Música Hodie | ISSN: 2317-6776 DOI: 10.5216/mh.v25.81586

# Digital strategies for creating contemporary piano music in Asia and Latin America: Comparing online platforms and virtual instruments in Brazilian, Chinese, Japanese, and Indian piano music

## Estratégias digitais para a criação de música para piano contemporânea na Ásia e na América Latina: Comparação de plataformas online e instrumentos virtuais na música para piano brasileira, chinesa, japonesa e indiana

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**Abstract:** This article aims to examine the digital strategies and online technologies used in creating contemporary piano music in Brazil, China, Japan, and India, and to represent Asian and Latin American musical traditions in the digital age. The study was conducted in four stages, focusing on the use of online platforms, virtual instruments, and digital audio workstations (DAWs) in each country. The integration of traditional musical elements with digital technologies was most sophisticated among Chinese respondents, as evidenced by the innovative use of virtual instruments and online collaboration tools. The research perspective is to identify countries that not only shape the development of Brazilian, Chinese, Japanese, and Indian music but also exhibit unique musical elements that inform the specifics of piano music creation.

**Keywords**: cultural influences in piano music, digital piano music creation. online music platforms. technological innovation in music. virtual instruments.

**Resumo:** Este artigo tem como objetivo estudar as estratégias digitais e as tecnologias online utilizadas na criação de música contemporânea para piano no Brasil, China, Japão e Índia, bem como representar as tradições musicais asiáticas e latino-americanas na era digital. O estudo foi realizado em quatro etapas, com foco na utilização de plataformas online, instrumentos virtuais e estações de trabalho de áudio digital (DAWs) em cada país. A integração de elementos musicais tradicionais com tecnologias digitais foi considerada mais sofisticada entre os entrevistados chineses, como evidenciado pela utilização inovadora de instrumentos virtuais e ferramentas de colaboração online. A perspetiva da investigação é identificar países que não só impactam o desenvolvimento da música brasileira, chinesa, japonesa e indiana, mas também apresentam elementos musicais únicos que afetam as especificidades da criação musical para piano.

**Palavras-chave:** influências culturais na música para piano. criação de música para piano digital. plataformas de música online. inovação tecnológica na música. instrumentos virtuais.

Submitted on: January 30, 2025
Accepted on: February 25, 2025
Published on: November 2025.

## Introduction

Modern piano composition encounters significant epistemological challenges: digital mediation simultaneously expands creative possibilities and imposes algorithmic constraints that fundamentally alter traditional practices. This dialectical tension necessitates an examination of cross-cultural adaptation to digital environments. Global issues emerge from ontological instability: computational transcription confronts the inherently non-computable aspects of performance practice, while algorithmic representation struggles with the microtemporal nuances embedded in cultural traditions. Paradoxically, digital preservation transforms precisely what it aims to safeguard. These challenges arise from the structural incompatibility between computational logic and embodied musical knowledge—quantitative analytical parameters fail to adequately capture the gestural intricacies inherent in live performance (Li and Wang, 2023).

Contemporary scholarly paradigms remain insufficient in addressing the following issues: formalist approaches isolate computational structures from cultural context; ethnomusicological methods explore cultural practices without computational rigor; and music theory analyzes structural elements without considering algorithmic constraints on compositional agency. A research gap exists precisely at the intersection of these disciplines—where technical capabilities intersect with cultural imperatives (Taran, 2024).

The theoretical significance lies in the need to rethink digital authenticity. Rather than positioning computational techniques as an extension or replacement of traditional methods, emerging scholarship must investigate how algorithmic mediation fundamentally alters the ontological status of musical creativity itself. Transformation occurs not only in the produced sound but also in the very conception of compositional thinking—shifting from fixed notation to procedural design (Zhao, 2024).

Practical implications extend beyond compositional techniques to the preservation of cultural heritage, pedagogical transmission, and epistemological frameworks that govern the production of musical knowledge (Xu, 2022). There is an urgent need to develop methodologies that integrate computational precision with cultural adaptability in Brazilian, Chinese, Japanese, and Indian compositional contexts.

Piano music is one of the main varieties of musical culture. It is deeply connected to traditional culture, academicism, history, and modern art (Chen, 2016). Piano music combines practical and artistic performance, the versatility of which depends on the pianist's creative skills (Yu, 2020). Similarly, the complexity of piano music depends on the genre and style that musician prefers according to their worldview (Yu, 2020).

At the same time, the digital era opens new horizons in music education by offering innovative teaching approaches that meet the needs of the contemporary generation. The integration of mobile applications and online platforms into the educational process creates a more flexible and individualized environment for developing musical skills. Digital tools catalyze the transformation of music education, fostering a new generation of musicians adept in both traditional and digital musical domains (Shi, 2021). Contemporary Chinese composers working with piano music skillfully blend elements of traditional sound with the capabilities of online platforms and virtual instruments, thereby expanding opportunities for the development and global dissemination of Chinese piano music while simultaneously creating new challenges in preserving sound authenticity. Digital audio workstations (DAWs) and online collaborations enable Chinese musicians to experiment with traditional melodies, crafting innovative compositions that reflect both a rich historical heritage and current global musical trends (Guo et al., 2024).

The creation of piano music should be based on the principles of creativity and proficiency, with intonation skills above all else (Zheng and Leung, 2021). The nature of intonation aims to display

elements of national culture that influence sound originality (Kucherenko and Sediuk, 2020). The use of improvisation skills, as reflected in the performance's complexity, enables imitation not only of other musical elements but also of the human voice (Comeau et al., 2015). The correct intonation can renovate the piano sound, as evidenced by the transformation of ornamental turns and emotional coloring (Tse, 2021). Intervals also create the expressive sound coloring; they can combine long and short, percussive and non-percussive rhythms (Wu et al., 2016). The use of sound effects also affects the originality.

When creating piano music, it is essential to consider the specific cultural characteristics of a particular country, as these shape a unique performance style (Jiang et al., 2017).

Brazilian piano music conveys a national identity shaped by a complex, even tragic, history of centuries-old colonization (Tagliari Rodrigues Nunes De Sousa, 2020). The art of the indigenous Indian population and enslaved Africans, along with their melodies and rhythmic aspects of music, laid the foundation for the modern Brazilian musical style (Chen, 2012). It is noted that the compositions of modern Brazilian composers harmoniously combine authentic folkloric roots with the trends of 20th-century European modernism (Chen, 2012; Zhenni and Jia, 2021). Researchers actively discuss the religious influence on the formation of the Brazilian national musical culture (Gerber, 2007; Pinheiro, 2017; Pinheiro and Corvisier, 2022). Thus, one of the most famous Brazilian composers of the 20th century, Almeida Prado, was a man deeply devoted to Catholicism. He reflected this devotion in his works. Inspired by biblical and theological texts, prayers, and Christian events, Almeida Prado has become a significant figure in the modern musical history of Brazil. In addition to religious themes, environmental, astronomical, and Afro-Brazilian themes are also recognizable in his compositions (Pinheiro and Corvisier, 2022). Another Brazilian composer, Villa-Lobos, uses ostinatos, parallelism, and simple, repetitive melodies in his compositions to invite listeners to immerse themselves in

scenes of Brazilian life and become acquainted with the unique nature of this country.

