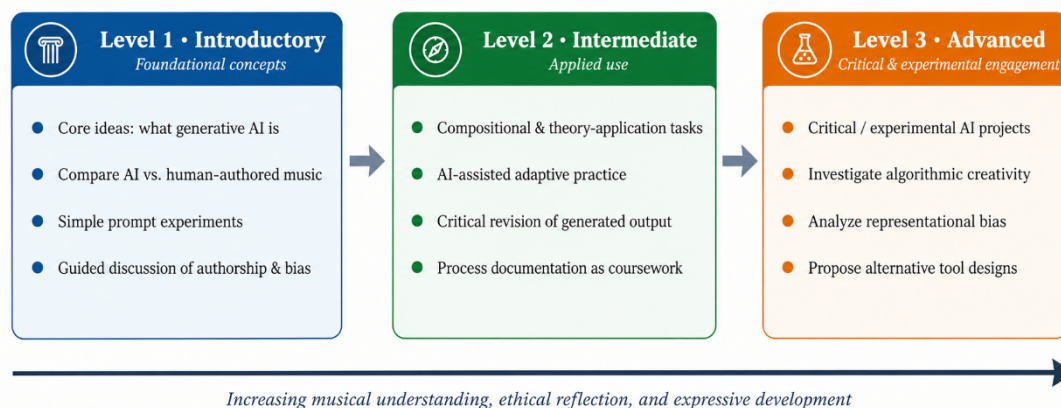


Figure 3. Three-level curriculum integration framework for generative artificial intelligence (AI) in music education, progressing from foundational concepts through applied use to critical and experimental engagement

educational effectiveness.

4.2. Contribution to systematic innovation in music education

This review is part of a process of systematic innovation, a sequence of problem-solving and implementation with generative AI: identify a musical/pedagogical problem, generate alternatives, assess alternatives against a set of musical, educational, cultural, and ethical criteria, revise/reject outputs, implement the selected solution, and reflect on the evidence generated along the way. Innovation lies in the disciplined interaction among automatic generation, human judgment, assessment, and governance, rather than in these elements alone.

Recurring student decision-making is described at the micro level in Figure 2 and the generate-analyze-revise and generate-and-critique models in Table 6. At the meso level, Figure 3 and the other models in Table 6 represent the sequencing of the curriculum, teacher mediation, and assessment throughout the process. Table 7 relates innovation to issues of copyright, privacy, equity, cultural representation, and institutional responsibility at the macro level. The framework is then translated into an evaluation research agenda, as shown in Table 8.

The result is a multilevel, responsible, systematic innovation process for music education: experimentation is structured, with review and ethical boundaries; pedagogical statements are articulated in relation to the strength of evidence; and implementation is accompanied by repeated evaluation rather than a single technology uptake. The framework remains synthesis-based and should be tested in the real world, but it provides a unified approach to establishing the structure of upcoming generative AI projects, evaluating their success, and overseeing their operations.

4.3. Future research directions

Further studies should move beyond conceptual debate and examine how generative AI interacts with actual music-learning, creative, assessment, and teaching processes. The priorities listed below are based on the evidence gaps found in the synthesis.

Controlled classroom comparisons should be the highest priority. Based on existing research, there are potential areas of composition, songwriting, and creativity that will benefit from the use of AI; however, there is a need for designs that compare AI and non-AI tasks before claims of effectiveness can be made. Outcomes should include knowledge of music, understanding of revisions, critical listening, musical quality, confidence, musical originality, and retention. Sustained development

in listening, technique, expression, collaboration, and reflective judgment is required for music learning, and a longitudinal study is needed. The temporary novelty or motivation should not be confused with lasting improvements in musicianship and creative independence.

Evaluations of these tools, such as MusicGen, MusicLM, Suno AI, MIDI-GPT, and multi-modal systems, should be conducted through educational standards and technical aspects of the audio. The following are the relevant criteria: Accessibility, controllability, transparency, privacy, cultural representation, age suitability, teacher workload, and visibility of student decision-making.

