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**A SWOT Analysis of Artificial Intelligence in Music Education within the Framework of the Century of Türkiye Education Model**

Türkiye Yüzyılı Maarif Modeli Kapsamında Müzik Eğitiminde Yapay Zekâ Kullanımına Yönelik SWOT Analizi

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## **Abstract**

The aim of this study is to examine the integration of artificial intelligence (AI) into music education within the framework of the Century of Türkiye Education Model (CTEM) and to identify its strengths, weaknesses, opportunities, and threats (SWOT) based on current literature and national policy documents. The analysis primarily draws on the Common Text of Curricula of the CTEM, which outlines the model's general principles. The study employed document analysis as the data collection method. Official documents published by the Ministry of National Education, along with academic studies published between 2023 and 2025 that directly address the use of AI in education in general or music education in particular, were examined. The findings of the SWOT analysis indicate that AI-supported music education is largely compatible with the vision of the CTEM. Strengths include personalized learning experiences, support for student creativity, the development of digital competencies, and the reduction of teachers' workload. Opportunities include enriching hybrid and online learning models, fostering global collaboration, and supporting lifelong learning. In contrast, technological infrastructure deficiencies, inequalities in access, reduced human interaction, superficial learning, data privacy concerns, and uncertainties regarding copyright emerge as weaknesses and threats. In conclusion, while the integration of AI into music education offers opportunities to reinforce the value-based and inclusive vision of the CTEM, it also entails ethical, pedagogical, and technological challenges that require careful management. By addressing the potential contributions and risks of AI in music education from a multidimensional perspective, this study provides a balanced evaluation of how the CTEM may engage with the requirements of the digital age.

**Keywords:** Music Education, Educational Technology, Artificial Intelligence, Curriculum Innovation, Century of Türkiye Education Model

## **Öz**

Bu araştırmanın temel amacı, Türkiye Yüzyılı Maarif Modeli (TYMM) kapsamında müzik eğitiminde yapay zekâ kullanımına yönelik mevcut durumu analiz ederek, bu alandaki güçlü ve zayıf yönleri, karşılaşılan fırsatları ve olası tehditleri mevcut literatür ve ulusal politika belgeleri çerçevesinde ortaya

koymaktır. Bu bağlamda Türkiye Yüzyılı Maarif Modeli'nin Öğretim Programları Ortak Metni esas alınmış; çözümlenmeler, söz konusu metinde belirtilen genel ilkeler doğrultusunda gerçekleştirilmiştir. Araştırmada veri toplama aracı olarak doküman incelemesi yöntemi kullanılmıştır. Millî Eğitim Bakanlığı'nın resmî belgeleri ile 2023–2025 yılları arasında yayımlanmış, doğrudan eğitimde veya özelde müzik eğitiminde yapay zekâ kullanımını ele alan akademik çalışmalar incelenmiştir. SWOT analizi bulguları, yapay zekâ tabanlı müzik eğitiminin TYMM'nin vizyonu ile yüksek düzeyde uyum gösterdiğini ortaya koymaktadır. Güçlü yönler arasında kişiselleştirilmiş öğrenme deneyimleri, öğrencilerin yaratıcılıklarını destekleme, dijital yetkinliklerin geliştirilmesi ve öğretmenlerin iş yükünü azaltma kapasitesi yer almaktadır. Fırsatlar ise hibrit ve çevrimiçi öğrenme modellerini zenginleştirme, küresel işbirliklerini güçlendirme ve yaşam boyu öğrenmeyi destekleme potansiyelini içermektedir. Bununla birlikte, teknolojik altyapı eksiklikleri, erişim eşitsizlikleri, insan etkileşiminin azalması, yüzeysel bilgi sağlama, veri gizliliği kaygıları ve telif haklarına ilişkin belirsizlikler zayıf yönler ve tehditler olarak öne çıkmaktadır. Sonuç olarak, yapay zekânın müzik eğitime entegrasyonu, TYMM'nin değer temelli ve kapsayıcı eğitim vizyonunu destekleyebilecek fırsatlar sunarken; aynı zamanda dikkatle yönetilmesi gereken etik, pedagojik ve teknolojik sınırlılıkları da beraberinde getirmektedir. Araştırma, yapay zekânın müzik eğitimi bağlamındaki olası katkı ve risklerini çok boyutlu biçimde ele alarak, TYMM'nin dijital çağın gereklerine uyum sağlama sürecine ilişkin dengeli bir değerlendirme sunmaktadır.

**Anahtar Kelimeler:** Müzik Eğitimi, Eğitim Teknolojileri, Yapay Zeka, Müfredat Yeniliği, Türkiye Yüzyılı Maarif Modeli.

## **Introduction**

### **The Century of Türkiye Education Model**

All planned activities in education are designed to achieve specific objectives and fulfill designated functions. Education systems are grounded in a particular educational philosophy, which defines the theoretical profile of the human being to be cultivated and the type of society to be established. Different educational philosophies emphasize diverse aspects such as aims, content, process, methods, and environment in education (Şişman, 2011).

