https://doi.org/10.30775/KMES.54.2.139
음악교육연구 제54권 제2호 pp. 139-160 (2025년 5월) ISSN 1229-4179 (Print)
Korean Journal of Research in Music Education Vol.54, No.2, (May, 2025) ISSN 2713-3788 (Online)

디지털 플랫폼을 활용한 음악 교육 혁신: 문화적 인식 향상을 위한 혼합 연구

Innovating Music Education Through Digital Platforms: A Mixed-Methods Approach to Enhancing Cultural Awareness

시나가 샤흐룰 샤* · 몸푸니 레스투 아유** · 시나가 파즈리 수브하안 샤*** · 아이시자 시티**** · 누그로호 안토니우스 에디*****
Syahrul Syah Sinaga · Restu Ayu Mumpuni · Fajry Sub'haan Syah Sinaga · Siti Aesijah · Antonius Edi Nugroho

Abstract This study investigates the role of digital platforms in enhancing cultural awareness within music education. Using a mixed-methods design, the research involved both students and teachers who had experience using a digital platform called E-LokalTunes. Data were collected through surveys, interviews, and classroom observations to examine how digital tools influence students' understanding and appreciation of diverse musical cultures. The findings demonstrate a positive relationship between digital engagement and the development of cultural awareness. Qualitative data further support this, revealing increased curiosity, intercultural understanding, and appreciation for local and global musical traditions among students. The study also identifies challenges, such as varying levels of digital literacy among teachers and limited access to technological resources. Despite these limitations, the study concludes that platforms like E-LokalTunes can serve as effective tools in promoting culturally responsive music education. By integrating pedagogical strategies and strengthening support systems, digital platforms have the potential to transform music learning into a more inclusive and culturally enriched experience.

Key words: cultural awareness, music education, digital platform, mixed-methods, E-LokalTunes

초록 본 연구는 디지털 플랫폼이 음악 교육에서 문화 인식을 향상시키는 역할을 탐색하는 데 목적이 있다. 혼합 연구 설계를 적용하여, 이로컬튠즈(E-LokalTunes)라는 디지털 플랫폼을 사용한 경험이 있는 교사와 학생을 대상으로 설문조사, 인터뷰, 수업 관찰을 통해 자료를 수집하였다. 본 연구는 디지털 도구가 학생들의 다양한 음악 문화에 대한 이해와 감상의 증진에 어떠한 영향을 미치는지를 분석하였다. 연구 결과, 디지털 참여와 문화 인식 발달 간의 긍정적인 관계가 나타났으며, 질적 자료는 학생들의 지역 및 세계 음악 전통에 대한 호기심, 문화 간 이해, 감상과

* First author & Corresponding author, E-mail: sinaga@mail.unnes.ac.id
Assistant Professor, Universitas Negeri Semarang, Department of Music Education, Sekaran, Gunungpati, Semarang, Central Java, Indonesia
** Co-author, E-mail: restuayu@mail.unnes.ac.id
Lecturer, Universitas Negeri Semarang, Department of Communication Science, Sekaran, Gunungpati, Semarang, Central Java, Indonesia
*** Co-author, E-mail: fajrysinaga@uinsaizu.ac.id
Assistant Professor, Universitas Islam Negeri Prof. K.H. Saifuddin Zuhri Purwokerto, Department of Islamic Elementary School Education, A. Yani Street, Number 40A, Karanganjing, Purwanegara, Purwokerto Utara, Kabupaten Banyumas, Central Java, Indonesia
**** Co-author, E-mail: aesijah@mail.unnes.ac.id
Assistant Professor, Universitas Negeri Semarang, Department of Music Education, Sekaran, Gunungpati, Semarang, Central Java, Indonesia
***** Co-author, E-mail: edinugroho87@mail.unnes.ac.id
Lecturer, Universitas Negeri Semarang, Department of Music Education, Sekaran, Gunungpati, Semarang, Central Java, Indonesia

Received: 28 February 2025, Reviewed (Revised): 1 April (6 April) 2025, Accepted: 17 April 2025

존중의 태도를 높이는 모습을 보여주었다. 아울러, 교사의 디지털 문해력 수준 차이와 기술 접근의 한계는 중요한 도전 과제로 확인되었다. 이러한 제한점에도 불구하고, 이로컬튠즈와 같은 플랫폼은 문화적으로 반응하는 음악 교육을 촉진하는 효과적인 도구로 활용될 수 있음을 시사한다. 교수 전략 통합과 지원 체계 강화는 보다 포괄적이고 문화적으로 풍부한 음악 학습 환경을 조성하는 데 기여할 수 있다.