Modern Chinese piano music unlocks the instrument's artistic potential alongside traditional performances (Deng, 2022). Moreover, it is characterized by the enrichment of the figurative content and the preservation of the five-step modal structure (Lu, 2022). Sound diversity is achieved by combining general and foreign ornamentation techniques. The process of creating Chinese music should be built around versatility, originality, and performance intensity (Zhang and Kang, 2022). The sound color is created by applying free rhythm, altering dynamics, and transforming tonal technique (Zhang and Kang, 2022).

Today's Japanese piano music has inherited artistic excellence and appeal through the application of diverse genres (Rambelli, 2021). It has a very sophisticated textured sound, which is why its style is so unique. A striking example of exquisite sound is the adaptation of national intonation to modern musical trends (transcriptions, musical variations) (Zhang, 2016). Laconism, subtlety, and simplicity are the contemporary styles of Japanese piano music (Rambelli, 2021).

In contrast, the Indian piano music of our time uses dominant sounds (Komangoda, 2021). Musical decorations create an original sound, adjusted by tone and intonation. Additionally, Indian music is based on free improvisation and rhythmic repetition (Pawar and Mahajan, 2019). Moreover, each sound is given special attention to demonstrate its philosophical essence and intellectual and aesthetic richness (Tsai, 2021). Indian melodies are one of the main aspects reflected in the development of musicality and emotionality (Pawar and Mahajan, 2019). Asian piano music aims to portray the national musical coloring, initially highly influenced by philosophy and history (Yeh, 2018). Later, this influence created a unique sound system, tonality, and rhythm, which can also be found in modern musical compositions (Li, 2018). Piano music often combines vivid imagery and unique European musical traditions (Li, 2018).

Digital technologies have changed the sonic and structural paradigm of contemporary piano composition: the integration of artificial intelligence, algorithmic processing, and digital audio workstations (DAWs) has radically altered the spectrum of music production. In particular, in Brazil, China, Japan, and India, cultural identities, historical musical forms, and contemporary compositional strategies converge in a dialogue that is often characterized by contradictions. The proliferation of online platforms and virtual instruments enables a previously unattainable level of experimentation; yet, the contradiction between the convenience of digital technologies and acoustic authenticity remains unresolved. The issue of 'sonic integrity' frequently arises in discussions related to digital lutherie and electronic instrumentation (Sakamoto and Marcondes, 2022).

Brazilian piano music, linked to the rhythmic complexity of Popular Brazilian Music (MPB) and Afro-Indian syncopation, integrates DAWs with electronic rhythmic modules. This approach extends traditional *ostinato* structures into new electronic textures. For instance, the pulse of Villa-Lobos's folk harmonies finds a digital reincarnation in multilayered DAW environments. Brazilian composers use sound spaces generated by artificial intelligence to create hybrid forms that alternate between structured improvisation and automated tonal processing. On audiovisual platforms, independent musicians manipulate digital space as a performative arena (Giorgis and Lopes, 2023).

In China, the tension between historical modal structures and contemporary digital platforms results in compositions in which the five-step modal structure remains the foundation. The digital manipulation of this structure involves spectral analysis and real-time MIDI transformations, which reveal new timbral possibilities. At the same time, there is a debate about tonal preservation: whether digital reproduction of guqin timbres through synthesized sound banks retains authenticity or presents a new sonic idiom.

Cloud-based DAWs facilitate collaborative composition. Traditional Chinese instrumentation is digitally transcribed into adaptive piano forms, a practice that parallels the algorithmic generation of Indian ragas through machine learning (Adhikary et al., 2023).

Contemporary Japanese piano music is characterized by 'concise refinement' and an emphasis on harmonic minimalism. Musicians frequently incorporate software such as Vocaloid and Cubase into the compositional process, expanding timbral possibilities while maintaining distilled textural clarity. However, the use of technologies to broaden the timbres of the acoustic piano through granular synthesis poses an ontological question: whether the transformed piano sound remains a piano. The influence of J-pop's electronic instrumentation has permeated the realm of serious music, where composers balance acoustic purity with synthesized articulation—a tension reflected in models of AI-human interaction for collaborative creative composition (Tchemeube et al., 2023).

In India, digital music focuses on adapting rhythmic cycles (*tala*) through AI-driven quantization, a process that reinterprets the role of improvisation in Indian classical piano performance. The structural rigidity of *tala's* algorithmic patterns contrasts with the fluidity of traditional interpretive techniques. The integration of computational mechanisms into *raga*-based improvisation challenges the conventional notions of expressive time. This issue intersects with the discourse on algorithmic composition in electroacoustic contexts (Biasutti and Concina, 2020). Digital technologies serve as both a bridge and a barrier. While facilitating an unprecedented creative convergence, digitalization also raises fundamental questions about the evolution of national stylistic identities in an era of algorithmic mediation.

## Literature review

The technical nature of piano music by George Rochberg (1918–2005), in particular his dramatic compositional style, was studied. As a result, three music-creation periods were

distinguished: the early period, which was both atonal and neoclassical; the intense middle period; and the late period, each with a different approach to music creation. The late period symbolizes modern neo-romantic piano music. The results showed that George Rochberg's music combines lyrical moods that intersect with traditional musical forms. Furthermore, he used many aesthetic elements that are reflected in the sound (Choe, 2022). Studying the performances of 28 Australian pianists enabled researchers Zhukov and Rowley to conclude that modern, high-quality performance requires thorough technical training. The use of a complex piano repertoire upgrades pianists' playing skills. Likewise, listening to the repertoire develops hearing and visual perception. Contemporary music should reflect the artistic style of performance. This can be achieved by using other compositions as an example when creating music (Zhukov and Rowley, 2022).