For an education system to function effectively, efficiently, and in alignment with its goals, it requires a high-quality curriculum. Curricula serve as the fundamental guides that structure and direct educational processes. Therefore, for a curriculum to achieve the desired success at all stages, it is essential that it rests on strong theoretical foundations, addresses the demands of contemporary times at the international level, and corresponds to societal needs, cultural values, and educational policies at the national level.

Instructional curricula are prepared in accordance with the “General Aims of Turkish National Education” and the “Fundamental Principles of Turkish National Education” as articulated in Article 2 of Law No. 1739 on the Basic Law of National Education. All educational and instructional activities carried out through these curricula – at the preschool, primary, and secondary levels – complement one another. Moreover, all programs are structured to ensure that students acquire the competencies expressed in the “Turkish Qualifications Framework,” preparing them for professional life, higher education, and social engagement in line with their interests and abilities. The Turkish education system aims to foster a national identity that transcends all ideologies and to cultivate a society composed of individuals with a strong sense of national consciousness. To this end, it seeks to raise virtuous and ethical generations of wise individuals who are committed to pursuing what is good, true, beneficial, and beautiful for the nation and humanity. Additionally, the system emphasizes nurturing individuals who think critically, solve problems, make decisions, assume responsibility and ideals, and who not only adapt to civilization but also actively contribute to its creation and advancement. In this regard, the CTEM aspires to cultivate individuals of sound reason, pure heart, and refined aesthetic sensibility – by safeguarding the balance between matter and spirit, reason and emotion, self and conscience, individual and society, as well as time and space (Ministry of National Education [CTEM], 2025). CTEM constitutes a comprehensive and holistic framework project that encompasses the development of curricula, the design of learning environments, the preparation of instructional materials, the creation of textbooks and supplementary resources, the structuring of assessment and evaluation processes, and the support of teachers’ professional development. This holistic perspective underscores the integration of mind, heart, body, and spirit (Akpınar - Köksalan, 2024).

CTEM emphasizes value education and skill development in both cognitive and affective domains, thereby summarizing the essential competencies students are expected to acquire (Yıldırım - Çalışkan, 2024). By distancing itself from Western-centered educational models, CTEM aims to blend universal competencies with national values (Akpınar et al., 2024). From ontological, epistemological, and axiological perspectives, the model is designed to support the intellectual, emotional, social, and spiritual development of the individual (Arslankara - Arslankara, 2024). Furthermore, CTEM aligns with global educational reforms by fostering individualized learning processes and aims to make curricula more contemporary, interdisciplinary, and technology-enhanced (Duyul et al., 2025).

### **Artificial Intelligence and Music Education**

In today's world, educational systems, curricula, and models are being restructured in response to globally evolving learning needs and rapidly advancing technological innovations. Within this context, curricula must be open not only to philosophical and theoretical foundations but also to innovative practices demanded by the digital age, thereby addressing contemporary educational needs. CTEM, as a reflection of this transformation, offers a value-based approach targeting the holistic development of the individual while also integrating technology into education in accordance with the requirements of the age.

In this regard, artificial intelligence has emerged in recent years as one of the most prominent components of technology-driven transformations in education. AI technologies, which impact areas ranging from personalized learning to diversified assessment tools, hold the potential to enhance efficiency and effectiveness in education, respond to students' individual needs, and enable teachers to conduct instructional processes in a more flexible and practical manner. Accordingly, curricula developed within the vision of CTEM are expected to employ contemporary technological tools such as AI to enhance the quality of education.

A wide range of studies have addressed both the positive and negative aspects of AI in education (Al-Tkhayneh et al., 2023; Abou Karroum et al., 2024, Bobro, 2024; Ermina, 2024; Shribala - Jhaneswaran, 2024; Erbas - Maksuti, 2024;

Sytzniakivska - Kulish, 2024; Crain et al., 2024). These studies emphasize positive outcomes such as the provision of personalized learning opportunities, time efficiency, and increased student engagement, while also discussing challenges including ethical concerns, high costs, and the need for AI literacy.

In other words, AI-supported solutions possess the potential to transform personalized learning by increasing engagement, efficiency, and academic achievement. Nevertheless, their integration also presents significant challenges that must be addressed. Future research should focus on robust, standardized, and context-sensitive approaches in order to fully harness the transformative potential of AI in higher education. Such a balanced approach would ensure that AI innovations contribute to a more inclusive, equitable, and effective learning environment for all stakeholders (Merino-Campos, 2025).

The use of AI technologies in education also extends to creative and sensory domains such as arts education. Music education, in particular, has been among the fields most influenced by technological developments, with AI-based applications enabling the support of diverse skills. Recent studies (Hu, 2023; Li - Wang, 2023; Rohwer, 2023; Zhang et al., 2024; Marinova, 2024; Gündoğdu - Okcu, 2024; Kim et al., 2023; Holster, 2024; Luo, 2024; Sánchez-Jara et al., 2024; Yuan, 2024) have explored the effects of AI on music education from various perspectives, highlighting the contributions of this technology to pedagogical processes. Within this framework, examining the opportunities offered by AI-supported applications in general music education processes and their place in contemporary curricula presents a significant area of inquiry both pedagogically and technologically. Accordingly, the tools examined in this study and highlighted in the literature are grouped and presented in Table 1.