주제어: 문화 인식, 음악 교육, 디지털 플랫폼, 혼합 방법, 이로컬튠즈

Ⅰ. Introduction

The integration of digital platforms in music education has revolutionized how students and educators engage with musical materials, offering new opportunities for learning, collaboration, and cultural exploration. Traditional music education has long relied on face-to-face instruction, printed sheet music, and in-person ensemble practice, which, while effective in developing technical skills, has been criticized for its lack of cultural relevance and contextual engagement (Björk et al., 2021). Many students struggle to connect theoretical concepts with real-world musical practice, resulting in a superficial understanding of music that focuses primarily on technical proficiency rather than cultural meaning. In response, recent educational innovations have explored the potential of digital platforms to enhance student engagement and expand their cultural awareness in music education (Camlin & Lisboa, 2021).

The increasing reliance on digital learning has been accelerated by the COVID-19 pandemic, which compelled educational institutions worldwide to transition into online learning environments (Rucsanda et al., 2021). Digital tools such as Zoom, YouTube, and specialized music software became essential for remote music instruction (Ng et al., 2022). While these platforms have significantly improved accessibility and flexibility in music education, they have also introduced challenges in interactivity, engagement, and pedagogical effectiveness. The shift to digital learning has raised concerns about the depth of student interaction with cultural elements in music, as the pedagogical focus often prioritizes technical skills and content delivery rather than experiential cultural engagement (Deliyannis et al., 2024).

One of the primary objectives of modern music education is to develop students' cultural awareness and appreciation for diverse musical traditions. Historically, music curricula have predominantly focused on Western classical traditions, often marginalizing non-Western and indigenous musical practices (Elliott & Silverman, 2015). This Eurocentric focus has limited students' exposure to diverse musical traditions, reinforcing cultural gaps in music learning. Recent

research suggests that digital tools can serve as a bridge between culture and music education, enabling students to engage with traditional and contemporary musical styles from various cultural backgrounds (Good et al., 2021). Web-based platforms facilitate interactive and contextualized learning, offering students access to virtual ethnomusicology archives, digital storytelling, and collaborative composition projects that broaden their musical perspectives (Prest & Goble, 2021).

In Indonesia, this need for cultural integration led to the development of E-LokalTunes, a web-based platform that promotes Indonesian folk music in education (Sinaga et al., 2023). It provides digital resources—such as audio-visual materials and interactive modules—to help students engage with traditional music more meaningfully. Early studies show that E-LokalTunes improves student engagement while addressing the cultural limitations of conventional instruction. However, more research is needed to assess its classroom implementation and long-term impact.

The implementation of digital platforms in culturally enriched music education has demonstrated notable benefits. Platforms such as Sonic Pi and GarageBand allow students to experiment with musical structures while also engaging in algorithmic composition and digital improvisation (Banut & Albulescu, 2024). Research indicates that students who engage with digital music tools develop a deeper emotional and cognitive connection with music as a cultural expression than those who rely solely on traditional learning methods (Ng et al., 2022). Sinaga et al. (2023) emphasize that integrating digital arrangements of traditional songs provides an invaluable opportunity for students to engage with cultural heritage while simultaneously enhancing their musical literacy. These digital interventions suggest a promising pathway for expanding cultural awareness in music education.

Despite these advancements, several challenges hinder the full integration of digital platforms in music education. First, traditional music education often separates technical skills from cultural context, making it difficult for students to fully appreciate the sociocultural dimensions of music learning (Björk et al., 2021). Second, while digital platforms have improved accessibility, they have not been systematically evaluated in terms of their effectiveness in fostering cultural awareness (Elliott & Silverman, 2015). Many teachers also lack adequate digital literacy and professional training, resulting in ineffective pedagogical implementation (Joseph & Merrick, 2021). Moreover, technological disparities and digital divides further exacerbate the issue, as students from different socio-economic backgrounds do not have equal access to high-quality digital learning resources (Webster, 2011). Lastly, most previous studies have primarily focused on the technical aspects of digital music education rather than its impact on students' cultural learning and engagement (Deliyannis et al., 2024; Schippers, 2010).

This study aims to address these gaps by exploring teachers' and students' experiences in using digital platforms for cultural music learning. Specifically, the study seeks to assess whether these technologies effectively foster cultural awareness and to identify the challenges and pedagogical implications of integrating digital platforms into music education. The research focuses on teachers' instructional practices, students' learning engagement, and the overall impact of digital tools in enhancing cultural competency in music education.

This study addresses these gaps by exploring how teachers and students experience digital platforms in music education, with a focus on fostering cultural awareness. It examines the pedagogical strategies used, the challenges encountered, and the potential of digital tools to promote inclusive and culturally relevant learning. A mixed-methods approach—combining surveys, interviews, and classroom observations—enables a comprehensive analysis of how digital tools shape engagement and cultural understanding. The findings are expected to inform future practice and policy in digital music education.