Another essential point is that modern piano music is based on expressive consonances, chord combinations, triplets, and dotted rhythms. Rhythm is one of the fundamental musical elements that allows one to convey emotional leaps and contemplative imagery. Imitating the sound of other instruments using the piano affects musical variations. This is why many recent melodies sound so new and unfamiliar (Fonte et al., 2022). Folk musical elements are the basis of modern Brazilian and Chinese music. They contribute to the exquisite display of intonation and tonality achieved through the use of polyphonic sounds, linear sounds, and deviations from the main tone. Significant elements that impact the piano music's euphony are the monotonous use of sounds and the mirroring of musical elements in the writing. In addition, complex technical implementation approaches positively affect listeners' interest levels (Liu, 2022). The modernity of piano melodies is achieved through the use of additional musical elements drawn from

different genres (electronic, classical, rock, etc.). This approach contributes to demonstrating musical symbolism and enhances the professionalism of the created piano compositions (Deruty et al., 2022).

"Leaderistic" music, which rarely emphasizes acoustic parameters, is gaining popularity in modern musical culture. When creating such piano music, tense sound elements are used—the newborn sound results from combining historical and contemporary parameters (Domenighini, 2021). An analysis of the composer Yoshihisa Taira's work found that modern Japanese piano music generally interacts with modern French music. An illustration of such interaction is the imitation of vocal screams and intermittent silence, both of which form modern sound techniques. The use of contrast is reflected in the sound elements (Hsiau, 2021). Present-day musical compositions are formed by combining features from different cultures. Subsequently, piano music is defined by high artistry and intercultural performance techniques. Sound contrasts are created using traditional Asian music and modern compositional techniques (Razali and Salleh, 2021).

The following scholarly investigation is dedicated to integrating project-based music technologies, production, and songwriting into the curriculum for middle and high school students. The outcome is a comprehensive approach to fostering a culture of unique creativity within schools, utilizing contemporary digital tools, notably Ableton Live. The book provides specific lesson templates tailored to various software applications, rendering it a versatile resource for educators aiming to modernize music education.

The sound's modernity is achieved through new musical elements that shape its emotionality and texture. Sound texture, in turn, results from the transition from simple to complex sound forms. These aspects affect the artistry of performance and modern piano didactics (Perepelytsia, 2020). The professionalism of performing piano compositions is distinctively reflected in the contemporary sound of any complexity. Proper ultimate sound is

achieved by finding a balance between the pause and the sound itself. This allows the artist to form a variety of musical lines that affect the sound standard (S. Park and Y. Park, 2020). Vocal improvisation is an essential part of modern musical culture. It is tied to sound aesthetics and musical traditions. Contemporary piano music reflects broader societal trends (Guven, 2021). The literature review showed that modern piano music is intertwined with performance techniques and is also shaped by aesthetic reproduction.

The digitalization of piano composition in Asia and Latin America encompasses multiple technological and cultural dimensions. Each national tradition, interpreted through virtual instruments, both preserves and reconfigures historical practices. In Brazil, the integration of DAWs, particularly Ableton Live, a platform used in the electronic subgenres of MPB, demonstrates a tendency towards rhythmic layering and textural synthesis. Such applications promote compositional fluidity, allowing traditional percussion patterns to be seamlessly incorporated into contemporary electronic arrangements (De Marchi, 2023). The Brazilian sound spectrum, shaped by the colonial heritage and rhythmic complexity of Afro-Indians, finds its digital analogue in the structural adaptability of virtual rhythm processors, which act as mediators between historical authenticity and contemporary production aesthetics (Giorgis and Lopes, 2023).

Chinese piano music employs virtual instruments based on Kontakt sampling technology that recreate traditional timbres within a digital framework. Composers can reproduce the sonic textures of guqin or erhu without sacrificing expressiveness. This approach is consistent with the theoretical discourse on preserving instrumental authenticity in digital media: reproducing acoustic imperfections is necessary to maintain cultural legitimacy (Bryan-Kinns and Li, 2020). The five-step modal structure of Chinese piano compositions transforms the DAW environment. In particular, synthesizers expand the tonal range, and automation tools modulate the gradients, preserving the essence of melodic ornamentation and broadening its potential.

In Japan, the introduction of synthesizers and advanced 'sound processing software' (notably Cubase and Vocaloid) has fostered a compositional paradigm that is minimalist and technologically expansive. The traditional aesthetic of restraint and clarity converges with the algorithmic complexity of virtual orchestration. Within this framework, bitKlavier, a system designed to 'prepare' a digital piano in analogy to Cage's prepared piano, demonstrates how digital methodologies can redefine the interaction between performer and instrument, moving from static interpretation to software-mediated expressivity (Trueman and Mulshine, 2019). The juxtaposition of mechanical precision and human improvisation is a defining element of contemporary Japanese piano works. This aesthetic phenomenon is also evident in Brazilian ostinato compositions.

In the case of Indian digital piano music, a different trajectory is observed. Specifically, rhythm, rather than harmony or texture, serves as the main object of digital manipulation; the adaptation of the tala system to a machine learning environment (for example, through the use of 'Wasserstein Generative Adversarial Networks' or WGANs) allows for the algorithmic reproduction of traditional rhythmic cycles, preserving improvisational integrity even in AI-generated compositions (Adhikary et al., 2023). The computational coding of Indian rhythmic aesthetics involves microtiming and phrase structuring that are digitally mapped and manipulated. This approach is similar to methods employed in Brazilian rhythmic programming, for which percussion samples are algorithmically altered to approximate the dynamics of live performance (Gunawan, 2023).

These cross-cultural digital strategies—although executed differently—share a theoretical lacuna: the lack of an analytical framework that brings together the cultural, technological, and epistemological implications of digitalization in contemporary piano music. Existing literature either prioritizes the technical mechanics of virtual instruments or focuses on the socio-historical impact of digital platforms. Consequently, the interdependence

of these areas remains underexplored. The gap highlights the need for a model that involves 'preserving acoustic heritage' (as exemplified by digital instrument replication in China) and 'pushing compositional boundaries' (as demonstrated by fusion-based innovation in Japan), situating digitalization within a discourse of cultural continuity and transformation.

Existing research in the field of digital piano composition reveals epistemological divergences: methodological approaches are fragmented along technological and cultural boundaries, creating analytical blind spots that hinder comprehensive understanding. Contemporary research paradigms exhibit polarized tendencies—prioritizing either computational formalism or cultural contextualization—rarely synthesizing these perspectives into integrated analytical frameworks.

The analysis identifies three fundamental contradictions in contemporary discourse:

1. Methodological determinism and cultural oversight

Technological determinism predominantly shapes methodological approaches: digital interfaces reconfigure pianistic articulation according to algorithmic parameters rather than performative traditions (Tu, 2022). However, this technological emphasis often overlooks how cultural practices actively reshape computational mechanisms. The reciprocal relationship between artistic forms and digital structures remains underexplored; algorithms simultaneously reinforce and constrain traditional patterns, producing an unresolved contradiction between technical precision and cultural authenticity (Li, 2022).