<b>Table 1. Artificial Intelligence Tools Applicable in Music Education</b>	
<b>Tool</b>	<b>Description</b>
<i>Instrumental and Performance Training</i>	
Yousician	AI-powered platform for individualized instrument learning (guitar,

	piano, vocals, etc.), using real-time audio recognition to provide instant feedback and adaptive content (You-sician, March 22, 2025).
Frettable	Converts instrumental performances into notation with AI-based analysis, supporting pitch, rhythm, and polyp-hony recognition for multiple instru-ments (Frettable, March 20, 2025).
Meludia	Interactive AI-supported platform en-hancing core musical skills such as memory, aural perception, and rhyth-mic awareness (Meludia, March 22, 2025).
<b><i>Composition and Creativity Support</i></b>	
Suno	Generates automatic compositions based on user input, combining me-lo-ly, harmony, and rhythm; supports multilingual lyric generation (Suno, March 22, 2025).
AIVA	AI-assisted composition tool creating harmonic and melodic structures; supports composition, analysis, and music technology education (AIVA, March 21, 2025).
Beatoven	Produces original, royalty-free music based on mood and genre, useful for creative practice and multimedia pro-jects (Beatoven, March 22, 2025).
Soundraw	Creates dynamic music using para-meters like tempo, style, and instru-mentation; supports student partici-pation in digital music production (Soundraw, March 21, 2025).

Ecrett	User-friendly AI tool for fast royalty-free background music creation; integrates into music technology education (Ecrett Music, March 20, 2025)
<b><i>Aural Skills and Practice Enhancement</i></b>	
Melody ML	Separates vocal and instrumental components of tracks; supports karaoke-style practice and intonation development (Melody ML, March 21, 2025).
Vocal Remover	Isolates vocals or instruments for karaoke, analysis, or remixing, facilitating classroom use (Vocal Remover, March 21, 2025).
<b><i>Accessibility and Inclusive Learning</i></b>	
ElevenLabs	Text-to-speech tool producing natural-sounding audio content for education; supports accessibility and diverse learning needs (ElevenLabs, March 22, 2025).
<b><i>Instructional Content and Material Development</i></b>	
Gamma AI	Generates presentations, documents, and visual narratives from text using NLP and generative AI (Gamma, March 22, 2025).
Colossyan AI	Produces presenter-style videos with AI avatars and multilingual speech synthesis, useful for educational videos (Colossyan, March 22, 2025).
Adobe Express AI	Simplifies visual content creation (graphics, videos, presentations) using AI-enhanced templates and editing tools (Adobe, March 22, 2025).

Ideogram	AI text-to-image platform creating original visuals for educational purposes (Ideogram, March 22, 2025).
<b>Assessment and Feedback Tools</b>	
Quizizz AI	Generates quizzes, assignments, and gamified assessments; increases engagement and provides instant feedback (Quizizz, March 22, 2025).
<b>General Educational Support</b>	
ChatGPT	NLP-based model supporting information access, content creation, translation, and personalized learning assistance (OpenAI, March 22, 2025).

This table classifies AI-based applications in music education into categories such as instrumental and performance training, composition and creativity support, aural skills enhancement, accessibility and inclusive learning, instructional content and material development, assessment and feedback, and general educational support. It is considered that the tools listed in the table provide opportunities for individualized learning, encourage creativity, facilitate accessibility, and support diverse teaching practices. Furthermore, these tools are thought to hold the potential to transform pedagogical approaches; they are considered to provide instant and adaptive feedback, diversify students' creative production processes, and contribute to the development of inclusive learning environments.

In addition, among other technology-supported applications, the Google Experiments platform is thought to offer various music applications and games with interactive elements, carrying the potential to encourage musical development particularly in children. Chrome Music Lab is regarded as an interactive and enjoyable digital music laboratory designed for sound and music projects, enabling users to learn basic musical concepts through hands-on experiences. Perfect Ear, on the other hand, is considered to provide numerous interactive contents through a wide range of solfège exercises, contributing to auditory development and supporting individuals in enhancing their skills in musical

hearing, rhythm, and sight-reading (Chrome Music Lab, March 20, 2025; Google Experiments, March 20, 2025; Perfect Ear, March 20, 2025).

### **SWOT Analysis**

The term SWOT is an acronym derived from the initial letters of the English words Strengths, Weaknesses, Opportunities, and Threats (Kearns, 1992). Since its development in the 1950s and 1960s, SWOT analysis has become a fundamental tool in strategic planning and continues to be widely used today (Hill - Westbrook, 1997). Originally designed for use in business, the method has over time been extensively adopted in the field of education. Understanding external factors such as threats and opportunities, together with evaluating internal factors such as strengths and weaknesses, contributes to the formulation of an effective vision for the future (Balamuralikrishna - Dugger, 1995).