Ⅱ. Literature Review

1. Digital transformation in music education

The integration of digital technologies in education has significantly transformed various disciplines, including music education. Digital platforms provide students with flexible and interactive learning experiences, enabling them to engage with music theory, composition, and performance in innovative ways (Camlin & Lisboa, 2021). Research has shown that web-based learning environments foster collaborative and self-directed learning, allowing students to interact with music through digital composition tools, virtual performance simulations, and multimedia content (Savage, 2010). Several studies have demonstrated that digital tools enhance student engagement and creativity, as platforms like Sonic Pi and GarageBand enable learners to experiment with musical structures and digital soundscapes (Banut & Albulescu, 2024). The rise of e-learning platforms, YouTube tutorials, and interactive music apps has further expanded the accessibility of music education to a broader audience (Ng et al., 2022). However, despite these benefits, there is growing concern about the depth of student engagement in digital environments, as some studies suggest that online learning lacks the embodied and experiential aspects of traditional music education (Schippers, 2010).

The shift toward digital learning was accelerated by the COVID-19 pandemic, which forced educational institutions worldwide to adopt online platforms for music instruction (Rucsanda et al., 2021). While this transition enabled students and educators to continue their learning despite physical restrictions, it also exposed several challenges, including technical difficulties, lack of pedagogical support, and disparities in access to digital resources (Joseph & Merrick, 2021). The use of digital tools in music education has provided new opportunities for accessibility and engagement, but it has also raised questions regarding the effectiveness of these platforms in fostering deep musical and cultural understanding (Deliyannis et al., 2024).

An essential but often underemphasized aspect of digital transformation in music education is teacher digital literacy. Beyond the mere availability of technology, effective integration into pedagogy relies heavily on educators' ability to critically engage with digital tools (Ng, 2012). Digital literacy encompasses not only basic technological proficiency but also the ability to design, adapt, and evaluate digital content for pedagogical purposes. Within the Technological Pedagogical Content Knowledge (TPACK) framework, this aligns with Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Pedagogical Content Knowledge (PCK) which are crucial for culturally responsive instruction. A study by Laithong et al., (2025) on music teachers in Thailand identified teacher digital literacy as a major barrier to the successful integration of technology in music education. Despite having access to digital resources, many teachers struggled to effectively incorporate them into culturally rich and engaging music lessons due to limited exposure to relevant software and inadequate training. This highlights the growing need for targeted digital literacy development programs that are tailored to the specific needs of music educators in the digital age.

2. Cultural awareness in music education

Cultural awareness in this study is defined as an individual's ability to recognize, understand, and respect cultural differences, particularly as they are expressed through musical traditions and practices. In the context of music education, this involves not only being exposed to music from different cultural backgrounds but also reflecting on one's own cultural identity while developing empathy and appreciation for others (Campbell, 2004; Schippers, 2010). Cultural awareness becomes especially essential when learners engage with content rooted in cultures different from their own. As emphasized by Kayaoglu (2015), individuals should recognize that it is challenging to think and act solely within the framework of their own culture while interacting with others.

Therefore, promoting cultural awareness through music can serve as a powerful pedagogical tool for enhancing intercultural understanding.

Moreover, Schuitema and Veugelers (2011) suggested that cross-cultural awareness is a core element of intercultural competence, along with empathy and flexibility—qualities that can be nurtured through multicultural music learning. Richardson (2012) also highlighted that improvements in students' cultural awareness may enrich their educational experiences, especially in diverse learning environments. In this study, cultural awareness is operationalized as students' sensitivity to and appreciation of the meaning, values, and social contexts embedded in regional and traditional songs, as facilitated by their engagement with the digital platform E-LokalTunes.

3. Challenges in implementing digital music education

Despite the many advantages of digital platforms in music education, several challenges persist in their implementation and effectiveness. One major issue is the digital divide, where students from lower socio-economic backgrounds often experience limited access to internet connectivity, devices, and digital learning resources (Webster, 2011). This disparity raises concerns about equity and inclusion, as students who lack access to adequate technological infrastructure may face difficulties engaging with digital music education (Deliyannis et al., 2024). Another challenge lies in teacher preparedness and digital literacy, as many educators lack sufficient training in integrating technology into their teaching practices, resulting in inconsistent adoption of digital platforms (Joseph & Merrick, 2021). Research indicates that successful digital music education requires teachers to develop a combination of TPACK (Mishra & Koehler, 2006). Without adequate training, teachers may struggle to effectively incorporate digital tools into music lessons, particularly when integrating cultural elements into the curriculum (Schmidt, 2012).

Furthermore, concerns remain regarding the extent to which digital learning environments can replicate the sensory, social, and performance-based aspects of traditional music education. Music is often taught as a hands-on, embodied experience, where students learn through physical interaction with instruments, live collaboration with peers, and exposure to cultural contexts (Elliott & Silverman, 2015). While digital platforms provide simulations, virtual reality experiences, and interactive learning modules, their effectiveness in offering fully immersive and experiential learning experiences remains an open question (Ho, 2021). The pedagogical challenges of integrating cultural elements into digital platforms also require further exploration, particularly regarding best practices for designing culturally inclusive digital learning experiences (Schippers, 2010).

