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The Collision of Rationality and Artistic Essence: Progress and Trends in Artificial Intelligence Music Education Research

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ABSTRACT: This research investigates the intricate relationship between technological rationalism and artistic essence in AI music education. Utilizing a systematic literature review methodology, relevant studies from the Web of Science Core Collection database between 2020 and 2025 were examined. The review identifies six principal applications of AI in music education: intelligent teaching systems, customized Learning, AI-assisted music composition, affective computing applications, intelligent assessment systems, and immersive teaching technologies. Research indicates three forms of alienation associated with technological integration: cultural, creative, and resource-based alienation. These challenges stem from the erosion of artistic integrity due to technological dominance, the limitation of creative diversity resulting from algorithmic standardization, and the inequitable distribution of educational resources caused by dependence on advanced technologies. Based on these findings, this research proposes a collaborative governance framework that integrates ethical constraints, technical corrections, and policy compensations to balance technological efficiency with artistic essence. The research results inform the development of an AI music education system that strikes a balance between technological empowerment and creative essence.

1. INTRODUCTION

In recent years, the educational technology market has experienced rapid growth, driven by the development of artificial intelligence (AI) technology. According to the Market Forecast report (2024), the size of the AI Education Market is projected to explode from USD 2.46 billion today and reach USD 28.22 billion by 2032, representing a compound annual growth rate (CAGR) of 35.6%. The rapid growth in the educational technology (EdTech) sector has been primarily driven by substantial support from investors and policymakers. Andreas Schleicher, Director for Education and Skills at the OECD (2021), has described this phenomenon as a "data revolution" capable of deeply reforming teaching methods. According to Schleicher, emerging technologies have the capacity to revolutionize traditional classrooms into dynamic learning environments characterized by greater flexibility, active student engagement, individual instruction, and boosted collaboration. Nevertheless, even with this hopeful outlook, numerous scholars advocate for caution, stress the inherent intricacies and unintended consequences that may accompany such sweeping technological changes (Al-Zahrani, 2024). The European Commission has identified education as a sector with high-risk applications of artificial intelligence. Recently, students' and teachers' unions worldwide have staged protests over the uncritical adoption of AI technologies in classrooms (Selwyn, 2024). Such must demonstrate why there must be an ongoing evaluation and thorough analysis of AI's role in education.

At present, AI offers both prospects and obstacles in the domain of education. Supporters contend that AI could improve music education via adaptive accompaniments, intelligent practice coaching, and tools that stimulate student creativity (Merchán Sánchez-Jara F. et al., 2024). AI-assisted polyphonic composition has shown great capacity in stimulating student interest in musical learning (Yuan, 2024). However, critics warn that if technology is less cautious in considering moral implications, the artistic essence and human values may be compromised. AI technology may harm relationships between teachers and students, diminish human care and creativity, and compromise the fairness and inclusivity of music education (Al-Zahrani, 2024).

Therefore, integrating AI technology with artistic essence is an important topic. We should evaluate new technological practices carefully to protect the artistic essence. Building upon previous work, we have developed a framework that balances efficiency with the protection of human values and ethical standards, linking technology to musical education.

2. PREVIOUS STUDIES

Since the early phase of computer-assisted instruction, AI technologies in music education have undergone considerable transformation, becoming increasingly complex with advanced algorithmic capabilities and cognitive frameworks. In 1967, Kuhn and Allvin reported on a Stanford University experimental setup where a computer operated a device that assessed the pitch accuracy of melodies sung into a microphone (Eddins, 1981). In the 1970s, early intelligent tutoring systems—built upon behaviorists' learning theories and rule-based frameworks—were developed to address fundamental musical skills, fundamental music theory, and ear training. In the late 1980s and early 1990s, researchers incorporated expert systems, such as those based on cognitive models like Vivace or Lasso, into music education software. This allowed for real-time adaptation based on learner feedback, enabling the development of effective teaching strategies promptly.

As technology advanced into the 21st century, progress in machine learning drove further development of applications such as intelligent accompaniment and automatic scoring (Holland, 2000). This technological evolution has continued to expand. Merchan Sanchez-Jara et al. (2024) conducted a literature review that identified nine artificial intelligence applications designed to increase efficiency, creativity, and inclusiveness within music teaching practices. For example, students can quickly find and correct errors using AI-assisted piano-fingering correction systems, increasing learning efficiency (Zhai & Xu, 2023). Zhang et al. (2024) found that AI-assisted composition tools help students increase accuracy and expressiveness in music composition. Gala's (2024) study demonstrated a 41% increase in course completion rates after applying the AI system. For students with special needs, such as dyslexia, Della Ventura (2019) notes that AI technology, through the CAMA (Computer-Aided Musical Analysis) software, has a positive impact on music education by helping teachers effectively stimulate learning motivation and overcome specific learning challenges. Chen's (2022) research showcases the efficacy of virtual reality technology in music education through practical applications. By creating an intelligent music-teaching platform that integrates modeling, facial capture, gesture tracking, and camera systems, he was able to enhance students' musical perception as well as their motivation to learn.