Rubrics for prompt design, prompt-draft comparison, musical decision-making, prompt-revision quality, prompt-reflection, prompt-disclosure, and prompt-oral explanation should be validated through assessment research. The goal is to expose learning and human contribution rather than rely on unreliable detection tools. Professional-development interventions should pilot the influence of training on pedagogy, ethics, cultural responsiveness, curriculum design, assessment, and student agency, as well as the quality of the interventions.

To be culturally responsive, research must audit the musical traditions represented, distorted, and marginalized by generative systems, and analyze classroom activities that enable learners to identify and question these patterns. Student voice, identity, sense of belonging, and personal identity need a focus of study. Research needs to address this issue: what aspects of authorship are reinforced with the use of AI, and what aspects are diminished when relying on AI-generated material? The study of legal and ethical governance should be undertaken in authentic classrooms. Future research should consider the transparency of rules and their impact on responsible research, as copyright, authorship, privacy, disclosure, and data ownership remain unstated.

4.4. Limitations of the review

There are several limitations to this review. First, not all relevant works are published in English. The English-language search may have excluded relevant work from areas where music technology and AI research are active. Second, field evolution is rapid, and classroom ownership, access, abilities, and practices might become outdated. Third, practitioner reports, or local curriculum experiments that are not included in scholarly databases, may have been overlooked. Fourth, the corpus included empirical studies, technical papers on music generation, conceptual analyses, legal scholarship, policy reports, teacher perception studies, and other related music ed-tech. This breadth would be suitable for an integrative

Table 8. Refined future research agenda for generative AI in music education

Research priority	Key question	Recommended design	Expected contribution
Learning outcomes	Does AI-supported composition improve musical understanding compared with non-AI tasks?	Controlled classroom comparison	Moves the field from speculation to evidence
Creativity development	Does AI increase originality or only surface-level novelty?	Longitudinal portfolio study	Clarifies effects on creative growth
Tool comparison	Which tools are most suitable for different education levels?	Comparative tool-evaluation study	Supports evidence-based tool selection
Assessment validity	How should human contribution be assessed in AI-supported music work?	Rubric validation and oral-defense design	Strengthens academic integrity
Teacher development	What training helps teachers use AI responsibly?	Professional-development intervention	Supports sustainable implementation
Cultural representation	Which musical traditions are privileged or marginalized by AI systems?	Bias audit and culturally responsive curriculum study	Protects cultural diversity
Student agency	Does AI support or weaken student ownership?	Mixed-methods student-experience study	Clarifies human–AI creativity
Ethics and governance	What policies produce responsible classroom use?	Institutional case study	Guides schools and universities

Abbreviation: AI: Artificial intelligence.

review but not for a quantitative meta-analysis. Fifth, few controlled, longitudinal music-education studies on generative AI are currently available; any assertions about learning, creativity, motivation, agency, or assessment should be taken with a grain of salt. Sixth, a variety of other related technologies, such as learning analytics, intelligent tutoring, AR/VR, automated feedback, and Soundtrap, were also presented, not to demonstrate the effectiveness of generative AI, but rather for contextual interpretation.

Seventh, the statistic for inter-reviewer agreement could not be calculated retrospectively because paired item-level pre-consensus coding records were not kept in a reconstructible form. The procedure and decision rules for reaching consensus are therefore made clear in the manuscript without any support and do not constitute an estimate. Lastly, the pedagogical and the systematic-innovation frameworks are synthesis-type proposals. They need to be supported with controlled studies, longitudinal studies, teacher development interventions, student portfolios, and culturally diverse music-learning settings.

5. Conclusion

This review synthesizes ongoing developments and directions in generative AI in music education and musical creativity. When used in teacher-mediated, process-assessed, culturally responsive, and ethically governed

ways, generative systems may provide opportunities to support composition, songwriting, theory exploration, selected forms of practice, improvisation, and collaborative music-making. Originality, authorship, assessment integrity, cultural bias, privacy/confidentiality, access, teacher autonomy, and student agency remain issues for which direct educational evidence is lacking, and the evidence base is less developed than the technical and pedagogical rationale.