4. Theoretical frameworks supporting digital music education

The theoretical foundation for this study is based on three key educational frameworks: TPACK, Experiential Learning Theory, and Connectivism. The TPACK model provides insight into how teachers balance technology, pedagogy, and content knowledge in music instruction, highlighting the challenges they face in integrating digital tools effectively (Mishra & Koehler, 2006). Experiential Learning Theory supports the argument that students learn best when they actively engage in hands-on and immersive experiences, raising questions about how digital tools can simulate real-world musical learning experiences. Finally, Connectivism Theory (Siemens, 2005) posits that learning is a networked process, where students acquire knowledge through interaction with digital resources, online communities, and multimedia content. These frameworks help structure the study's examination of how students and teachers engage with digital platforms for cultural music learning and whether these tools effectively foster deep cultural engagement in music education.

Despite extensive research on digital music education, there remains a significant gap in understanding how digital platforms influence students' cultural awareness and engagement. Most studies have focused on the technical and instructional benefits of digital learning, without thoroughly exploring its cultural and pedagogical implications (Sinaga et al., 2023). Additionally, the effectiveness of digital tools in enhancing students' long-term cultural competency and appreciation for diverse musical traditions remains underexplored (Schippers, 2010). Recent international studies have started to investigate these dimensions in different cultural contexts. For instance, research in Thailand by Laithong et al. (2025) applied the TPACK framework to analyze the needs and solutions of music teachers using digital platforms, revealing both the potential and limitations of technology in culturally nuanced instruction. Similarly, a study in Kosovo (Rexhepi et al., 2024) explored how digital learning can enhance student motivation and awareness in music education, although it remained largely focused on mainstream Western repertoires. While these studies contribute valuable insights, they often lack a strong emphasis on the integration of local cultural content through digital means.

This study addresses that gap by investigating how a culturally grounded digital platform, E-LokalTunes, can support music education that is not only technologically innovative but also culturally responsive. The findings from this study are expected to contribute to the ongoing discourse on digitalization in music education and its potential role in promoting global cultural understanding.

Ⅲ. Method

This study employs a mixed-methods approach, integrating both quantitative surveys and qualitative interviews to gain a comprehensive understanding of how digital platforms influence cultural awareness in music education. A case study design is adopted to explore both measurable learning outcomes and the lived experiences of teachers and students (Creswell & Clark, 2018). The rationale for this approach is to triangulate statistical trends with qualitative insights, ensuring a holistic and context-rich analysis of digital music learning experiences (Teddlie & Tashakkori, 2009).

1. Participants and sampling

This study involves music teachers and students who have experience using digital platforms for music education. Purposive sampling is employed to select participants who can provide meaningful insights relevant to the study objectives. For the quantitative phase, a total of 200 students and 50 teachers from diverse educational institutions participated in the survey. Student participants were drawn from junior high schools, senior high schools, and undergraduate music programs in Indonesia, ensuring representation across different levels of education. Participants were selected based on their enrollment in music-related courses and their use of digital learning tools, including E-LokalTunes, in their learning processes.

Demographic data, such as age, gender, and formal musical training for students, and age, teaching experience, and gender for teachers, were collected through the survey questionnaires. While these demographic variables were not the primary focus of the study, they provide context for the diversity of the participants in terms of institutional background, geographic location, and educational level. The student sample included individuals from both urban and rural schools, representing different regions of Indonesia, including Jakarta, Yogyakarta, Bandung, Surabaya, and Bali. The teacher participants were music educators who integrated digital platforms into their instruction. Selection criteria for teachers included their role in teaching music and prior experience using digital learning tools.

For the qualitative phase, 20 students and 10 teachers were selected from the survey participants to participate in semi-structured interviews. These interview participants were chosen to represent different educational levels, school types (urban and rural), and regions where digital music education initiatives, including E-LokalTunes, had been implemented. The study was

conducted over a six-month period from June to December 2024, covering online surveys, interviews (virtual and in-person), and selected classroom observations.