Implementing AI technology in music education presents some practical difficulties. One of the issues is cultural alienation stemming from biases inherent in AI systems, which are primarily trained in Western music. Barenboim et al. (2024) note that AI technologies frequently fail to accurately represent musical elements from non-Western cultures, thereby reinforcing Western-centric norms and marginalizing diverse musical traditions. Production alienation refers to how AI systems inhibit creative exploration. Standard training models decrease music innovation rates by 41% (Deruty et al., 2022), reducing creators' willingness to explore diverse styles (Chan & Hu, 2023). Furthermore, Resource alienation is another vital issue that deserves attention. Vesna's team (2025) points out that this problem comes from several places—patchy internet coverage, money issues, and many people just not knowing how to use digital tools properly. Therefore, rather than promoting educational equity, the implementation of AI can inadvertently exacerbate existing disparities.

Current research covers various applications of AI in music education, and some scholars have also examined the possible adverse effects of AI applications. However, present research still fails to provide a comprehensive viewpoint that balances technological efficacy with artistic essence. Given this research gap, it is necessary to construct a comprehensive framework that balances efficiency enhancement, humanistic values, and moral standards. This study aims to fill the present research void and provide more systematic and comprehensive theoretical guidance for the healthy development of music education.

3. THEORETICAL FRAMEWORK

The lenses of the technological alienation theory, human-AI teamwork in learning, and critical media theory provide a coherent framework for AI music education, which aligns to maintain the vitality of innovation and analytical reasoning while preserving humanistic values in AI music education (See Chart 1).

Technological Alienation Theory

Technologies touch human thinking and behaviors, thereby leading to alienation between human ends and means, where tools and methods take over or even change people's original value pursuits, according to Herbert Marcuse's *One-Dimensional* Man (Li, 2023). The immersive nature of AI music education may lead to an emotional detachment between teachers and students, which can reduce students' learning motivation and confirm Marcuse's concerns about technological alienation.

While analyzing the influence of technological advancement on human society by focusing on how it leads to a one-dimensional existence, Herbert Marcuse developed the technological alienation theory and asserts that technological progress causes a "one-dimensional" society where politics, economics, and culture become uniform, suppressing diversity and critical thinking (Yang, 2023; Kus & Ebinc, 2024). Due to false needs or superficial desires imposed by communal structures, technological rationality diverts individuals from genuine human fulfillment, losing their critical and negative dimensions and becoming passive consumers rather than active participants in society (Kus & Ebinc, 2024). Through a critical lens on technological progress, Marcuse's theory evaluates the potential advantages of technology, such as enhanced living standards and increased access to information; however, the theory serves as a cautionary reminder of the need to balance technological advancement with humanistic values to prevent community homogenization and the erosion of individuality. As technology alienates individuals from their true human nature and potential, they experience spiritual deprivation (Yang, 2023).

Offering a vital lens through which the integration of AI music education can be examined but suggesting that technology, while beneficial, can lead to alienation by promoting a one-dimensional society where innovation and analytical reasoning are stifled, Marcuse's theory emphasizes the risk of technology leading to a one-dimensional society, where human imagination and deep thought are suppressed by technological rationality (Kus & Ebinc, 2024). By automating creative processes in music education, thus reducing opportunities for original thought and emotional expression, AI can potentially alienate students (Berkowitz, 2024; Holland, 2000).

For a reflexive and ethical design of AI tools that align with humanistic values, technology serves to enhance rather than replace human creativity (Yang, 2023). Rather than merely automating tasks, AI tools should be designed to support fresh ideas and innovative thinking, including encouraging reflection and negotiation in music learning (Holland, 2000). Warranting student rights and educational outcomes, AI integration addresses concerns of bias, transparency, and data privacy, which are essential for protecting a student-centered approach in music education (Holster, 2024).