Considering these results as a whole, it seems prudent to take a “battered” approach and proceed with caution: Generative AI might afford opportunities for assisting listeners, musical ideation, musical revision, musical practice, musical collaboration, and musical reflection, but there is no clear evidence of consistent causal gains in these capacities. In addressing systematic innovation, the review’s specific contribution is a multilevel approach that connects iterative generation and musical evaluation, process-based assessment, curriculum progression, ethical governance, and future assessment. Therefore, generative systems should complement, rather than displace, musicians’ skills and knowledge, teachers’ professional judgment, embodied practice, and sustained musical learning.

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Conflict of interest

The authors declare no conflicts of interest.

Authors' contributions

Conceptualization: Shujing Tang

Investigation: Yuanhong Sun

Methodology: Shujing Tang

Formal analysis: Shujing Tang

Writing – original draft: Shujing Tang

Writing – review & editing: Yuanhong Sun

Availability of data

No new empirical dataset was generated. All 75 included sources are identified in the reference list and documented in Table S1; the complete identification and screening flow is provided in Figure S1.

References

- Agostinelli, A., Denk, T. I., Borsos, Z., Engel, J., Verzetti, M., Caillon, A., Huang, Q., Jansen, A., Roberts, A., Tagliasacchi, M., Sharifi, M., Zeghidour, N., & Frank, C. (2023). *MusicLM: Generating music from text*. arXiv.
<https://doi.org/10.48550/arXiv.2301.11325>
- Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics*, 2(3), 431–440.
<https://doi.org/10.1007/s43681-021-00096-7>
- Amankwah-Amoah, J., Abdalla, S., Mogaji, E., Elbanna, A., & Dwivedi, Y. K. (2024). The impending disruption of creative industries by generative AI: Opportunities, challenges, and research agenda. *International Journal of Information Management*, 79, 102759.
<https://doi.org/10.1016/j.ijinfomgt.2024.102759>
- Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, 7(1), 52–62.
<https://doi.org/10.61969/jai.1337500>
- Barenboim, G., Debbio, L. D., Hirn, J., & Sanz, V. (2024). Exploring how a generative AI interprets music. *Neural Computing and Applications*, 36(27), 17007–17022.
<https://doi.org/10.1007/s00521-024-09956-9>
- Bearman, M., & Ajjawi, R. (2023). Learning to work with the black box: Pedagogy for a world with artificial intelligence. *British Journal of Educational Technology*, 54(5), 1160–1173.
<https://doi.org/10.1111/bjet.13337>
- Berkowitz, A. E. (2024). Artificial intelligence and musicking: A philosophical inquiry. *Music Perception*, 41(5), 393–412.
<https://doi.org/10.1525/mp.2024.41.5.393>
- Bozkurt, A. (2024). GenAI *et al.*: Cocreation, authorship, ownership, academic ethics and integrity in a time of generative AI. *Open Praxis*, 16(1), 1–10.
<https://doi.org/10.55982/openpraxis.16.1.654>
- Cao, W., Mai, N. T., & Guo, W. (2025). Personalized learning and adaptive systems: AI-driven educational innovation and student outcome enhancement. *International Journal of Education and Humanities*, 20(2), 173–182.
<https://doi.org/10.54097/tc5k6825>
- Chen, L. (2025). Unlocking the beat: How AI tools drive music students' motivation, engagement, creativity and learning success. *European Journal of Education*, 60(1), e12823.
<https://doi.org/10.1111/ejed.12823>
- Cheng, L. (2025). The impact of generative AI on school music education: Challenges and recommendations. *Arts Education Policy Review*, 126(4), 255–262.
<https://doi.org/10.1080/10632913.2025.2451373>
- Choi, W. C., Chang, C. I., & Choi, H. F. (2026). Suno AI: Opportunities and challenges of AI-generated music and lyrics in secondary music education. In *Proceedings of the 2025 8th Artificial Intelligence and Cloud Computing Conference (AICCC '25)* (pp. 281–292). Association for Computing Machinery, New York, NY.
<https://doi.org/10.1145/3789982.3790019>
- Copet, J., Kreuk, F., Gat, I., Remez, T., Kant, D., Synnaeve, G., Adi, Y., & Defossez, A. (2023). Simple and controllable music generation. *Advances in Neural Information Processing Systems*, 36, 47704–47720.
<https://doi.org/10.52202/075280-2066>
- Cui, K. (2023). Artificial intelligence and creativity: Piano teaching with augmented reality applications. *Interactive Learning Environments*, 31(10), 7017–7028.
<https://doi.org/10.1080/10494820.2022.2059520>
- Dash, A., & Agres, K. (2024). AI-based affective music generation systems: A review of methods and challenges. *ACM Computing Surveys*, 56(11), 1–34.
<https://doi.org/10.1145/3672554>
- Défossez, A., Copet, J., Synnaeve, G., & Adi, Y. (2023). High fidelity neural audio compression. *Transactions on Machine Learning Research*. Accessed August 20, 2026. <https://openreview.net/forum?id=ivCd8z8zR2>
- Doshi, A. R., & Hauser, O. P. (2024). Generative AI enhances individual creativity but reduces the collective diversity of novel content. *Science Advances*, 10(28), eadn5290.
<https://doi.org/10.1126/sciadv.adn5290>