2. Data collection

This study employed a mixed-methods approach involving surveys, interviews, and classroom observations to investigate how digital platforms influence cultural awareness in music education. In the quantitative phase, structured online questionnaires were administered to 200 students and 50 teachers who had used *E-LokalTunes* in their music learning or teaching. The student questionnaire consisted of 25 likert-scale items covering four key factors: student engagement with digital music content, perceived cultural learning outcomes, accessibility and technological support, and attitudes toward local and global musical traditions. The teacher questionnaire included 20 items that addressed digital pedagogy, student engagement, cultural awareness development, and implementation challenges. Both instruments were pilot-tested and revised based on feedback to improve clarity and content relevance. The internal consistency of the instruments was confirmed, with a Cronbach's alpha score of .89, indicating strong reliability. Additionally, a pre-test and post-test were conducted with student participants to assess changes in their cultural awareness after using *E-LokalTunes*. In the qualitative phase, semi-structured interviews were carried out with 20 students and 10 teachers selected purposively from among the survey participants. The interviews explored their experiences with digital learning, including their engagement with cultural content, teaching or learning strategies, technological challenges, and perceptions of cultural awareness. Classroom observations were conducted in selected schools and universities where digital music instruction using E-LokalTunes was implemented. Observational data focused on instructional practices, student interactions, and the integration of cultural content through digital tools. The combination of surveys, interviews, and observations allowed for data triangulation and provided a rich, multidimensional understanding of how digital platforms affect cultural learning in music education. Classroom observations were conducted in 3 classes across 2 selected schools where E-LokalTunes was implemented. Each observation session lasted 45-60 minutes, focusing on instructional practices, student engagement with the digital content, and the integration of cultural elements in music lessons.

3. Data analysis

The study applies separate analyses for quantitative and qualitative data, which are later integrated to provide a comprehensive interpretation of the findings. Quantitative data from surveys and pre-post assessments are analyzed using descriptive statistics, including mean, standard deviation, and frequency distribution, to summarize students' and teachers' responses. To determine significant differences in cultural awareness levels before and after using E-LokalTunes, inferential statistical tests, such as paired t-tests and ANOVA, are employed. The paired t-test was selected to compare students' cultural awareness scores before and after the intervention within the same group, making it suitable for measuring the effect of digital platform use over time. ANOVA was used to assess whether students from different educational levels (e.g., junior and senior high school) experienced significantly different outcomes in cultural awareness, providing insight into how grade level may influence the effectiveness of digital learning. Additionally, correlation analysis is used to examine relationships between students' engagement with digital platforms and their perceived cultural learning outcomes.

The student survey consisted of three main components: (1) likert-scale items measuring student engagement with digital platforms (e.g., frequency of use, perceived ease of use); (2) items assessing the perceived effectiveness of digital tools in enhancing cultural awareness (e.g., exposure to diverse musical traditions, appreciation of local music); and (3) pre-post assessment items to evaluate changes in students' understanding and attitudes toward cultural elements in music. In this study, a pre-test was administered at the beginning of the intervention period to establish a baseline measurement of participants' cultural awareness and knowledge of Indonesian traditional music. While the participants were already familiar with E-LokalTunes, the pre-test was designed to assess their initial understanding of general concepts related to Indonesian music and cultural diversity prior to the intensive use of the platform.

For qualitative data, thematic analysis was conducted through a systematic six-phase approach: (1) familiarization with data, where interview transcripts and observational notes were read multiple times to ensure deep engagement with the content, (2) generating initial codes, using an open coding process to identify meaningful segments in the data, (3) searching for themes, where codes were clustered into broader categories reflecting key aspects of digital music education experiences, (4) reviewing themes, refining and merging overlapping themes to enhance clarity and coherence, (5) defining and naming themes, ensuring that each theme accurately represented the underlying patterns, and (6) producing the report, where themes were supported

by representative quotes from participants to provide contextual depth.

The thematic coding framework focused on four core themes: (a) teacher adaptation to digital pedagogy, examining instructional shifts and professional development needs, (b) student engagement and cultural learning, exploring how digital platforms influenced students' interaction with diverse musical traditions, (c) technological challenges and accessibility, highlighting barriers such as digital literacy gaps and infrastructure limitations, and (d) perceived impact on cultural awareness, analyzing reflections on the development of cross-cultural musical appreciation. To ensure intercoder reliability, a second researcher independently coded 20% of the qualitative data, achieving a Cohen's kappa score of 0.82, indicating strong agreement. The qualitative findings were then triangulated with quantitative survey results to establish a robust, multidimensional interpretation of how digital platforms influence cultural awareness in music education.

4. The E-LokalTunes platform

E-LokalTunes is a web-based digital platform developed to enhance students' understanding and appreciation of Indonesian cultural heritage through music education. The platform was specifically designed for educational purposes and is suitable for learners at various grade levels, including elementary, junior high, and senior high schools. The platform hosts a diverse collection of traditional songs from all 38 provinces in Indonesia, each accompanied by the corresponding lyrics, musical notation, and audiovisual content. Each song page is contextually enriched with region-specific cultural elements, such as visual illustrations of traditional costumes, architecture, and regional motifs. This cultural framing aims to foster not only musical skills but also cultural awareness and identity.

In terms of pedagogical design, E-LokalTunes integrates audiovisual elements that allow students to engage in sing-along activities and immediate musical practice. An interactive quiz feature is included to reinforce learning and assess students' understanding of both musical and cultural content. The platform is fully responsive and optimized for both desktop and mobile devices, ensuring accessibility and convenience in diverse classroom settings. In this study, E-LokalTunes was integrated into the regular music curriculum over a period of six weeks. Students used the platform for approximately two 45-minute sessions per week, either during school hours or as part of structured online assignments. The implementation took place in formal music classes facilitated by school music teachers, who followed a lesson plan aligned with the features of the platform. Teachers guided students in exploring the cultural background of each

song, practicing singing with audiovisual support, and completing quizzes that assessed both musical and cultural understanding.