Human-AI Teamwork in Learning

Human-AI Teamwork in Learning is an interdisciplinary field that examines how Artificial Intelligence and human cognitive processes collaborate to achieve enhanced educational outcomes. Douglas Engelbart first introduced the concept of augmenting human intellect in 1962. Collaboration between humans and computational tools is stressed within this concept as a mechanism for enhancing creative capabilities and enabling intellectual development (Engelbart, 2023). Building upon this basis, Akata et al. (2020) proposed Hybrid Intelligence (HI), which integrates human and machine intelligence to accomplish goals unreachable through either alone.

As Human-AI Teamwork in Learning emphasizes that combining artificial and human intelligence can offer several distinct advantages over conventional methods for music education, especially concerning personalized learning, interactive instruction, and educational equity. For instance, the Flipped Classroom Model seamlessly integrates online and offline learning environments, providing students with the opportunity to access instructional materials at their own pace, thereby increasing comprehension and retention (Luo, 2024). Furthermore, the implementation of Intelligent Fuzzy Regression Classification (IFRC) within university music education systems facilitates the creation of personalized learning pathways. It provides real-time feedback, effectively catering to the individual needs of each student. Empirical evidence supports AI-powered systems as effective mechanisms for improving students' sight-reading, ear training, and music theory comprehension skills (Li, 2024). Additionally, AI-powered platforms play a crucial role in expanding access to music education by breaking down geographical and economic barriers, providing learning opportunities to underserved communities, non-traditional learners, and individuals living with disabilities (Ojha, 2022).

Though AI brings numerous benefits for music education, its integration can raise ethical concerns related to privacy protection, data security, and algorithmic bias. AI systems collect large volumes of personal data, which increases the risk of leakage or misuse (Farooqi et al., 2024). Furthermore, training AI algorithms on imbalanced datasets may exacerbate existing biases, leading to unfair educational outcomes (Mauti & Ayieko, 2025).

Therefore, to truly realize Engelbart's vision of human-AI teamwork in education, we need to balance technological benefits with ethical considerations. Scholars have offered solutions that address ethical concerns related to data processing. This includes creating robust data protection policies that comply with GDPR standards to mitigate risks associated with data processing, as well as developing diverse training datasets to minimize algorithmic bias (Farooqi et al., 2024; Leta & Vancea, 2023).

Critical Media Theory

Critical Media Theory (CMT) is one of several branches of the Critical Theory tradition, stemming from Marxist thought and Frankfurt School philosophy in early twentieth-century Europe. CMT critiques both commercialization and ideological manipulation within media systems (Fuchs, 2012). Based on this foundation, Marshall McLuhan further developed this theory, proposing that *the medium is the message*, which emphasizes the media's profound impact on human perception and cognition. These theoretical frameworks enable us to gain insight into how contemporary media technologies, including artificial intelligence, reshape education, cultural experiences, and cognitive frameworks.

How media systems perpetuate existing power structures is a central concern of CMT. On this topic, Fuchs (2012) provides a specific analysis, pointing out that mainstream media not only reinforce dominant socioeconomic systems but also marginalize diverse forms of cultural expression. In digital environments, personalized recommendations and algorithmic content curation reinforce existing biases and power dynamics (Tsekhmeistruk, 2024). The shift from traditional to algorithmic media has not eliminated bias within power structures. Instead, it has transformed it through new technologies, resulting in less visible yet potentially more pervasive manifestations.

CMT advocates for cultivating critical media literacy within AI-driven educational contexts. CMT emphasizes this capacity as it equips students to identify structural biases and critically interpret mediated information, rather than passively accepting algorithmically filtered content (Koltay, 2011). Furthermore, CMT advocates for proactive ethical reflection, as well as resistance strategies against media monopolization, algorithmic biases, data colonialism, and any form of media colonialism (Couldry & Mejias, 2019).

4. METHODOLOGY

4.1 Research Methodology and Research Questions

This study uses a systematic literature review method, adhering closely to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al., 2021), to systematically survey research in AI music education from 2020 to 2025 and develop key questions surrounding its progress.

(1) How is artificial intelligence improving music education by reconstructing teaching processes?

(2) Are there hidden dangers lurking behind these efficiency gains?

(3) How can a synergistic governance framework integrating ethical constraints, technological corrections, and policy compensations be developed to balance efficiency and artistic essence in AI music education?

4.2 Literature search and Screening methods

4.2.1 Data source and Search strategy

This study's primary data source is the Web of Science Core Collection Database (WOS). Its journals can reflect leading international research trends. A search was completed in January 2025 using these search terms: TS = ("artificial intelligence"

OR “AI” ）AND TS = (“music education” OR “music teaching”) AND PY = (2020-2025).