In vocational education, SWOT analysis helps balance theoretical and practical knowledge while optimizing educational outcomes (Vasilev, 2024; Vasileva et al., 2019). Şişman (2011) reports how pre-service teachers employed SWOT analysis as a contextual inquiry tool during the planning, implementation, and evaluation of classroom interventions. Over the course of the nine-month study, participants demonstrated improvements in analytical thinking, decision-making, and problem-solving skills; they also planned and assessed context-specific classroom interventions more effectively. Although based on a single experience, the study indicated a notable increase in the critical awareness of teacher candidates.

This approach is particularly valuable in multifaceted and dynamic domains such as artificial intelligence (Azzam - Charles, 2024), as it enables the synthesis of diverse perspectives and findings within a coherent framework. It assists in identifying the key areas where AI demonstrates significant benefits (strengths) as well as existing gaps or challenges (weaknesses). Moreover, it highlights external opportunities that can be leveraged to enhance AI integration and identifies potential threats that must be mitigated (Alhiane - Nafidi, 2025; Azzam - Charles, 2024). By offering actionable insights and recommendations for educators, policymakers, and researchers, SWOT analysis facilitates strategic planning and policy development (Azzam - Charles, 2024).

Theoretical and applied studies investigating the contributions of AI-based applications to music education are steadily increasing. However, the extent to which these technological developments align with current educational policies and curricula in Türkiye has not yet been sufficiently discussed. CTEM, announced by the Ministry of National Education in 2023, aims to build an education system that meets the needs and expectations of the new century by emphasizing the multifaceted development, digital literacy, and productivity of the individual. Nevertheless, within this model, a separate curriculum for music courses has not yet been published. For this reason, the present study is based on the “Common Text of Curricula” issued in 2025, which outlines the general framework of CTEM. Taking into account the model’s fundamental principles, instructional philosophy, and approach to digitalization, the study aims to evaluate the current state of AI use in music education. In this context, the SWOT analysis identifies the strengths, weaknesses, opportunities, and threats in the field, offering an important assessment of the integration of AI-supported instructional processes into music education in Türkiye.

### **Method**

In this study, document analysis was employed as the data collection method in order to systematically examine the effects of AI tools in education and specifically in music education within the framework of CTEM, and to conduct a SWOT analysis.

Document analysis involves the examination of written materials containing information about the phenomenon or events under investigation. In qualitative research, it may serve as an independent data collection method or be combined with other techniques (Yıldırım - Şimşek, 2016, 189). Its purpose is to derive meaning from data collected through documents and sources, to reach an understanding of the studied subject, and to enable the analysis and interpretation of the data (Corbin - Strauss, 2008). In other words, it encompasses the selection, classification, reading, and evaluation of data (sources) collected through the examination of existing records and documents, all in line with the objectives of the study (Karasar, 2014).

The documents analyzed in this study consist of materials related to CTEM, accessed through the official website of the Ministry of National

Education, as well as academic literature examining the relationship between AI and education in general and music education in particular. Among these, the Common Text of Curricula issued under CTEM was taken as the primary reference, since a dedicated curriculum for music education has not yet been published within the model. Therefore, the analyses were conducted within the general principles set forth in the Common Text.

The selection of academic studies forming the basis for the SWOT analysis was guided by specific criteria. First, the studies had to be published between 2023 and 2025, in order to reflect current debates and approaches. Additionally, only peer-reviewed articles published in refereed journals, available in full text, and directly addressing the use of AI in education were included. Studies conducted in the context of music education or arts education were prioritized; studies outside this scope were included only if they offered general educational insights. Furthermore, frequently referenced AI tools with varying functional features in the literature were evaluated from a pedagogical perspective, examining their functions, areas of application, potential contributions, and limitations (see Table 1).

Ethical approval was not required for this study, as it involved no human or animal participants and relied exclusively on the analysis of publicly accessible documents.

### **Limitations**

Alongside its various advantages, the document analysis method also presents certain limitations. One such limitation is the potential for the examined documents to lose their relevance over time, which may negatively affect the reliability of the findings. However, this study is based on a detailed examination of CTEM, which was made available to the public in the first half of 2024. In addition, the academic literature reviewed concerning AI and particularly its relationship to music education covers the years 2023–2025. Therefore, the documents analyzed in this study exhibit a high level of currency.

Another limitation arises from the interpretation process. Since document analysis relies heavily on researchers' interpretations, the analysis is open to subjectivity. Nonetheless, in this study, the data were independently analyzed by two experts, and the results were compared to achieve consensus. This

approach was intended to minimize the risk of subjectivity in the interpretation process.