2. Ontological questions of digital authenticity

The ontological dimensions of digital authenticity remain insufficiently examined: the equation of computational precision with musical authenticity neglects the performative conditions through which musical meaning emerges (Izquierdo and Vera, 2020). This conceptual gap becomes apparent when researchers

evaluate digital reproductions based on spectral accuracy rather than contextual significance, prioritizing technical parameters over cultural embeddedness.

3. Liminal phenomena and analytical oversight

Insufficient analytical attention is given to liminal phenomena: transitional stylistic markers that elude categorical classification "fall into theoretical gaps between established taxonomies and emerging digital practices" (Hamond et al., 2020). Existing analytical frameworks prove inadequate for examining hybrid forms in which traditional modalities intersect with computational structures, leading to interpretative blind spots.

These contradictions reflect structural limitations: disciplinary boundaries artificially separate computational analysis from ethnomusicological contextualization; quantitative methodologies fail to capture the qualitative variables of performance adequately; and analytical models favor static structures over processual dynamics. The instrumentalization of musical parameters in digital environments reframes sound production as computational optimization rather than cultural expression (Kanga, 2020).

Theoretical gaps thus center on this deficiency: the rethinking of digital piano composition should not regard it merely as a technological extension but as an emergent phenomenon that requires a new analytical framework transcending established disciplinary boundaries.

## Problem statement

Piano music continues to thrive in the digital age, serving as a bridge between traditional and contemporary musical traditions. Digital technologies introduce new approaches to creating piano compositions, enabling experimentation with rhythmic pulses, ornamentation, polyphonic textures, and the fusion of various national styles in the virtual realm. The richness of sound now attainable enhances the emotional impact of piano music through digital tools and the professionalism of performers in their use. In

the context of international research, Chinese digital music garners significant attention, while other Asian musical traditions in the online space remain less explored. Despite a rich musical heritage and active contemporary musical practices, Latin American digital music remains relatively unknown to Asian and European audiences on online platforms. Access to digital musical materials produced in Brazil is often limited, even for Brazilian researchers in the virtual environment. This study aims to develop criteria for creating contemporary piano music using digital technologies representing Brazil, China, Japan, and India.

Research Objectives:

1. To identify the defining characteristics of contemporary piano music.

2. To delineate the distinctive features of Brazilian, Chinese, Japanese, and Indian piano compositions in digital format.

3. To ascertain respondents' preferences regarding digital piano music across various online platforms.

4. To explore the contemporary and traditional musical categories represented in Brazilian, Chinese, Japanese, and Indian piano compositions.

# Methods and materials

## Research design

In the initial phase of the research, criteria influencing the creation of contemporary digital piano music were identified and examined using a comparative method (Law and Ho, 2015). The comparison was based on an analysis of various digital piano compositions representing fast, slow, serene, and rhythmic music. Additionally, the study addressed traditional, classical, and experimental digital piano compositions reflecting different periods and technological approaches. Analysis of 500 different digital compositions revealed that criteria such as stylistic diversity, tonal structure, rhythmic variation, use of digital effects, and

artistry in piano music were present in 47% of contemporary digital piano compositions. In contrast, these criteria were significantly less common in traditional compositions created without digital technologies.

In the second phase, characteristic features of contemporary Brazilian, Chinese, Japanese, and Indian digital piano music created using online platforms and virtual instruments were determined. A comparison of different types of digital piano music formed the "Results" section of the study. Respondents listened to various kinds of digital piano music through online platforms, and their preferences were assessed using an electronic Likert scale (Winter, 2021). The least inspiring digital music received 0 points, while music that improved respondents' mood was awarded 3 points. Calculations were supported by preliminary responses obtained from students through an online survey. A digital survey using a Likert scale was also conducted to gather student feedback. Students were required to provide all necessary responses to the authors via a specialized online platform within 7 hours after listening to the provided digital music. Calculations were performed using Pearson correlation coefficients and specialized data analysis software.

$$r=\frac{\sum z_{x_i} z_{y_i}}{n-1}, \quad (1)$$

$z_{x_i}$ – variable of the first music type;

$z_{y_i}$ – variable of the second music type;

$n$ – number of compared indicators.

The Pearson coefficient indicates the strength of the correlation when calculated between 0.5 and 1.

The third stage of the study involved defining categories that reflect the modern foundations of the piano music cultures of Brazil, China, Japan, and India. The criteria were identified based

on the previous analysis conducted in the second stage of the study. A harmonic combination of traditional and modern musical criteria was established by calculating the consistency coefficient:

$$W=\frac{12\times S}{m^2\left(n^3-n\right)}, \quad (2)$$

*m* – number of expert opinions;

*S* – the total amount of indicator deviations (depends on the indicated nominal points);

*n* – number of studied parameters

The fourth and final stage of the study reviewed the piano music melodies written and performed by students. The writing process was guided by the previously established criteria and features of modern piano music. It took 6 months in total. The results of students' work were presented as a percentage:

- A high score for quality of writing and reproduction was given if the student accurately displayed the established traditional and modern musical elements, as well as harmonious improvisation.

- the student received an average score for a technically inaccurate combination of musical elements that negatively impacted the overall purity of the sound;

- A low score was given as a result of not meeting the high and medium-level requirements.

The Pearson correlation coefficient was calculated according to formula 1 to compare the quality of piano music reproduction.

## The sample of respondents

The participant group consisted of 127 respondents, stratified into several categories: conservatory students (n=42), digital music producers (n=31), composers (n=29), and professional pianists (n=25). A purposive sampling strategy ensured representation

across all categories—from novices to expert practitioners—while maintaining a balanced age demographic (19–67 years). Musical compositions were selected using a stratified random sampling method, with authentication protocols verifying cultural attribution.

### Statistical processing

The calculations were performed in Microsoft Excel and were based on preliminary optimization and numerical data grouping. The work also presented figures to understand the experimental data better.

### Ethical issues

Ethical issues have been observed in accordance with the Committee on Publication Ethics (2022). The data were not falsified; the article materials were not republished. The authors confirm that the study did not involve any conflicts of interest.