4.2.2 Inclusion and Exclusion Criteria

In our research, we used stringent screening criteria to decide which studies would be included or excluded and maintain their credibility. Inclusion in this review required studies to meet three essential criteria: they had to be written in English, published in peer-reviewed academic journals, and focus on AI applications in music education settings.

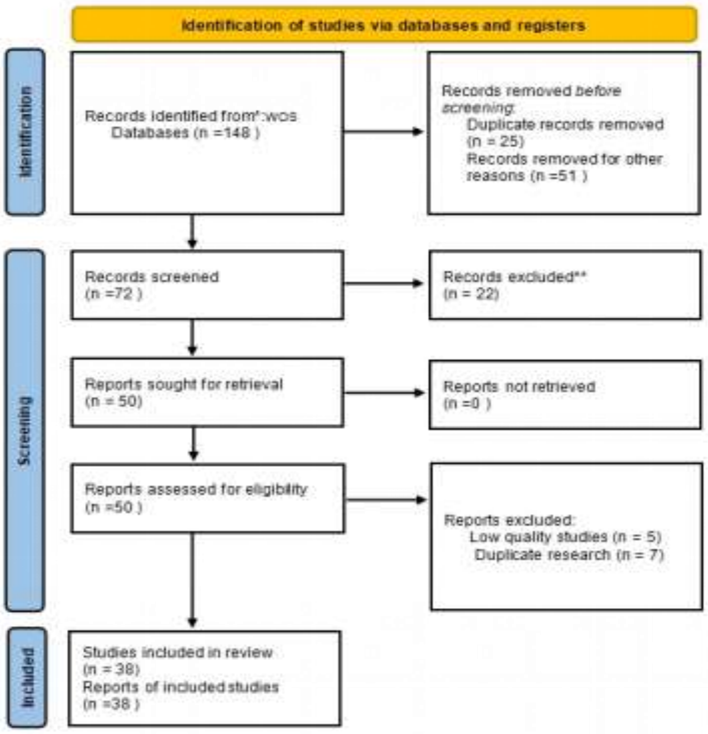
The exclusion process involved eliminating categories of material beyond our research focus. This included secondary analyses (such as literature reviews or book reviews) and papers on AI technology lacking direct music education applications. Additionally, duplicates appearing repeatedly in database searches were deleted.

4.2.3 Screening Process

Following PRISMA 2020 guidelines, our literature selection includes three distinct steps. We retrieved 148 records from WOS, then cleaned them by eliminating 25 duplicates and 51 problematic entries (such as papers that had been withdrawn or became inaccessible), leaving only 72 relevant works for further consideration.

As our screening progressed, we thoroughly reviewed titles and abstracts and eliminated 22 papers that did not fit with our research focus. After doing a complete text evaluation for the 50 remaining articles, we identified five articles with quality concerns as well as seven that repeated existing findings; those were removed from our pool of studies.

Through rigorous screening, we identified 38 high-quality studies for our final analysis. The process is documented in our PRISMA flowchart.



4.3 Features of the Selected Literature

4.3.1 Geographic Distribution of Research Contributions

Institutions contributing documents were distributed among three countries/regions with notable regional concentration patterns; Chinese scholars contributed most documents (34 papers; 89.5%) while Korean (3 papers; 7.9%) and Malaysian scholars (1 paper; 2.6%) also played important roles. This distribution indicates the dominance of Asia while also suggesting greater geographical diversification across research fields.

4.3.2 Chronological Pattern

The publication time of the literature presents the characteristics of the volatility distribution. In 2021, the number of published articles was 3, but it increased to the highest level in 2022 (19, 51.4%), then decreased in 2023 (5, 13.5%), and rose again in 2024 (9, 24.3%).

4.3.3 Research Methods Distribution

At the methodological level, the research paradigm primarily adopts a quantitative approach. Quantitative research accounted for the majority (32 papers, 84.2%), qualitative research accounted for a relatively small proportion (5 papers, 13.2%), and mixed research methods were the least (1 paper, 2.6%) (Shin, J., & Jung, J.Y., 2024).

4.3.4 Thematic Focus Areas

The research focus revealed an uneven distribution: most literature (37 papers, 97.4%) focused on technical efficiency, with five papers briefly mentioning related risks in the conclusion but not engaging in an in-depth discussion. There was only one review (2.6%) (Berkowitz, 2024).