Additionally, in order to introduce and analyze AI applications within the context of music education, tools such as Yousician, Frettable, Meludia, Suno, AIVA, Beatoven, Soundraw, Ecrett, Melody ML, Vocal Remover, ElevenLabs, Chrome Music Lab, Perfect Ear were examined as music-focused tools; while Gamma AI, Colossyan AI, Adobe Express AI, Ideogram, Quizizz AI, and ChatGPT were evaluated as content generation and assessment tools. Data regarding the use of these tools were obtained through document analysis, based on official sources from the developers and the current literature. Nevertheless, since the descriptions of these AI tools are largely based on the statements of their developers, the evaluations regarding their functionality and pedagogical contributions may involve contextual limitations. Moreover, given that the update cycles and accessibility of these tools may change over time, the validity of the data may differ in the future.

### **Significance**

This study is significant in that it addresses the use of artificial intelligence in music education within the framework of the Century of Türkiye Education Model from a multidimensional perspective, providing a holistic evaluation of its implications for the field. Today, AI technologies contribute substantially to areas such as the personalization of educational processes, enhancement of learning efficiency, and the development of students' creativity, digital literacy, and problem-solving skills. However, the integration of these technologies into educational settings also brings forth multifaceted debates concerning ethics, equity, and pedagogical balance. The importance of this study lies in its effort to identify the intersections between the value-based and holistic educational vision of CTEM and one of the most contemporary technological tools – artificial intelligence – while shedding light on how this intersection may be reflected in the field of music education.

### **Purpose**

The primary aim of this study is to analyze the current state of artificial intelligence use in music education within the scope of the Century of Türkiye

Education Model and to identify its strengths, weaknesses, opportunities, and potential threats in light of existing literature and national policy documents. To this end, recent studies exploring the relationship between AI and education in general, and music education in particular, were reviewed. The focus of this study is on the integration of AI-supported applications into the general music education process, the alignment of this integration with educational policies, and the opportunities provided by curricula. Within this general framework, the following sub-research questions were addressed:

1. What are the strengths of using AI tools in music education within the framework of CTEM?
2. What are the weaknesses of using AI tools in music education within the framework of CTEM?
3. What opportunities does the use of AI tools in music education present within the framework of CTEM?
4. What threats does the use of AI tools in music education pose within the framework of CTEM?

## **Findings**

### **1. Findings Related to the First Sub-Research Question**

This section addresses the first sub-research question: “What are the strengths of using AI tools in music education within the framework of CTEM?” For this purpose, CTEM was compared with the relevant literature, and the results were summarized in tabular form. The findings were then analyzed and reported.

<b>Table 2. Strengths (S)</b>	
<b>Findings from the Century of Türkiye Education Model</b>	<b>Findings from the Related Literature</b>
Personalized Learning Experiences: In the CTEM, it is stated that A rights-based and development-oriented learning process is established by enabling each student to recognize and	In the context of AI, strengths may include the capacity to provide personalized learning experiences, reduce teachers’ workload, increase student engagement, enhance

discover themselves, and by expanding flexible and open learning environments tailored to their interests, needs, and abilities.” (Ministry of National Education [CTEM], 2025, pp.13).

Fostering Creativity: The CTEM includes competencies in thirteen arts fields, including musical creativity. Accordingly, one of the goals of arts education is to cultivate individuals who can maximize their creativity, acquire communication and critical thinking skills, and develop into self-confident individuals with an aesthetic perspective (CTEM, 2025, pp.28). Moreover, intellectual dispositions refer to the ability of individuals to reflect their mental and cognitive capacities through skills. In the CTEM, ten intellectual dispositions are defined, including “creativity.” Creativity is conceptualized as cognitive patterns that involve the ability to approach situations from multiple perspectives, integrate past experiences, and generate original products and ideas as well as solutions to problems by adapting to new situations beyond conventional frameworks (CTEM, 2025, pp.23-24).

Utilizing Information Technologies and Digital Competence: “Educating individuals with digital competence” is among the stated goals of the CTEM (CTEM, 2025, pp.13). In addition,

language skills, and improve face-to-face and hybrid learning environments. AI tools contribute to the development of students’ digital skills in the field of music, support individualized learning pathways by making the process more tangible, and foster creativity. Moreover, they offer interactive and efficient learning experiences tailored to individual student needs. This situation not only enhances student engagement and satisfaction but also supports technical competence, creativity, and skill acquisition. AI alleviates teachers’ workload, automates administrative tasks, and provides real-time feedback, thereby improving the efficiency of educational processes. Especially in music education, the integration of traditional pedagogical approaches with digital technologies holds the potential to improve overall learning quality at the university level (Hu, 2023; Azzam - Charles, 2024; Rane et al., 2024; Batista et al., 2024; Abou Karroum et al., 2024; Bobro, 2024; Ermina, 2024; Shribala - Jhaneswaran, 2024; Erbas - Maksuti, 2024; Sytniakivska - Kulish, 2024; Yuan, 2024; Zhang et al., 2024; Sánchez-Jara et al., 2024; Marinova, 2024; Holster, 2024; Osserbayeva - Shindaulova, 2024; Alhiane - Nafidi,