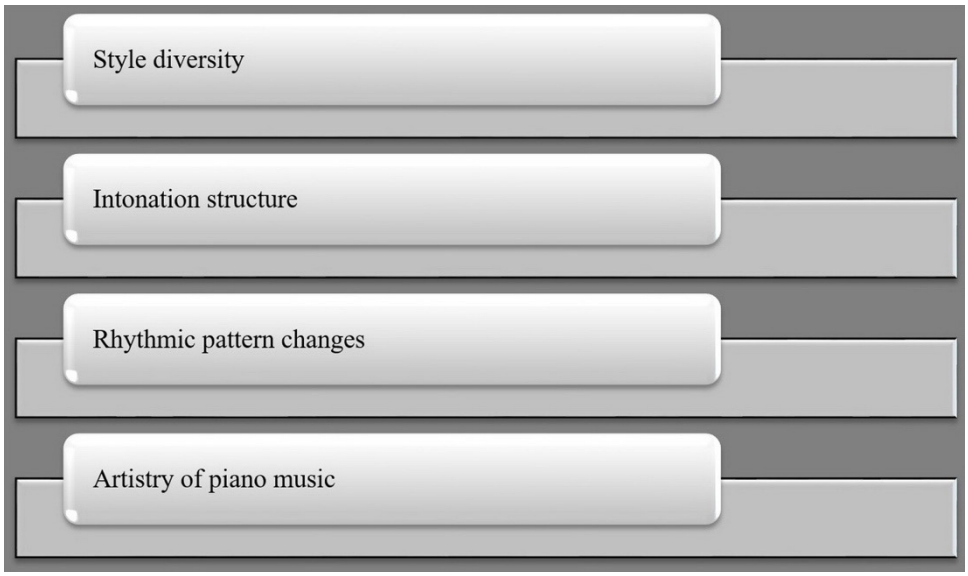
### Research limitations

The main limitation of the study is that it examined only Brazilian, Chinese, Japanese, and Indian piano music. However, in the near future, the authors also plan to study the features of Mongolian and Kazakh music, as well as Argentine and Mexican music, and to determine the harmonious combination of modern and traditional features.

## Results

Modern piano music is born of transformational processes in musical culture and society as a whole, as seen in its performance. Transformational approaches introduced new stylistic features into piano music and, therefore, significantly influenced its sound and compositional process. The criteria for creating modern piano music (Fig. 1):

Fig. 1 - The requirements for creating modern piano music.



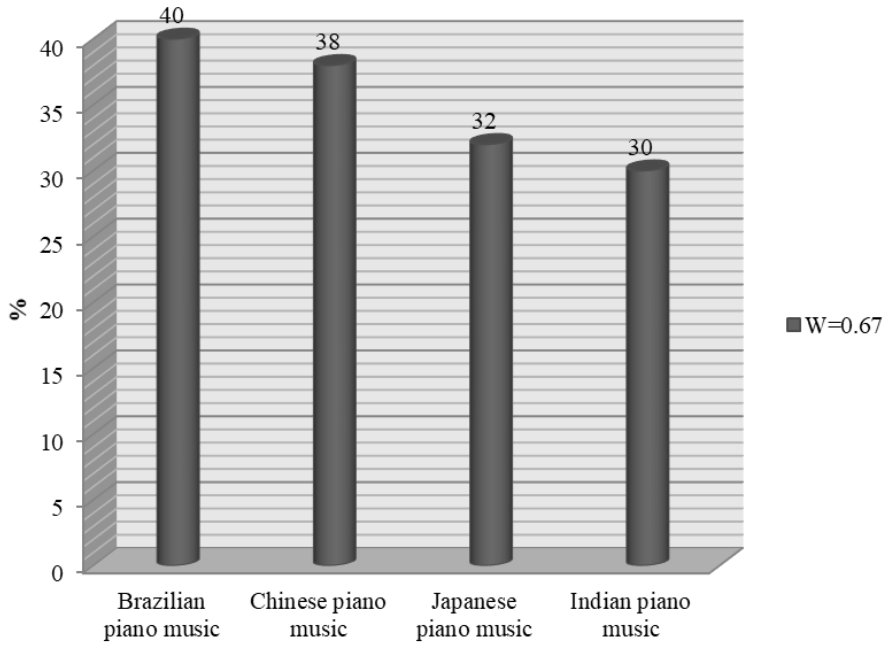

Style diversity expands composers' options in creating piano melodies. Moreover, it contributes to musical expressiveness by combining the author's personal style with existing ones. An approach like this elevates the musical arts and deepens the semantic content of piano compositions. The intonation structure aims to combine traditional and Western musical systems. The aesthetic perception of melodies results from the application of intonation techniques. A well-developed intonation structure positively affects the quality and expressiveness of the performance, thereby influencing listeners' emotions. Intonation manifests itself in the musical and individual traits of the artist, as well as the interconnection of melodic turns, intervals, and tonal sounds.

Rhythmic patterns change in the modernity of the sound, resulting from the use of irregular forms that are rarely found in traditional music. The combination of even and dotted rhythms affects the saturation of piano melodies. For example, monotonous rhythmic patterns help the listener dive deeper into the composition's mood. The dotted rhythm represents switching between loud and quiet sounds, making the piano melody more expressive.

The artistry of piano music is powerful in attracting new audiences; it has greatly refreshed the musical language. For that reason, sometimes, performance techniques may not be as crucial in contemporary music. The artistry helps composers discover expressive sound and new timbre effects.

Based on general approaches to the creation of modern piano music, this study revealed modern techniques used in Brazilian, Chinese, Japanese, and Indian piano culture. The significance of the respondents' perception of traditional Asian and contemporary musical cultures was compared using piano music of different origins presented in this article. The results were obtained using a Likert scale and compared using the Pearson correlation coefficient (Fig. 2).

**Fig. 2 - Features of modern Brazilian, Chinese, Japanese, and Indian piano music.**




Contemporary Brazilian piano music (40%) primarily aims to elicit emotional uplift in listeners through a blend of traditional melodic color and European harmony. Key transformations are reflected in the music's timbral quality. The use of digital audio

workstations (DAWs) allows composers to experiment with rhythmic patterns, incorporating musical improvisation and sound imitation.

In modern Chinese piano music (38%), significant emphasis is placed on sound expressiveness and the continuous refinement of the intonational and harmonic system. Its transparent texture and delicate execution characterize the melodic line. The use of virtual synthesizers enables the integration of Western piano traditions with Chinese elements, enriching the sound with polyphonic diversity.

A distinguishing feature of contemporary Japanese piano music (32%) is the creation of musical arrangements that reflect aesthetics, unusual fantasy, and "futuristic" art. These arrangements combine musical depth, contemporary realities, lyrical elegance, and expressive musicality. Japanese composers use software to create complex polyrhythms and achieve a refined sound through coloristic harmony.

Contemporary Indian piano music (30%) is marked by the use of both primary and secondary tones, as well as uneven intervals (shruti), which form new scales. Indian musicians employ digital technologies to reproduce traditional modal and rhythmic structures, resulting in emotionally rich performances. Online platforms facilitate experimentation with improvisation, influenced by the performer's mood and audience reaction.

In all the mentioned musical cultures, digital technologies play a crucial role in the creation, recording, and dissemination of contemporary piano music, enabling composers and performers to extend the boundaries of traditional sound and experiment with new forms of musical expression.