Table 1 Literature Feature:

Classification Dimension	Project	Number of Papers	Percentage
Regional Distribution	China	34	89.5%
	South Korea	3	7.9%
	Malaysia	1	2.6%
Temporal Distribution	2021	3	8.1%
	2022	19	51.4%
	2023	5	13.5%
	2024	9	24.3%
	2025	1	2.7%
Research Methods Distribution	Quantitative Research	32	84.2%
	Qualitative Research	5	13.2%
	Mixed Research Methods	1	2.6%
Research Focus Distribution	Technical Efficiency	37	97.4%
	Theoretical Criticism	1	2.6%

5. RESEARCH FINDINGS ANALYSIS

5.1 Multidirectional Pathways of AI Application in Music Education Evolution

Analysis of literature on AI in music education indicates a strong focus on technological efficiency. Current applications span six key areas: intelligent teaching systems, customized Learning, AI-assisted music composition, affective computing applications, intelligent assessment systems, and immersive teaching technologies. These areas collectively reshape music education by refining resource allocation, personalizing instructional decisions, facilitating artistic expression, enriching emotional interaction, ensuring objective evaluation, and enhancing educational experiences through immersive environments.

5.1.1 Intelligent Teaching Systems: Optimizing Music Education Resource Allocation and Teaching Efficiency

Artificial intelligence technologies have transformed music education by improving teaching management, equitable resource allocation, and skill training through novel algorithmic structures and interactive communication networks.

Within AI-enhanced educational environments, Wei (2022) proposed the MET-AI framework, which integrates artificial intelligence into online music teaching platforms, demonstrating significant improvements in instructional efficiency (98.1%) and accuracy (95.3%). Wang (2022) extended this work by creating an AI-powered vocal music teaching platform that integrates music assignments, practice sessions, and interactive online classrooms. Based on the survey results (among 100 students), 82% of students preferred this method over traditional teaching approaches. Han (2023) further enhanced teaching support by utilizing neural networks to create a software system that integrates pitch detection and breath stability analysis, aligning with expert assessments. User evaluations demonstrated high satisfaction rates regarding immersion (97%), intelligent interaction (95%), and operational fluency (98%), reflecting support of autonomous student learning through this system.

Regarding resource allocation, Li (2022) proposed integrating artificial intelligence with wireless networks and developed a Quality-

Learning Algorithm (QLA), which significantly improved piano music teaching accuracy, reaching 99.23% when compared with traditional K-Nearest Neighbour (KNN) algorithms. This approach demonstrated considerable potential for improving the effectiveness of piano education through online platforms, mainly benefiting remote or geographically isolated areas. By integrating 5G technology with artificial intelligence algorithms, Zhang (2022) similarly explored new approaches to reforming the music education system. Practical evaluations indicated notable improvements in students' online learning, group collaboration, and self-directed learning, with middle-grade students exhibiting notably higher engagement and improved academic performance.

In order to increase efficiency and accuracy for online piano learning, Xue and Jia (2022) proposed an artificial intelligence and wireless network piano teaching system using the Multiple Signal Classification (MSC) algorithm and the MAESTRO dataset. Additionally, Chang (2024) presented the MusicARLtransNet system, which increases interactive learning outcomes through personalized real-time feedback. This interactive multimodal music education platform combines speech-to-text technology (STT), the multimodal alignment ALBEF model, reinforcement learning (RL), and dynamically optimized teaching strategies.

5.1.2 Customized Learning: Data-Driven Reconstruction of Teaching Decision Logic

Deep learning algorithms develop multifaceted innovations to reconstruct music education decision-making systems. Wang's (2025) AI system improves teaching effectiveness during critical music skill development periods (2nd-3rd quarter) through flexible learning path adaptation, which confirms the value of data-driven mechanisms for timely instructional interventions. During the group resource optimization phase, Liu's (2024) TSGEL framework uses a two-stage graph-embedding learning method. This approach captures shared patterns and preferences within the group, thereby shifting the focus of teaching content recommendations from individual preferences to leveraging collective intelligence. Bai (2024) proposed a hybrid model that integrates CNNs and recommendation algorithms to explore music education recommendation systems. This model integrates users' historical behavioral data with audio features to efficiently address the cold-start issue in traditional recommendation systems and assist university teachers with quickly understanding students' music tastes.