Ⅳ. Results

1. Quantitative findings

The survey responses from 200 students and 50 teachers provide comprehensive insights into the impact of E-LokalTunes on cultural awareness in music education. The pre-test and post-test assessments show a significant increase in students' cultural awareness scores after engaging with the platform ($M = 3.16$, $SD = .74$ in the pre-test vs. $M = 4.48$, $SD = .47$ in the post-test, $t(199) = -22.19$, $p < .001$, Cohen's $d = 1.97$). This substantial effect size confirms that digital platforms, particularly E-LokalTunes, play a crucial role in enhancing students' understanding and appreciation of diverse musical traditions.

<Table 1> Descriptive statistics of cultural awareness score

Measurement	N	Mean	SD	Min	Max
Pre-test	200	3.16	.74	1.1	5
Post-test	200	4.48	.47	2.56	5

<Table 2> Paired t-test for pre-test and post-test cultural awareness scores

Measurement	Mean difference	t-value	df	p-value	Effect size (Cohen's d)
Pre vs. Post-test	1.32	-22.19	199	< .001	1.97 (large)

Survey data further indicate high levels of student engagement with digital learning. 82% of students agreed that E-LokalTunes made learning about different musical cultures more interactive and enjoyable, while 76% reported that the platform helped them explore non-Western music traditions, which were previously underrepresented in their curriculum. Correlation analysis reveals a strong positive relationship ($r = .72$, $p < .001$) between students' engagement with digital tools and their perceived improvement in cultural awareness, suggesting that higher interaction with digital resources leads to more significant cultural learning gains.

Teachers' perspectives align with these trends, with 84% of teachers agreeing that integrating E-LokalTunes into their lessons improved students' interest in exploring different musical traditions. However, 36% of teachers reported facing technical challenges and insufficient training in utilizing digital platforms for culturally inclusive teaching. These findings indicate that while digital tools effectively foster cultural awareness, teacher readiness and infrastructure support remain critical factors for successful implementation.

<Table 3> ANOVA analysis: Cultural awareness by education level

Source	SS	sf	MS	F	p-value
Between groups	.172	1	.172	.50	.48
Within groups	67.528	198	.341		
Total	67.700	199			

To examine whether changes in cultural awareness scores varied by education level, a one-way ANOVA was conducted. Results indicate that there are no statistically significant differences across different educational levels ($F(1.198) = .50$, $p = .48$), suggesting that the effectiveness of E-LokalTunes in fostering cultural awareness is consistent among students from diverse educational backgrounds. This finding supports the broad applicability of digital platforms in enhancing music education, regardless of students' academic levels.

While the ANOVA results indicate no significant statistical difference, qualitative data provide deeper insights into how students at different educational stages experienced cultural learning through the digital platform. Students in elementary school often used affective and sensory-based language when describing their experiences. For example, one student said, "I like hearing music from other islands—it sounds fun and different." These responses suggest a natural curiosity and affective engagement, albeit without deeper reflection on cultural context.

In contrast, secondary and university-level students exhibited a more reflective and analytical engagement. A university student shared, "Exploring traditional music through the platform helped me understand how music reflects cultural identity and social values." Such responses indicate higher-level cognitive processing and deeper appreciation of cultural meanings. These patterns imply that while effectiveness is consistent across levels, the depth of engagement and interpretation evolves with students' cognitive and developmental stages. This supports the idea that differentiated scaffolding or level-appropriate content design may further enrich students' cultural learning experiences when using digital platforms.

2. Qualitative findings

The thematic analysis of 20 student interviews and 10 teacher interviews revealed four core themes aligned with the study's analytical framework: (1) teacher adaptation to digital pedagogy, (2) student engagement and cultural learning, (3) technological challenges and accessibility, and (4) perceived impact on cultural awareness. These themes were supported by quantitative survey data, offering a multidimensional perspective on the integration of digital platforms in music education.

The first theme, teacher adaptation to digital pedagogy, highlights the instructional shifts teachers experienced in response to digital learning demands. While teachers acknowledged the platform's potential, they expressed a need for more structured training and curriculum-aligned resources. One teacher stated, "The platform is useful, but we still need clear guidance and support on how to adapt our lessons digitally." Survey results echo this concern, with 36% of teachers indicating challenges due to limited pedagogical and technological preparation. The integration of these qualitative insights with the survey results illustrates the crucial need for ongoing professional development and tailored resources to enhance digital pedagogy in music education.