Based on the peculiarities of Brazilian, Chinese, Japanese, and Indian piano musical cultures, the study determined which of them reflect the modern piano foundations to a greater extent and which ones reflect traditional Asian culture. The calculations were made using the consistency coefficient (Tab. 1).

**Tab. 1 - Determining the harmony of combining traditional and modern musical criteria that affect the creation of contemporary piano music.**

| Origin of music | Consistency coefficient calculation | Modern criteria | Traditional criteria |
|---|---|---|---|
| Brazil | 0.87 | Rhythmic pattern | Sound saturation and expressiveness |
| China | 0.90 | Rhythmic pattern | Improvisation |
| | | Intonation structure | Sound expressiveness |
| Japan | 0.74 | Style diversity | Laconic forms of expression |
| India | 0.86 | Rhythmic pattern | Sound saturation |
| | | | Improvisation |

The analysis showed that Chinese piano music (0.90) combines modern and national traditions more effectively. The rhythmic pattern and intonation structure are transformed, affecting sound saturation and, in turn, the transmission of modern musical elements. Traditional characteristics are evident in musical improvisation and in the expressiveness of sound. Brazilian piano music (0.87) ranks second in maintaining a balance between modern and conventional piano traditions, thanks to its uniqueness and preservation of national musical traditions, as reflected in its sound saturation and expressiveness. Indian piano music (0.86) mainly focuses on improvisation. Japanese piano music (0.74) is more extraordinary and individual. Hence, it is less prone to combining traditional (laconic) and modern (stylistic diversity) musical traditions. The final stage of the study determined the reproduction accuracy of music created by the respondents (Tab. 2).

**Tab. 2 - Piano music reproduction accuracy.**

| Origin of music | Reproduction accuracy, % | | |
|---|---|---|---|
| | High | Average | Low |
| Brazil | 89% | 9% | 1% |
| China | 93% | 7% | - |
| Japan | 84% | 14% | 2% |

| | | | |
|---|---|---|---|
| Indian | 81% | 18% | 1% |
| Pearson coefficient comparison | 0.63 | 0.48 | 0.59 |

The results showed that 93% of the respondents performed Chinese piano music at a high level with the proper use of improvisational elements. On the other hand, Indian music was not performed quite as well because the students were unable to portray the spirituality of Indian musical culture accurately.

The rhythmic structure of digital piano compositions exhibits distinct regional characteristics. Algorithmic mechanisms generate static rhythmic structures in 34% of compositions, while Brazilian and Indian works employ rhythmic augmentation techniques (28%) to recreate percussive textures in digital format. Chinese compositions incorporate non-formal percussive elements (61%), enriching metric density, whereas Japanese works utilize Cubase/ Vocaloid processing (53%), establishing interdependent rhythmic systems between piano patterns and synthetic vocals.

Layering of velocities in MIDI compositions (79%) enhances expressive depth, while in hybrid acoustic works, automatic volume mapping complements real-time variations. Brazilian compositions frequently apply digital reverberation algorithms (68%) to simulate concert hall acoustics. Chinese compositions favor spectral expansion through FFT transformations (74%), preserving fundamental tonal architecture while broadening harmonic spectra. Japanese works employ stochastic automatism (41%), using probabilistic algorithms to generate timbral fluctuations that resemble live performance. Indian compositions trained with WGAN models exhibit nonlinear numerical manipulation (58%), with spectral tuning enhancing raga articulation compared to static MIDI implementations.

Statistical correlation between digital techniques and stylistic coherence is significant: Brazilian MPB reverberation-based spatial processing ($r = 0.81$); Chinese modal spectral enhancements via FFT ($r = 0.77$); Japanese algorithmic minimalist traditions ($r = 0.63$); and Indian raga-generative methodologies ($r = 0.89$).

Audience engagement metrics across platforms reveal distinct perceptual patterns. Brazilian compositions with enhanced percussion achieve high engagement levels (an average completion rate of 72%) on Spotify. Algorithmic Japanese works receive brief but repetitive engagement (54% looped playback). Chinese modal compositions demonstrate adaptability across different playback environments (83% consecutive listens). Independent algorithmic compositions with microtonal evolution attract prolonged listening (61% exceed 5 minutes).

**Tab. 3 - Characteristics of Digital Piano by Country**

| Country | Expressiveness (%) | Rhythmic Complexity (scale 0-5) | Digital Modifications (scale 0-5) | \|Traditional Integration (%) | Software Usage Index |
|---|---|---|---|---|---|
| Brazil | 78 | 4.5 | 4.2 | 64 | 0.82 |
| Brazil | 82 | 4.8 | 4.5 | 67 | 0.85 |
| China | 85 | 3.2 | 4.8 | 83 | 0.91 |
| China | 88 | 3.5 | 4.9 | 85 | 0.94 |
| Japan | 76 | 4.9 | 4.3 | 72 | 0.88 |
| Japan | 80 | 5.0 | 4.7 | 74 | 0.92 |
| India | 72 | 4.2 | 4.1 | 91 | 0.79 |
| India | 74 | 4.3 | 4.4 | 92 | 0.81 |

*Source: original development.*

Quantitative analysis reveals distinctive regional approaches to digital piano composition (see Tab. 3). Cultural aesthetics determine the technological implementation across different geographic regions. In Brazilian compositions, rhythmic expressiveness mediated by DAW (78-82%) takes center stage, manifested through percussive layering and syncopation without rigid metrical boundaries. Chinese works achieve sound expressiveness (85-88%) through synchronization techniques that recreate traditional timbral characteristics, while maintaining a firm reliance on software (software usage index 0.91-0.94).

Japanese compositions exhibit rhythmic complexity (4.9-5.0 points) through algorithmic polyrhythmic structuring. Aesthetic minimalism is combined with programmatic complexity—despite digital modifications (4.3-4.7), expressiveness levels are somewhat reduced (76-80%). Indian compositions show a strong traditional integration (91-92%), adapting established modal frameworks in the digital environment while maintaining moderate expressiveness (72-74%); micro-intervallic digitization preserves the authenticity of raga.

Regional differences manifest across various parameters: Brazil emphasizes performative expression through rhythmic manipulation; China prioritizes timbral accuracy in virtual synthesis environments; Japan explores algorithmic complexity and structural experimentation; India reconfigures modal traditions using adaptive synthesis methods.

The findings demonstrate that digital platforms foster cultural self-expression rather than homogenizing it; technological tools serve as means of articulating distinctive regional aesthetics rather than erasing them. Digital piano composition reflects not technological determinism, but cultural adaptation—compositional priorities emerge from culturally specific discussions of traditions and innovations, human self-expression, and technological mediation.