5.1.3 Creative Cooperation: Generative Technology Lowers the Barrier to Artistic Expression

Artificial Intelligence has achieved remarkable advances in music creation education. For example, Yin and Sun (2024) developed an artificial music generation system using Transformer models and adaptive encoders in the context of teaching material development, which enhances teaching resources and develops students' technical capabilities and emotional expression. Similarly, Zhang and Li (2021) designed an automatic melody synthesis technology based on recurrent neural networks (RNNs). This system makes music creation simpler and lowers the barrier for ordinary people to create music. Moreover, Liu et al. (2022) developed a folk song creation system based on a fuzzy cognitive rule algorithm. This approach employed granular computing to select semantic concepts from historical data as nodes for building a fuzzy cognitive map (FCM), then used particle swarm optimization (PSO) to optimize node weights globally. Experiments revealed that 90% of students actively participated in class creation activities. Demonstrating the effectiveness of this AI-driven method in enhancing students' creative performance in music education, the experimental group achieved an average oral test score of 95.46, which exceeded the control group's score of 91.56 by 3.9 points.

5.1.4 Affective Computing: Constructing a New Paradigm for Teaching Interaction

Affective computing technology optimizes the quality of music teaching interactions in three aspects. In the classroom, for emotion recognition, Liu (2022) developed an RBF/BP dual network model that captures and analyzes teacher-student emotional states in real time. It provides emotional feedback loop support for teaching interactions. For cross-cultural adaptability, Lian (2023) built an IoT-based emotion classifier that validates the feasibility of analyzing non-Western music scenarios, providing a technological foundation for multicultural education. In the interactive mode of innovation, Zhang and Li (2022) designed a gesture recognition system based on dual-channel convolutional neural networks (DCCNN), which expands the behavioral dimensions and expression methods of music perception education. It achieves an immersive music-teaching experience through human-machine collaboration.

5.1.5 Intelligent Assessment: System Transformation from Experiential Judgment to Algorithmic Validation

Recent advances in intelligent assessment technologies, specifically neural networks and genetic algorithms, have dramatically increased the objectivity and precision of music teaching evaluations. Chu (2022) proposed an evaluation model that combined an improved backpropagation neural network (BPNN) and a genetic algorithm to remove subjectivity while measuring nonlinear relationships accurately. This model was tested and validated using a simulation program designed in MATLAB, using student teaching evaluation data as inputs and expert teaching evaluation data as expected outputs. His experiments demonstrated that his model achieved 94.79% accuracy, surpassing traditional methods by 8.52 percentage points to demonstrate its efficiency and precision for assessing music teaching quality. Tan and Cao (2022) developed 24 secondary indicators covering teaching design and learner interactions for online music-flipped classrooms. These indicators form the foundation of an evaluation index system for music flipped classroom teaching quality evaluation, supported by an optimization backpropagation neural network (BPNN) optimized with a genetic algorithm (GA). Experimentation using student evaluation data collected via questionnaires revealed that this model achieved high predictive accuracy, further validating its efficiency as a teaching quality assessor.

Li and Gong (2022) developed a fuzzy intelligent multicriteria evaluation system for musical courses using Convolutional Neural Networks (CNNs). Researchers used CNNs to extract features from musical notation sequences and created a three-level evaluation model with reduced error rates compared to traditional BSA algorithms. They optimized it using Genetic Algorithm-Backpropagation (GA-BP). Notably, this model demonstrated significant advances in terms of accuracy, precision, recall, and F1 score, while simultaneously experiencing a significant decrease in error rates. The optimized model demonstrated superior performance when classifying musical symbols, showing its effectiveness at improving the accuracy and reliability of teaching quality assessments for music courses. Cao (2022) developed an artificial neural network model incorporating twelve vocal skill indicators for testing purposes. He trained his model using training data before conducting assessments with test datasets; its scoring error rate ranged between 0.005% and 0.039%, indicating high accuracy and reliability for vocal music teaching evaluation while minimizing subjective responses in this process.

Huang and Ding (2022) developed an AI-powered piano performance evaluation system. They optimized MIDI analysis to increase note and pitch correction accuracy rates. They used “Minuet” as their test piece. Performance data from piano teachers as well as students of different levels was recorded via MIDI for note-related information recording purposes. The optimized BPNN achieved a note correction accuracy of 94.3%, which is 5.25% higher than traditional methods, and a pitch correction accuracy of 92.9%. These results suggest that this system can help beginners correct errors while enhancing practice accuracy and efficiency.

5.1.6 Immersive Learning: Virtual Reality Redefines the Dimensions of Artistic Experience

Virtual and augmented reality technologies transform teaching scenarios by enabling three-dimensional interaction and visualization. Yan and Xia (2024) developed a VR music-teaching system that combines the short-time Fourier transform with deep learning algorithms for improved student success. This system facilitates 3D visualization and interaction of music signals, garnering positive reviews with over 61.6% of students reporting satisfaction with its smooth functionality.