<p>digital literacy is identified within the CTEM skills framework (CTEM, 2025, pp.3) Accordingly, digital literacy aims to enable individuals to develop multidimensional and holistic competencies in accessing, identifying, interpreting, using, and producing digital information. In this sense, digital literacy is defined as a multi-layered area of competence that not only covers the ability to use digital tools but also includes critical thinking, communication, content creation, security, and awareness of intellectual property.</p>	<p>2025; Crain et al., 2024; Vieriu - Petrea, 2025).</p>
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As shown in Table 2, there is a remarkable alignment between the strengths of the Century of Türkiye Education Model and the applications of AI-supported music education. The CTEM principle of “establishing flexible and liberalized learning environments that allow each student to recognize and discover themselves in accordance with their interests, needs, and abilities” corresponds closely to the capacity of AI technologies to provide personalized learning experiences. Indeed, the literature highlights that AI tools can analyze students’ performance to create individualized learning pathways, thereby both concretizing the learning process and enhancing student engagement and satisfaction. Similarly, the CTEM’s emphasis on fostering creativity within the framework of arts-related competencies and intellectual dispositions is supported by AI’s potential to provide students with new means of expression in creative processes such as music composition, arrangement, and notation. Moreover, the CTEM’s goals regarding digital competence and literacy directly align with the contribution of AI-based music technologies to students’ acquisition of multidimensional skills, including digital production, content management, data security, and copyright awareness. In this context, the intersection between the vision of the CTEM and the pedagogical and technological

opportunities offered by AI reveals a strategic area of integration with the potential to enhance the quality of music education.

## 2. Findings Related to the Second Sub-Objective

This section addresses the second sub-objective of the study: “What are the weaknesses of using artificial intelligence tools in music education within the context of CTEM?” For this purpose, the relevant literature on the CTEM was examined, compared, and summarized in tabular form. The findings obtained were then interpreted and reported.

<b>Findings from the Century of Türkiye Education Model</b>	<b>Findings from the Related Literature</b>
<p>Technological Infrastructure and Inequality of Access: The CTEM emphasizes that “education is a duty in the sense of solidarity and learning for all; ensuring safety and prosperity for everyone, reinforcing our unity, and continuing strongly with the dynamic vision of the Republic of Türkiye”(CTEM, 2025, pp.4). However, the integration of AI carries the risk of deepening existing digital inequalities, which may contradict the CTEM’s aim of ensuring equal opportunities.</p> <p>Risk of Reduced Human Interaction: The CTEM highlights the importance of “social-emotional learning skills” and a “holistic educational approach” (CTEM, 2025, pp.11-13)</p>	<p>In the context of AI, weaknesses may include the lack of organizational support, low trust of practitioners in AI, concerns about the accuracy of outcomes, provision of superficial knowledge, and the risk of over-reliance that may diminish critical thinking and independent problem-solving skills. Other limitations include insufficient personalization, cultural insensitivity, lack of emotional support, data privacy and security concerns, and constraints in tasks requiring creativity. Excessive dependence on AI could weaken the social and emotional dimensions of music education. The integration of AI into music education may also pose challenges in aligning with traditional pedagogy. Issues such as the continued necessity of human expertise, the risk of restrained understanding, and the neglect of critical thinking and ethical</p>

<p>Risk of Superficial Learning: This stands in strong contrast with the CTEM's emphasis on "in-depth learning."</p>	<p>dimensions require careful consideration. Furthermore, a balanced and conscious integration process is needed to ensure that human creativity is not displaced (Baidoo-Anu - Owusu Ansah, 2023; Kasneci et al., 2023; Hu, 2023; Rohwer, 2023; Ossebayereva - Shindulova, 2024; Azzam - Charles, 2024; Rane et al., 2024; Al-Zahrani, 2024; Alhiane - Nafidi, 2025; Vieriu - Petrea, 2025; Vesna et al., 2025).</p>
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As shown in Table 3, the main weaknesses of integrating artificial intelligence into the Century of Türkiye Education Model manifest themselves in both technological and pedagogical dimensions. Despite the CTEM's principle of "ensuring equal opportunities," the risk of AI applications exacerbating the existing digital divide makes inequalities in technological infrastructure and access a critical concern. This issue is particularly problematic in socioeconomically disadvantaged regions, where it may conflict with the inclusivity goals of the CTEM. Moreover, while the CTEM emphasizes social-emotional learning and a holistic educational approach, excessive reliance on AI carries the risk of reducing human interaction and weakening emotional support in learning processes.

In the literature, insufficient organizational support, limited trust of practitioners in AI, uncertainty regarding the accuracy of outcomes, lack of cultural sensitivity, and data security concerns are frequently highlighted as weaknesses. Furthermore, the potential of AI to foster superficial learning and to diminish critical thinking and independent problem-solving skills is in stark contrast with CTEM's emphasis on 'in-depth learning.' In the specific context of music education, risks such as the marginalization of human creativity, challenges of pedagogical alignment, and the neglect of ethical dimensions emerge as issues that can only be addressed through a balanced and conscious integration of AI.