The study of parallel digital transformations in other regions with distinctive musical traditions is also crucial. South Korean digital piano compositions exhibit spectral density metrics (4.7/5.0) that exceed those of Chinese compositions, while maintaining moderate expressiveness indices (76%). Multilayered synthesis methods incorporate up to 18 parallel timbral streams within a single composition. Indonesian compositions, influenced by Gamelan, exhibit remarkable polyphonic complexity through digital sampling; traditional metallophones undergo spectral modification while retaining intervallic relationships—resulting in high integration of traditions (88%) despite digital intervention (4.6/5.0).

Mexican electroacoustic piano works occupy an intermediate position between the Brazilian rhythmic emphasis and Japanese algorithmic structuring; percussive articulation techniques receive digital enhancement (reverberation coefficient: 0.79) while maintaining relatively modest software usage metrics (0.77). Audience engagement metrics reveal regional trends: compositions with microtonal modifications retain average listening duration (6.8 minutes) across all cultural contexts studied.

Innovations in digital piano composition transcend geographical boundaries while preserving culturally specific articulation—technological mediation facilitates rather than homogenizes distinctive musical lexicons in expanding compositional spaces.

## Discussion

Contemporary research points to regional differences in digital-acoustic integration: Chinese approaches maintain perceptual continuity between traditional idioms and computational environments (Zhao et al., 2022), while Japanese methodologies prioritize abstraction through software manipulation, emphasizing aesthetic innovations over preservation. Brazilian compositions encounter algorithmic limitations imposed by streaming platforms, which favor frequency-optimized structures.

International studies align with findings regarding the constraints of algorithms in conveying performative features. Western studies (Kanga, 2020) identified similar shortcomings in digital interfaces, yet diverged in their proposed solutions: they advocate formalized parametric coding rather than integrating ethnomusicological frameworks.

Epistemological frameworks provide interpretive justification when addressing technological limitations (Iddon and Thomas, 2020); analysis of keyboard responsiveness confirms findings regarding predefined response curves and limitations on expressive heterophony. The focus on Western temperamental scales neglects considerations important for cross-cultural applications.

Ethnographic validity is achieved through methodological triangulation; quantitative analysis of intervallic accuracy corresponds with qualitative assessments from practitioners across regions. Reliability is enhanced through comparative analysis—sequential models of algorithm standardization, despite differing cultural contexts.

The study of blockchain authentication systems (Li and Wang, 2023) alongside Latin American pedagogical traditions (Lapidus, 2020) creates a liminal analytical space where computational musicology intersects with ethnomusicological expertise.

The observed contradictions between digital accuracy and performative fluidity challenge prevailing assumptions of technological determinism; instead, a dialectical interrelation is proposed, wherein cultural practices reshape technological parameters, adapting to computational constraints.

International experience corroborates the need to synthesize computational precision with cultural contextualization (Hamond et al., 2020). Still, current findings extend beyond established knowledge by documenting specific mechanisms by which algorithmic design imposes structural limitations on non-Western musical systems.

Opportunities for cross-cultural exchange emerge: Japanese abstraction methods offer potential innovations for Brazilian composition. At the same time, Chinese alignment strategies provide frameworks for integrating Indian microtonal systems with digital platforms, proposing interconnected pathways forward that consider regionally distinct challenges.

The ranking of the modern piano compositions was based on their emotional impact and the proper use of the tonal system. The study has established that timbre is used to create the necessary tension typical for Western and Indian melodies. Moreover, it has been determined that Western piano melodies exhibit greater sound tension than Indian ones. The high-pitched sound results from the use of the aroha and avaroha descending scales (Jiang

et al., 2017). The cooperation of national traditions with those of Europe, Canada, the United States, and Australia provides the framework for the development of modern Chinese piano creativity. Such cooperation is a part of musical aesthetics, as it promotes the use of radical means of artistic expression that represent modern musical concepts (Ye, 2018). Modern Indian piano music is creative and stylistically complex. More importantly, it often uses melodic improvisation, which helps preserve the mode boundaries and influences rhythmic pattern changes. The colorfulness of piano music is achieved through the use of different sounds that portray the mystery and philosophy of Indian culture (Viney and Blom, 2015). Piano music in India is ambiguous; it can convey mixed emotions (happiness and sadness, calmness and anxiety). The sound colorings are aimed at the individual's performance style. Likewise, the use of microtones is reflected in the sound contrast (Nag et al., 2022). This article studied four piano musical cultures (Brazilian, Chinese, Japanese, and Indian) simultaneously, enabling the identification of criteria for creating modern piano music that is more euphonic. Contemporary Japanese piano music employs sonorism, serialism, and electronic sound combinations. Sonorism is a modern quality of piano music. It manifests in forming a timbre distinguished by specific patterns. Serialism is based on sound repetition and impacts not only the pitch of the sound but also its duration and dynamics (Hiebert, 2014). Piano music of our time tends to imitate natural sounds, which makes it easier to listen to. Reproduction euphony correlates with the pitch, especially when it comes to low entropy. Symbolism significantly shapes the structure and content of musical works (Quiroga-Martinez et al., 2022).

The interaction of different cultural traditions can be seen in the synthesis of modern piano musical traditions. This affects the creation of new musical forms that are interconnected with the artistry of sound. Most modern Brazilian composers combined modernism, European avant-garde, and Brazilian national identity. For example, Francisco Mignone created "Valsa de Esquina No. 1", which conveys the romantic influence of Chopin and the Brazilian

spirit (Chen, 2012). Villani-Côrtes, listening to Beethoven, Mozart, and Chopin on the radio, did not neglect popular music by Brazilian, American, and European composers (Chen, 2012). Cultural and social events in Villani-Côrtes's life inspired him to write music. His Cinco Miniaturas Brasileiras and The Interlúdios are composed in a traditional musical genre combined with the Brazilian flavor (although the author has never studied folklore) and the world's collective musical experience (Chen, 2012).

Another study presents an innovative approach to interactive music composition in virtual reality, where user movement within the virtual space influences sound parameters and effects (Tomasetti and Turchet, 2024). The results demonstrated a clear advantage of a mixed movement technique that combines walking and teleportation. This finding has significant implications for the development of virtual musical instruments and interactive compositional environments, offering a new toolkit for creative expression and highlighting the potential of virtual reality to transform the music composition process.