Cui (2023) developed an AR piano teaching system using real-time hand motion tracking and virtual keyboard mapping. This system provides learning opportunities for those without traditional resources for piano study. As a result, about 70% of these students successfully achieved basic performance skill standards.

5.2 Technological Alienation: The Triple Dissolution of the Ontological Value of Music Education

5.2.1 Cultural Alienation: Exclusion Resulting from Data Bias

Cultural alienation in music education caused by artificial intelligence stems from cultural biases in mainstream music datasets. Currently, commonly utilized music datasets, such as Ballroom, GTZAN, ISMIR2004, Magna Tag ATune, and MSD, primarily focus on Western musical styles and genres (Bai, 2024). This Western-centric data structure not only marginalizes non-Western music but also unconsciously reinforces implicit cultural hierarchies within AI music education practices. As a result, AI systems trained on these datasets inevitably inherit such cultural biases, undervaluing or even ignoring the richness of diverse musical cultures. Over time, this data-driven bias may limit students’ cultural horizons, causing them to develop a narrow and uniform musical taste gradually. This issue deserves our careful reflection and attention.

5.2.2 *Production Alienation: The Suppression of Artistic Diversity Through Algorithmic Standardisation*

Artificial intelligence has influenced music composition education. Using preset style templates, generative tools like Transformer composition systems have increased both the quantity of works students can produce and the speed at which they can create them. However, this efficient production often results in students creating works that resemble one another, lacking individuality and uniqueness (Liu et al., 2022). This model, which operates on principles of instrumental rationality, has become a target of academic criticism. In his study, Berkowitz (2024) suggested that the reduction of cultural encoding to data symbols in AI composition diminishes the emotional richness of musical creations. A recent field study revealed that South Korean teachers are worried about how digital tools undermine aesthetic perception (Shin & Jung, 2024).

5.2.3 Power Alienation: Educational Resource Imbalance Caused by Technological Dependence

The promise of technology-driven equity has turned into a new form of exclusion. High-end devices, such as the wireless sensor systems analyzed by Li (2022), are still luxuries in developing regions. This situation aggravates the digital divide—the more advanced the technology, the less likely it is to be widely available in resource-scarce regions.

The hidden costs of AI applications are worsening educational inequality. As Mao (2022) argues, the time teachers must invest in learning AI skills creates differences in technological proficiency across educational settings. This technological gap also extends to students, where differences in digital literacy levels among learners further widen disparities in educational access. As a result, technological tools that should be equally accessible to everyone instead function as filtering mechanisms, benefiting only those who already possess adequate resources and digital competencies. Guan and Ren's (2021) research reveals that 9.3% of students frustrated by complex interfaces risk being excluded from the learning process.