- Gottschalk, F., & Weise, C. (2023). *Digital equity and inclusion in education: An overview of practice and policy in OECD countries* (OECD Education Working Papers No. 299). OECD Publishing, Paris, France.
<https://doi.org/10.1787/7cb15030-en>
- Habib, S., Vogel, T., Anli, X., & Thorne, E. (2024). How does generative artificial intelligence impact student creativity? *Journal of Creativity*, 34(1), 100072.
<https://doi.org/10.1016/j.joc.2023.100072>
- Han, Y. (2025). Exploring a digital music teaching model integrated with recurrent neural networks under artificial intelligence. *Scientific Reports*, 15(1), 7495.
<https://doi.org/10.1038/s41598-025-92327-8>
- Huang, W. (2024). Suno AI: Language learning with AI songwriting. *The FLTMAG*.
<https://doi.org/10.69732/ITFV6200>
- Jiang, H., Cheong, K. W., & Tan, W. H. (2024). Development and validation of a measure assessing children's creative practice ability in music. *Thinking Skills and Creativity*, 51, 101446.
<https://doi.org/10.1016/j.tsc.2023.101446>
- Jiang, J., & Harpaz, G. (2024). Impact of music learning on students' psychological development with mediating role of self-efficacy and self-esteem. *PLOS ONE*, 19(9), e0309601.
<https://doi.org/10.1371/journal.pone.0309601>
- Karpouzis, K. (2024). Plato's shadows in the digital cave: Controlling cultural bias in generative AI. *Electronics*, 13(8), 1457.
<https://doi.org/10.3390/electronics13081457>
- Kim, S., & Lee, J. (2025). Exploring students' experiences and perceptions of human-AI collaboration in digital content making. *International Journal of Educational Technology in Higher Education*, 22(1).
<https://doi.org/10.1186/s41239-025-00542-0>
- Knapp, D. H., Powell, B., Smith, G. D., Coggiola, J. C., & Kelsey, M. (2023). Soundtrap usage during COVID-19: A machine-learning approach to assess the effects of the pandemic on online music learning. *Research Studies in Music Education*, 45(3), 571–584.
<https://doi.org/10.1177/1321103X221149374>
- Lam, M. W. Y., Xing, Y., You, W., Wu, J., Yin, Z., Jiang, F., Liu, H., Liu, F., Li, X., Lu, W.-T., Chen, H., Feng, T., Zhao, T., Liu, C.-H., Song, X., Li, Y., & Zhou, Y. (2025). *Analyzable chain-of-musical-thought prompting for high-fidelity music generation*. arXiv.
<https://doi.org/10.48550/arXiv.2503.19611>
- Lampropoulos, G., & Evangelidis, G. (2025). Learning analytics and educational data mining in augmented reality, virtual reality, and the metaverse: A systematic literature review, content analysis, and bibliometric analysis. *Applied Sciences*, 15(2), 971.