The second theme, student engagement and cultural learning, demonstrates how digital platforms like E-LokalTunes increased students' curiosity and participation in music learning. Students described the platform as immersive and interactive, allowing exploration of both local and international musical traditions. One student reflected, "Before using the platform, I didn't pay attention to traditional music. Now, I'm more curious about gamelan and regional songs." This aligns with survey findings where 82% of students agreed the platform made cultural content more engaging. The qualitative data, in this case, adds depth to the numerical findings, showing how students' individual experiences of cultural learning were enriched through the use of the platform.

The third theme, technological challenges and accessibility, addresses infrastructural and digital literacy barriers encountered during implementation. Both students and teachers reported issues such as unstable internet and limited access to devices, especially in rural areas. A teacher shared, "Students in my area often can't access the platform smoothly due to poor internet." In addition to these technological barriers, digital literacy emerged as a key challenge. Many students and teachers struggled with navigating the platform effectively due to insufficient digital skills. One teacher noted, "Some students are unfamiliar with how to use certain features of the platform, which slows down the learning process." Similarly, several students mentioned difficulties in fully utilizing the platform's interactive features, which they attributed to a lack of experience

with digital tools. This digital literacy gap was quantitatively reflected in the survey, where 28% of students reported difficulties in using the platform not only due to connectivity problems but also because of a lack of basic digital competencies. These findings indicate that, in addition to improving technological infrastructure, there is a need for targeted digital literacy training for both teachers and students to ensure more effective engagement with digital platforms.

Finally, the fourth theme, perceived impact on cultural awareness, captures how students' exposure to diverse musical content influenced their appreciation of cultural identity. Many students mentioned that the experience helped them reflect on their own traditions in relation to others. One student said, "Using this platform made me realize how unique my culture is compared to others. It helped me see the beauty in diversity." This was reinforced by survey data, where 76% of students agreed the platform enriched their understanding of non-Western music, which is often underrepresented in formal curricula.

3. Integration of quantitative and qualitative findings

The integration of statistical and thematic analyses provides strong evidence that digital platforms significantly enhance cultural awareness in music education. The pre-test and post-test assessments demonstrate a substantial improvement in students' cultural awareness scores (M = 3.2, SD = .8 to M = 4.5, SD = .6, p <.01), confirming the positive impact of digital learning on students' understanding of cultural diversity. Moreover, the correlation analysis (r = .72, p < .01) reveals a strong positive relationship between student engagement with digital tools and their perceived cultural learning outcomes, reinforcing the theme of student engagement and cultural learning.

These quantitative results are further supported by qualitative findings, particularly in themes such as perceived impact on cultural awareness and teacher adaptation to digital pedagogy, where students and teachers shared how digital platforms enhanced cultural exploration and pedagogical practices. For instance, student reflections highlighted increased appreciation for local and global musical traditions, while teachers emphasized the need for structured support in adapting digital tools to culturally responsive instruction.

However, the study also identifies persistent challenges that must be addressed to optimize the effectiveness of digital platforms in music education. The theme of technological challenges and accessibility resonates with both the qualitative interviews and survey responses, underscoring issues such as limited digital infrastructure, unstable connectivity, and insufficient teacher training. These factors continue to hinder equitable and seamless implementation of digital learning,

particularly in under-resourced settings. Despite these limitations, the findings suggest that with targeted improvements in training, infrastructure, and access, digital platforms—such as *E-LokalTunes*—can serve as powerful tools to foster cultural engagement and awareness in music education across diverse educational contexts.

Ⅴ. Discussion

The findings of this study demonstrate that E-LokalTunes significantly enhances students' cultural awareness in music education by providing an interactive and immersive learning experience. The quantitative results reveal a statistically significant improvement in students' cultural awareness scores after engaging with the platform, as indicated by the pre-test (M = 3.2, SD = .8) and post-test (M = 4.5, SD = .6) results ($p < .01$). Furthermore, the strong positive correlation (r = .72, $p < .01$) between students' engagement with the platform and their perceived cultural learning outcomes supports previous research highlighting the role of digital learning environments in fostering deeper cultural understanding (Himonides & Purves, 2021).

The qualitative findings provide further insights into how digital platforms like E-LokalTunes shape students' and teachers' experiences. Students reported increased engagement with cultural music content, suggesting that interactive and multimedia-based learning approaches are more effective than traditional textbook-based methods. Teachers also acknowledged the potential of digital platforms in broadening students' exposure to diverse musical traditions, aligning with previous studies that emphasize the importance of culturally inclusive pedagogy in music education (Schippers, 2010). However, both students and teachers identified technical and accessibility challenges as barriers to fully utilizing E-LokalTunes, particularly in remote areas with limited internet connectivity. These findings are consistent with prior research on digital divide issues in education (Selwyn, 2022), emphasizing the need for improved infrastructure and institutional support for technology-enhanced learning.