6. CONCLUSION

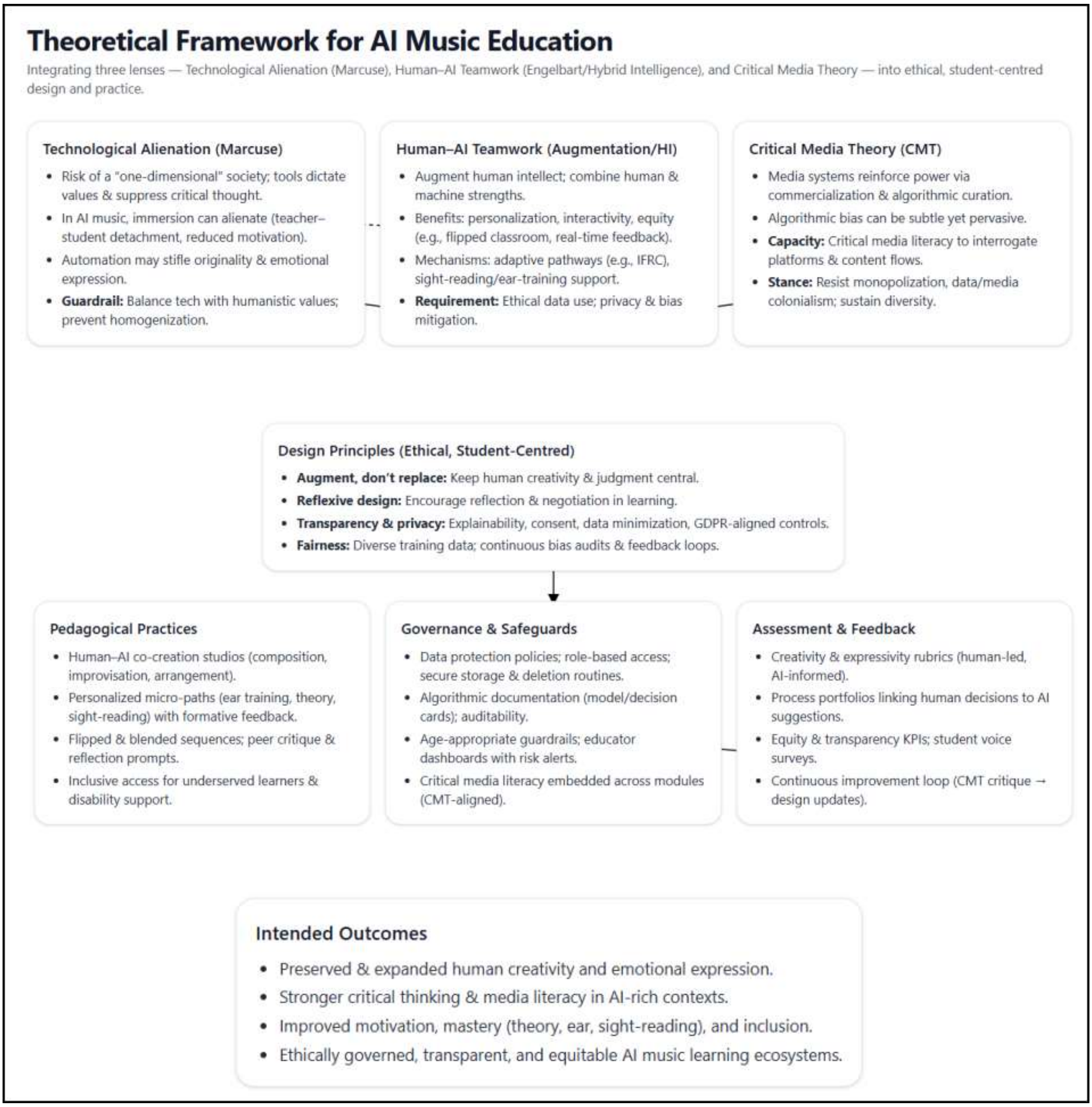
AI improves the efficiency of music education by utilizing intelligent teaching systems (Wei et al., 2022; Li, 2022), personalized decision-making (Wang, 2025; Liu et al., 2024), immersive scenes (Yan & Xia, 2024; Cui, 2023), and so on. However, the artistic essence of music education is being challenged by technological rationality. This contradiction arises from the fact that algorithms improve teaching efficiency, but they also risk reducing profound artistic experiences to measurable outcomes. This tension, I think, points to a deeper issue: when we lean too hard on algorithmic logic, it might chip away at what makes music education truly meaningful—its inherent value and core. The question then becomes: how do we keep that core intact? Striking that balance means finding ways to use AI tools without losing the human touch—the artistic heart of music education. To achieve such a balance, we require strategies that utilize AI technology while safeguarding the human spirit and artistic soul in music education.

We propose a collaborative governance framework that focuses on "ethical constraints, technical corrections, and policy compensations" as its core elements to solve the issues of cultural, creative, and power alienation in music education resulting from AI. Rather than allowing technology to dominate instruction, it redefines boundaries around technology use while protecting the deeper values of music education. Specifically, ethical constraints at the cultural level necessitate that we address the current limitations of Western-centric datasets. We must consciously expand these datasets to include a wide range of non-Western cultural data and avoid Western-centric bias.

Creativity is innately vulnerable and requires protective measures to sustain its vitality. Therefore, it is advisable to fit an artistic originality assessment module into creative teaching frameworks. Such a module would separate distinct creative elements from copied ones in students' work, curbing assimilation while nurturing each learner's unique stylistic expressions. Ultimately, achieving educational equity depends on a fairer redistribution of resources. Explicitly, driving lightweight computing technologies can break down access barriers. Additionally, collaboration among governments, businesses, and educational institutions is crucial for building comprehensive resource networks, ensuring all learners have fair access to essential tools. Only through such cross-sector efforts can equity in music education be maintained overall.

Given the rapid pace of AI technology development, this research may soon require reassessment and updates. Additionally, cross-cultural music datasets and evaluation metrics are still in the exploratory stage and have not yet established mature standards or methods. To widely understand AI's long-term impact on music education, mixed-methods approaches—integrating quantitative data and qualitative insights to capture its complex effects need to be explored.

Chart 1



Contribution/Originality

This study contributes to the literature by examining the intersection of technological rationalism and artistic essence in AI music education, identifying key forms of alienation and proposing a collaborative governance framework to balance technological efficiency with artistic integrity.

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