<https://doi.org/10.3390/app15020971>
- Liu, S., Wu, Q., Hussain, A. S., Shan, Y., & Sun, C. (2026). MuMu-LLaMA: Multi-modal music understanding and generation via large language models. *Expert Systems with Applications*, 130688.
<https://doi.org/10.1016/j.eswa.2025.130688>
- Ma, H., Zhang, Y., Shan, X., & Hu, X. (2025). Exploring the impact of artificial intelligence on the creativity perception of music practitioners. *Journal of Intelligence*, 13(4), 47.
<https://doi.org/10.3390/jintelligence13040047>
- Ma, Y., Øland, A., Ragni, A., Del Sette, B. M., Saitis, C., Donahue, C., Lin, C., Plachouras, C., Benetos, E., Shatri, E., Morreale, F., Zhang, G., Fazekas, G., Xia, G., Zhang, H., Manco, I., Huang, J., Guinot, J., Lin, L., ... Wang, Z. (2024). *Foundation models for music: A survey*. arXiv.
<https://doi.org/10.48550/arXiv.2408.14340>
- Mazzi, F. (2024). Authorship in artificial intelligence-generated works: Exploring originality in text prompts and artificial intelligence outputs through philosophical foundations of copyright and collage protection. *The Journal of World Intellectual Property*, 27(3), 410–427.
<https://doi.org/10.1111/jwip.12310>
- Merchán-Sánchez-Jara, J., Ramos-Ahijado, S., & Montoya-Rubio, J. C. (2022). Ecosistemas educativos para la práctica musical en el entorno de la Web Social: Una revisión sistemática de la literatura [Educational ecosystems for music practice in the Social Web environment: A systematic literature review]. *Revista de Investigación Educativa*, 40(2), 565–587.
<https://doi.org/10.6018/rie.477721>
- Milhano, S. (2025). Artificial intelligence in teacher education: Exploring pre-service teachers' perspectives through creative music projects for professional learning. *The International Journal of Learning in Higher Education*, 33(2), 143–165.
<https://doi.org/10.18848/2327-7955/CGP/v33i02/143-165>
- Militsyna, K. (2023). Human creative contribution to AI-based output one just can't get enough. *GRUR International*, 72(10), 939–949.
<https://doi.org/10.1093/grurint/ikad075>
- Miniae, S., Mikolov, T., Nikzad, N., Chenaghlu, M., Socher, R., Amatriain, X., & Gao, J. (2024). *Large language models: A survey*. arXiv.
<https://doi.org/10.48550/arXiv.2402.06196>
- Mondal, S., Das, S., & Vrana, V. G. (2023). How to bell the cat? A theoretical review of generative artificial intelligence toward digital disruption in all walks of life. *Technologies*, 11(2), 44.
<https://doi.org/10.3390/technologies11020044>