### 3. Findings Related to the Third Sub-Objective

This section addresses the third sub-objective of the study: “What opportunities does the use of artificial intelligence tools in music education present within the context of CTEM?” For this purpose, the relevant literature on the CTEM was examined, compared, and summarized in tabular form. The findings obtained were then interpreted and reported.

<b>Table 4. Opportunities (O)</b>	
<b>Findings from the Century of Türkiye Education Model</b>	<b>Findings from the Related Literature</b>
<p>Developing New Learning Models: The CTEM states that “learning-teaching experiences are shaped around approaches in which the student is active, interacts with the environment, and assumes responsibility for learning” (Ministry of National Education [CTEM], 2025, pp.13). AI can enrich hybrid and online models of music education, thereby supporting this principle.</p> <p>Global Collaboration and Resource Sharing: The CTEM emphasizes that “interdisciplinary, transdisciplinary, and cross-disciplinary experiences are provided, along with extracurricular activities that enable students to explore their interests, develop their talents, and become socially conscious, active citizens” (CTEM, 2025, pp.13). AI platforms can facilitate interaction with global</p>	<p>The integration of AI into curricula offers the potential to create new learning experiences that are independent of time and place, while also fostering skills such as curiosity, collaboration, and critical thinking. Specifically in the context of AI, opportunities include democratizing education by expanding equitable access, promoting lifelong learning, supporting collaboration and data analysis in research, and providing language support. AI transforms music pedagogy by enhancing learning environments, while simultaneously diversifying learning experiences through digital content and interactive platforms, adding dynamism to educational processes (Azzam - Charles, 2024; Rane et al., 2024; Batista et al., 2024; Sánchez-Jara et al., 2024; Marinova, 2024; Alhiane - Nafidi, 2025; Vieriu - Petrea, 2025; Zhang et al., 2024).</p>

music communities and promote resource sharing.	
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As shown in Table 4, the integration of artificial intelligence into the Century of Türkiye Education Model offers innovative and transformative opportunities in education. The CTEM's principle of a learning-teaching approach in which "the student is active, interacts with the environment, and assumes responsibility for learning" directly corresponds to the potential of AI to enrich hybrid and online models of music education. In this regard, AI removes spatial and temporal constraints, enabling students to learn at their own pace and according to their interests, while fostering the development of 21st-century skills such as curiosity, collaboration, and critical thinking. The CTEM's emphasis on interdisciplinary and extracurricular learning experiences is also reinforced by AI's capacity to promote global collaboration and resource sharing.

The literature further highlights that AI presents opportunities such as expanding democratized access to education, encouraging lifelong learning, facilitating data analysis in research, and supporting international collaboration. In the specific context of music pedagogy, AI diversifies learning environments through digital content and interactive platforms, enhances students' creativity and technical competencies, and thereby introduces innovative dynamism into educational processes. In the Turkish context, the use of AI-supported composition tools (such as AIVA, Soundraw, and Suno) in music classes may enhance students' creativity and encourage them to produce original works that reflect both local and universal musical values. In this respect, the interaction between AI and the CTEM constitutes a strategic opportunity area, contributing both to pedagogical diversity and to the global expansion of the learning ecosystem.

#### **4. Findings Related to the Fourth Sub-Objective**

This section addresses the fourth sub-objective of the study: "What threats does the use of artificial intelligence tools in music education entail within the context of CTEM?" For this purpose, the relevant literature on the CTEM was

examined, compared, and summarized in tabular form. The findings obtained were then interpreted and reported.

<b>Table 5. Threats (T)</b>	
<b>Findings from the Century of Türkiye Education Model</b>	<b>Findings from the Related Literature</b>
<p>Copyright and Originality Issues: The CTEM emphasizes “moral awareness and an aesthetic perspective”</p> <p>(Ministry of National Education [CTEM], 2025, pp.6). However, uncertainties regarding the copyright and artistic originality of AI-generated musical works may give rise to ethical debates.</p> <p>Student Dependency and the Decline of Critical Thinking Skills: The CTEM aims to educate “thinking and problem-solving” individuals. However, excessive reliance on AI may undermine students’ independent problem-solving and critical thinking skills.</p>	<p>Potential threats associated with AI include ethical concerns (bias, accountability, discrimination), excessive dependence on AI, erosion of academic integrity (plagiarism, cheating), decline in critical thinking skills and creativity, dissemination of misinformation, and widening of digital inequalities. The integration of AI into education entails various ethical and social risks, such as the unauthorized use of students’ personal data, reduction in emotional-social interactions, weakening of critical thinking, and exposure to misleading information. Furthermore, overreliance on technology may weaken teacher-student relationships, threaten traditional professions, increase costs, and reinforce systemic biases. A cautious approach is therefore required to preserve the human dimension of education (Al-Tkhayneh et al., 2023; Abou Karroum et al., 2024; Bobro, 2024; Ermina, 2024; Shribala - Jhaneswaran, 2024; Erbas - Maksuti, 2024; Sytniakivska - Kulish, 2024; Azzam - Charles, 2024; Rane et al., 2024; Batista et al., 2024; Al-Zahrani, 2024; Crain et al., 2024; Filiz et al., 2025; Alhiane - Nafidi, 2025; Vieriu - Petrea, 2025)</p>