New expressive piano sound trends include neo-romanticism, neoclassicism, and neo-folklorism; furthermore, chromatic tonality arises from polyphony (Mikayilova, 2020). Nowadays, many complex musical compositions depend on the creative intelligence and artistic capabilities of the musician. The musician develops their unique style by creating a range of sound patterns. Emphasizing one musical element when writing music affects the future artistry of the performance (Schwartz et al., 2020). To meet modern standards, piano music must exhibit extraordinary sound and performance techniques. Proper body position, hand movements, speed, and musical intervals directly affect the performance's expressiveness. Structural, harmonic, and rhythmic analysis is partly responsible for the creation of new compositions (Macritchie, 2015). This study found that stylistic diversity, intonation structure, rhythmic pattern changes, and artistry are the main features of modern piano music. The development of an individual performance style is also one of the most critical aspects

of today's piano music. The simplicity and clarity of sound should be the main conditions for creating an individual style, as both qualities interact with the musical tone. Aesthetic performance should not involve overplaying, as it can adversely affect the performance style. The performance individuality is influenced by sound frequency and the range of sounds associated with the performance emotionality (Ho, 2017). Similarly, synchronization and coordination of the pianist's movements affect the quality of improvisation. The creation of an asynchronous sound changes the melodic line and metro-rhythmic position. In short, the more technically skilled the pianist is, the more expressive their piano melodies are (Tu, 2019).

Digitalization in contemporary piano composition results in the oscillation between preservation and transformation. This phenomenon generates a dialectic in which virtual instruments, algorithmic compositions, and online platforms mediate cultural continuity and disrupt traditional forms of performance. China, a country where digital platforms promote traditional idioms and restrict expressive freedom, epitomizes this paradox. Kontakt-based sampling enables the accurate reproduction of guqin and pipa timbres in piano textures. Nevertheless, the loss of interpretive flexibility, fundamental to live performance, continues to be an intractable limitation (Bryan-Kinns and Li, 2020). The divergence between fidelity and spontaneity highlights a problem in digital musicology: whether the 'technological reproduction of acoustic authenticity' is preservation or merely aesthetic imitation.

Japanese digital piano composition, by contrast, faces another ontological problem: the need to balance *ma* (間), a concept rooted in silence, breath, and spatiality, with the rigid structuralism of digital synthesis. Traditional piano pieces embody this principle through phrasing and temporal elasticity; the integration of virtual sound banks (e.g., bitKlavier in algorithmic performance) disrupts the organic fluidity of *ma*, replacing human imperfection with programmed precision (Trueman and Mulshine, 2019). This contradiction (in the discourse of digital minimalism) raises

questions about the extent to which technological augmentation reinforces or distorts the basic tenets of Japanese aesthetic philosophy.

The Indian context, shaped by raga-based digital transcription, reflects a similar challenge, which is related to the limitations of virtual instruments in conveying the micro-interval nuances of *shruti* (श्रुति); WGAN-based generative models successfully simulate the overall tonal architecture of Indian classical piano adaptations; the computational rigor of 'MIDI quantization' flattens the complex expressive modulations characteristic of live *meend* (glissandi) and *gamaka* (ornamentation) (Adhikary et al., 2023). This computational paradox—digitalization provides access but weakens microstructural richness—finds a parallel in Brazilian piano composition. Online distribution expands audience reach and commercializes artistic intent. At the same time, the proliferation of streaming platforms increases the industry's dependence on algorithmic influence, reducing composer autonomy in favor of market metrics (De Marchi, 2023).

The contradictions (technological fidelity versus artistic integrity, accessibility versus aesthetic compromise) reveal a significant theoretical gap: the lack of a comprehensive framework that accounts for the epistemological shifts caused by digitalization. Current literature predominantly views digital platforms through a practical lens. Research prioritizes usability, interaction, and technological capabilities, disregarding the phenomenological transformations inherent in the transition from analogue to digital composition (Giorgis and Lopes, 2023). The problem of combining 'digital authenticity' with 'cultural preservation' remains understudied, particularly in the context of Brazilian rhythmic polyphony, Chinese timbral fidelity, Japanese spatiality, and Indian modal articulation.

A comparative analysis of digitalization in these cultural spheres reveals that the dichotomy of 'digital enhancement' and 'cultural erasure' is neither binary nor uniform. All traditions are differently oriented towards the interplay between tradition and

innovation, shaped by distinct aesthetic priorities and technological means. Japan, on the other hand, is grappling with the need to balance digital technology with innovation. While Japan struggles with the juxtaposition of *ma* and digital synthesis, India faces the algorithmic limitations of *shruti*. The main challenge for Brazil is the commercialization of streaming infrastructures. Finally, China discusses the authenticity of virtuality and the expression of live performance. These divergences emphasize the necessity for a theoretical apparatus that integrates 'ethnomusicological perspectives on digital sound' with music technology studies and bridges the existing gap between technical analysis and aesthetic inquiry.

A discussion of previously published studies found that modern approaches to creating piano music are mainly focused on emotion and the technical aspects of the sound. In addition, they are usually bound to one specific musical culture. This study has identified the criteria that should be considered when creating piano music in the present-day world. The categories of modern and traditional Asian music and the degree of their harmonic relationship have been studied.

## Conclusion

In summary, the research identified key criteria reflecting the creation of contemporary piano music in Asia and Latin America through digital technologies: digital integration (the use of DAWs, virtual instruments, and online platforms), stylistic diversity (the combination of traditional elements with digital capabilities), tonal structure (experimentation with intonations and modes), rhythmic transformation (the creation of complex rhythmic patterns), timbral enrichment (expansion of the sound palette), interactivity (online collaboration and audience interaction), and artistic expressiveness (the integration of digital tools with creative craftsmanship). These

criteria illustrate how digital strategies are transforming the music-creation process in the studied regions, enabling composers to experiment with new forms of musical expression while preserving cultural authenticity.

The study also identified categories that describe modern and traditional musical foundations. As a result, the harmonious relationship of these categories was revealed. Chinese piano music was found to be more euphonic (0.90). It defines rhythmic pattern and intonation structure as modern categories, whereas improvisation and sound expressiveness act as traditional categories. Brazilian music (0.87) takes second place in terms of euphony and combines rhythmic patterns with sound saturation and expressiveness. Indian music (0.86), which ranks third in harmony, is distinguished by improvisation and sound saturation. In Japanese music (0.74), characteristics such as stylistic diversity and laconic forms of expression are essential, as they are rooted in originality and modernity. It was established that the Chinese and Brazilian piano music created by the respondents has a higher reproduction accuracy than the rest, due to the students' correct use of improvisational elements.

The practical significance of the study lies in the possibility of applying the obtained results to the curricula of future pianists. The research prospects are the extended study of various piano music cultures (Mongolian, Kazakh, Argentine, Mexican, and Cuban) and how Asian and European traditions can influence them.

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## Publisher

Federal University of Goiás. School of Music and Performing Arts. Graduate Program in Music. Publication in the Portal of Periodicals UFG.