- Moruzzi, C., & Margarido, S. S. (2024). A user-centered framework for human-AI co-creativity. In *Extended abstracts of the 2024 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY.
<https://doi.org/10.1145/3613905.3650929>
- Mycka, J., & Mańdziuk, J. (2025). Artificial intelligence in music: Recent trends and challenges. *Neural Computing and Applications*, 37(2), 801–839.
<https://doi.org/10.1007/s00521-024-10555-x>
- Naayini, P. (2025). AI and the future of education: Advancing personalized learning and intelligent tutoring systems. *Frontiers in Educational Innovation and Research*, 1(1), 29–39.
<https://doi.org/10.62762/FEIR.2025.332098>
- Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, 2, 100041.
<https://doi.org/10.1016/j.caeai.2021.100041>
- O’Leary, E. J., & Bannerman, J. K. (2025). Online curriculum marketplaces and music education: A critical analysis of music activities on TeachersPayTeachers.com. *International Journal of Music Education*, 43(1), 39–53.
<https://doi.org/10.1177/02557614241307242>
- Pasquier, P., Ens, J., Fradet, N., Triana, P., Rizzotti, D., Rolland, J.-B., & Safi, M. (2025). MIDI-GPT: A controllable generative model for computer-assisted multi-track music composition. *Proceedings of the AAAI Conference on Artificial Intelligence*, 39(2), 1474–1482.
<https://doi.org/10.1609/aaai.v39i2.32138>
- Perkins, M., Furze, L., Roe, J., & MacVaugh, J. (2024). The artificial intelligence assessment scale (AIAS): A framework for ethical integration of generative AI in educational assessment. *Journal of University Teaching & Learning Practice*, 21(6).
<https://doi.org/10.53761/q3azde36>
- Peukert, C., & Windisch, M. (2024). The economics of copyright in the digital age. *Journal of Economic Surveys*, 39(3), 877–903.
<https://doi.org/10.1111/joes.12632>
- Ramos-Zaga, F. A. (2025). Reconceptualizing human authorship in the age of generative AI: A normative framework for copyright thresholds. *Laws*, 14(6), 84.
<https://doi.org/10.3390/laws14060084>
- Rhyu, S., Yang, K., Cho, S., Kim, J., Lee, K., & Lee, M. (2024). *Practical and reproducible symbolic music generation by large language models with structural embeddings*. arXiv.
<https://doi.org/10.48550/arXiv.2407.19900>
- Sag, M. (2023). Copyright safety for generative AI. *Houston Law Review*, 61(2), 295–357.
- Sajja, R., Sermet, Y., Cikmaz, M., Cwiertyny, D., & Demir, I. (2024). Artificial intelligence-enabled intelligent assistant for personalized and adaptive learning in higher education. *Information*, 15(10), 596.
<https://doi.org/10.3390/info15100596>
- Samuelson, P. (2023). Generative AI meets copyright. *Science*, 381(6654), 158–161.
<https://doi.org/10.1126/science.adi0656>
- Sanz-Tejeda, A., Dominguez-Oller, J. C., Baldaqui-Escandell, J. M., Gomez-Diaz, R., & Garcia-Rodriguez, A. (2026). The impact of generative AI on academic reading and writing: A synthesis of recent evidence (2023–2025). *Frontiers in Education*, 10, 1711718.
<https://doi.org/10.3389/feduc.2025.1711718>
- Savage, P. E., Cronin, C., Müllensiefen, D., & Atkinson, Q. D. (2018). Quantitative evaluation of music copyright infringement. In *Proceedings of the Folk Music Analysis 2018 Workshop*. Accessed August 20, 2026. https://www.researchgate.net/publication/324861654_Quantitative_evaluation_of_music_copyright_infringement
- Slimi, Z. (2026). A systematic critical review of generative AI’s impact on authorship, pedagogy, and integrity (2023–2025). *Frontiers in Education*, 11, 1769680.
<https://doi.org/10.3389/feduc.2026.1769680>
- Smailis, D., & Heliades, G. (2025, September). Artificial intelligence in music education: Teachers’ views and perceptions on enhanced kinesthetic activity. Paper presented at *Digital Culture & Audio Visual Challenges 2025 (DCAC)*, Corfu, Greece.
- Sturm, B. L., Iglesias, M., Ben-Tal, O., Miron, M., & Gómez, E. (2019). Artificial intelligence and music: Open questions of copyright law and engineering praxis. *Arts*, 8(3), 115.
<https://doi.org/10.3390/arts8030115>
- Tan, J., Anyanwu, C. C., Liu, Y., & Suryanti, S. (2025). How anthropomorphic AI features affect music students’ acceptance: A study among Chinese undergraduates. *Frontiers in Education*, 10, 1649747.
<https://doi.org/10.3389/feduc.2025.1649747>
- Taylor, J., El Ardelya, V., & Wolfson, J. (2024). Exploration of artificial intelligence in creative fields: Generative art, music, and design. *International Journal of Cyber and IT Service Management*, 4(1), 40–46.
<https://doi.org/10.34306/ijcitsm.v4i1.149>
- Thorp, H. H. (2023). ChatGPT is fun, but not an author. *Science*, 379(6630), 313.