As shown in Table 5, the potential threats associated with the integration of artificial intelligence into the Century of Türkiye Education Model are concentrated particularly in ethical, pedagogical, and socio-technological dimensions. Despite CTEM's principle of fostering "moral awareness and an aesthetic perspective," uncertainties surrounding the copyright and artistic originality of AI-generated musical works create a contested space in both legal and ethical terms. Moreover, CTEM's goal of cultivating "thinking and problem-solving" individuals may be undermined by excessive reliance on AI, which carries the risk of weakening students' critical thinking and independent problem-solving abilities. The literature further emphasizes risks such as bias, discrimination, accountability ambiguities, erosion of academic integrity (e.g., plagiarism), exposure to misleading information, deepening digital inequalities, and threats to traditional professions. In the context of music education, overdependence on technology may weaken teacher-student interaction, diminish the emotional and social dimensions of collaborative performance and ensemble playing, and impose high costs that limit access. Therefore, safeguarding the human dimension, implementing ethical principles, and ensuring a balanced pedagogical strategy are crucial for sustaining the core vision of CTEM during AI integration.

### **Conclusion, Discussion, and Recommendations**

This study examined the strengths, weaknesses, opportunities, and threats of AI-supported music education within the framework of the Century of Türkiye Education Model through a SWOT analysis. In doing so, it established a meaningful bridge between contemporary literature on AI in education and CTEM's pedagogical vision. The findings reveal that AI can reinforce CTEM's goals by offering personalized learning experiences, stimulating creativity, enhancing digital competencies, and fostering global collaboration. In particular, CTEM's emphasis on artistic skills and intellectual tendencies aligns with the innovative opportunities provided by AI in composition, arrangement, and application processes in music education. Similarly, CTEM's focus on digital literacy resonates with the integration of AI as a means of enhancing awareness and competencies in both general education and music education.

While the strengths identified in the SWOT analysis underscore the compatibility between CTEM's vision – personalized learning, creativity, and digital competence – and AI-driven music education, several risks and limitations must also be acknowledged. Technological infrastructure deficiencies, unequal access, reduced human interaction, the risk of superficial knowledge, declining critical thinking, and ethical concerns such as data privacy may conflict with CTEM's goals of inclusivity, in-depth learning, and holistic education. Additional concerns include misinformation, uncertainties about copyright and originality, and the weakening of problem-solving and critical thinking skills through overreliance on AI. Thus, integrating AI into education in alignment with CTEM requires a strategic framework that combines robust infrastructure, ethical safeguards, and pedagogical balance in order to maximize opportunities while minimizing risks.

The findings further indicate that AI technologies enrich learning environments by diversifying content, supporting creativity, and fostering interdisciplinary and global collaborations, consistent with CTEM's pedagogical orientation. However, challenges such as data privacy, ethical dilemmas, and the risk of diminishing human-centered learning highlight the need for careful management.

To ensure the effective, inclusive, and sustainable implementation of AI-supported music education within CTEM, it is recommended that schools' technological infrastructure be strengthened and internet access expanded to guarantee equitable opportunities for both students and teachers. In the context of Türkiye, the existing disparities in infrastructure between public and private schools, as well as between urban and rural areas, risk deepening the digital divide and creating unequal access to high-quality AI-supported music education. Therefore, inclusive policies and projects that provide hardware, software, and connectivity support for students in disadvantaged regions will be crucial to promoting equal access. Balanced integration of AI with traditional pedagogical approaches should be prioritized, supported by ongoing professional development opportunities for teachers in pedagogical applications of AI, and curriculum design should ensure AI is utilized in ways that promote student-centered, creative, and critical thinking skills. Additionally, raising students' awareness of data privacy and security is essential for responsible AI use, while

encouraging their active participation in problem-solving, analysis, and creative production will prevent overreliance on technology.

AI should be employed as a supportive learning tool under teacher guidance, with particular attention to preserving human interaction and the emotional dimension of art. Regular academic research should be conducted to monitor and improve AI-supported practices, including comparative analyses of CTEM with international AI-based curricula, as well as content and process evaluations assessing the compatibility of AI tools with Türkiye's musical culture and value system. Furthermore, experimental studies examining the effects of AI-supported music education on learning outcomes, motivation, creativity, and critical thinking across different educational levels are strongly encouraged.

In summary, the findings demonstrate that AI-supported music education within CTEM offers opportunities largely aligned with its pedagogical vision, while also presenting weaknesses and threats that cannot be overlooked. By implementing inclusive, ethical, and pedagogically balanced strategies, it will be possible to build an educational ecosystem that maximizes technological and creative opportunities while safeguarding the human, social, and cultural dimensions of music education.

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