<https://doi.org/10.1126/science.adg7879>

Treß, J. (2025). Tracking down the musical habitus of the machine. *Action, Criticism, and Theory for Music Education*, 24(3), 79–108.

<https://doi.org/10.22176/act24.3.79>

Triantafyllou, S. A. (2025). Understanding AI and Google's broader efforts in AI. In Y. Farhaoui, T. Herawan, A. L. Imoize, & A. E. Allaoui (Eds.), *Intersection of artificial intelligence, data science, and cutting-edge technologies: From concepts to applications in smart environment* (Lecture Notes in Networks and Systems, Vol. 1353, pp. 72–78). Springer, Cham, Switzerland.

https://doi.org/10.1007/978-3-031-88304-0_10

UNESCO. (2021). *Recommendation on the ethics of artificial intelligence*. UNESCO Publishing, Paris, France. Accessed August 20, 2026. <https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence>

UNESCO. (2023). *Guidance for generative AI in education and research*. UNESCO Publishing, Paris, France. Accessed August 20, 2026. <https://www.unesco.org/en/articles/guidance-generative-ai-education-and-research>

Väkevä, L., & Partti, H. (2025). Generative AI as a collaborator in music education: An action-network theoretical approach to fostering musical creativities. *Action, Criticism, and Theory for Music Education*, 24(3), 16–52.

<https://doi.org/10.22176/act24.3.16>

Velander, J., Taiye, M. A., Otero, N., & Milrad, M. (2024). Artificial intelligence in K–12 education: Eliciting and reflecting on Swedish teachers' understanding of AI and its implications for teaching and learning. *Education and Information Technologies*, 29(4), 4085–4105.

<https://doi.org/10.1007/s10639-023-11990-4>

Ventura, M. D. (2022). A self-adaptive learning music composition algorithm as virtual tutor. In I. Maglogiannis, L. Iliadis, J. Macintyre, & P. Cortez (Eds.), *Artificial intelligence applications and innovations* (Vol. 646, pp. 16–26). Springer, Cham, Switzerland.

https://doi.org/10.1007/978-3-031-08333-4_2

Wang, T., & Zhang, J. (2025). Enhancing musical creativity through AI: A chain-mediation model of self-efficacy and emotional intelligence. *Frontiers in Psychology*, 16, 1665609.

<https://doi.org/10.3389/fpsyg.2025.1665609>

Wang, X., & Li, P. (2024). Assessment of the relationship between music students' self-efficacy, academic performance and their artificial intelligence readiness. *European Journal of*

Education, 59(4), e12761.

<https://doi.org/10.1111/ejed.12761>

Wei, L., Yu, Y., Qin, Y., & Zhang, S. (2025). From tools to creators: A review on the development and application of artificial intelligence music generation. *Information*, 16(8), 656.

<https://doi.org/10.3390/info16080656>

Xu, B. (2024). Design and development of music intelligent education system based on artificial intelligence. In *Proceedings of the 2024 Third International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE)* (pp. 1–6). IEEE.

<https://doi.org/10.1109/ICDCECE60827.2024.10548114>

Yang, Y., Zhang, Y., Sun, D., He, W., & Wei, Y. (2025). Navigating the landscape of AI literacy education: Insights from a decade of research (2014–2024). *Humanities and Social Sciences Communications*, 12(1), 374.

<https://doi.org/10.1057/s41599-025-04583-8>

Yarlagadda, K. C. (2025). AI in education: Personalized learning and intelligent tutoring systems. *European Journal of Computer Science and Information Technology*, 13(32), 15–27.

<https://doi.org/10.37745/ejcsit.2013/vol13n321527>

Yu, X., Ma, N., Zheng, L., Wang, L., & Wang, K. (2023). Developments and applications of artificial intelligence in music education. *Technologies*, 11(2), 42.

<https://doi.org/10.3390/technologies11020042>

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education: Where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), 39.

<https://doi.org/10.1186/s41239-019-0171-0>

Zhou, Z., Wu, Y., Wu, Z., Zhang, X., Yuan, R., Ma, Y., Wang, L., Benetos, E., Xue, W., & Guo, Y. (2024). Can LLMs “reason” in music? An evaluation of LLMs' capability of music understanding and generation. In *Proceedings of the 25th International Society for Music Information Retrieval Conference* (pp. 103–110).

<https://doi.org/10.5281/zenodo.14877281>

Zhuang, Z., & Li, X. (2026). The influence of collaborative music creation supported by generative artificial intelligence on students' creativity. *Frontiers in Psychology*, 16, 1709513.

<https://doi.org/10.3389/fpsyg.2025.1709513>