Moreover, the study highlights the need for teacher training and professional development in integrating digital tools into culturally responsive music instruction. While 84% of teachers recognized the benefits of using E-LokalTunes, 36% reported difficulties due to limited training in digital pedagogy. This finding aligns with previous research, which underscores that while digital resources are valuable, their effectiveness depends on educators' ability to strategically incorporate them into the curriculum (Bauer, 2014). The challenges experienced by teachers

highlight the importance of TPACK in successfully implementing digital music education. Without adequate training in balancing the technological, pedagogical, and content knowledge components, teachers may struggle to effectively use digital platforms for fostering cultural awareness. Future initiatives should focus on developing structured training programs that enhance teachers' TPACK competencies, enabling them to integrate digital tools into culturally responsive teaching more effectively.

This issue resonates with international findings, such as a recent study in Thailand, which adapted the TPACK framework into MTPACK (Musical TPACK) to evaluate the needs of secondary music teachers (Laithong et al., 2025). The study revealed significant gaps in TPK, TCK, PCK, which hindered effective technology integration. Thai teachers emphasized the need for practical training, structured lesson plans, and exposure to music education software—concerns that mirror those voiced by participants in the current study. This parallel suggests that the challenges in implementing digital platforms in music education may be regional and systemic, requiring broader policy-level responses in professional development and infrastructure planning.

Additionally, the study findings emphasize that the successful implementation of digital platforms like E-LokalTunes is influenced by the availability of adequate digital infrastructure. Limited access to stable internet connections and technological resources affects the extent to which teachers can fully leverage digital tools in music instruction. This issue is particularly relevant within the TPACK framework, as access to technology is a prerequisite for developing and applying technological knowledge in educational contexts. A related international study from Kosovo supports this finding, indicating that students using digital resources demonstrated higher interest, creativity, and collaboration in music learning (Rexhepi et al., 2024). The study also emphasized how digital technologies help optimize time, preserve music resources, and promote active learning—outcomes also observed in the present research. Such international alignment underlines the global relevance of digital innovation in music education and the need for context-sensitive strategies to maximize its benefits.

The integration of quantitative and qualitative findings suggests that while E-LokalTunes effectively enhances cultural awareness, its implementation requires further technological, pedagogical, and institutional support. To maximize its impact, educational institutions should invest in better digital infrastructure, provide continuous training for educators, and develop collaborative strategies for integrating cultural content into music education curricula. Strengthening teachers' TPACK competencies will be crucial in ensuring that digital platforms are used effectively to foster cultural engagement and musical understanding.

1. Digital literacy in music education

The study's findings underscore that access to digital platforms alone is insufficient without the requisite digital literacyamong teachers to utilize them effectively. This is consistent with the TPACK framework, which emphasizes the integration of technological, pedagogical, and content knowledge in meaningful teaching practice (Mishra & Koehler, 2006). Teachers' difficulties in implementing E-LokalTunes due to limited digital competencies mirror findings from Thailand (Laithong et al., 2025), where even teachers in music-intensive programs struggled to apply digital tools without structured training and exposure to music-related software. Moreover, this aligns with international findings from Kosovo, where Rexhepi et al. (2024) found that teacher digital literacy significantly influenced students' engagement, creativity, and collaboration in digital music projects. These parallels suggest that strengthening teacher digital literacy is a global imperative in the digital transformation of music education. Future initiatives must not only improve infrastructure but also focus on targeted professional development that builds teachers' confidence and competence in using digital platforms for culturally inclusive music teaching.

2. Implications for music education

This study offers several implications for the future of music education in digital environments. First, the findings reinforce the importance of integrating interactive learning tools that actively support students' engagement with diverse musical traditions, thereby enhancing digital pedagogies.

Second, to address digital inequality, policymakers and educators must collaborate to develop practical solutions that bridge the digital divide and ensure equitable access to technology-assisted learning for all students. Third, structured professional development programs should be established to equip educators with the necessary skills and knowledge to effectively integrate digital platforms into culturally inclusive teaching practices, particularly by strengthening their Technological Pedagogical Content Knowledge (TPACK) competencies.

3. Limitations and future research

While this study provides valuable insights, several limitations should be acknowledged. First, the study focuses on one digital platform (E-LokalTunes), which may limit the generalizability

of findings to other music education technologies. Second, self-reported data from surveys and interviews may introduce response bias, as participants might overestimate their learning experiences. Future research should include longitudinal studies to examine the long-term impact of digital platforms on students' cultural development and explore comparative studies between different digital learning tools in music education.

Ⅵ. Conclusion

This study demonstrates the transformative role of digital platforms in enhancing cultural awareness within music education. The integration of E-LokalTunes not only increased student engagement but also expanded their exposure to diverse musical traditions, illustrating how technology can bridge cultural divides in the learning process. Quantitative results showed significant gains in students' cultural awareness, while qualitative data revealed increased curiosity and appreciation for both local and global music traditions—affirming the value of interactive digital tools in fostering cultural literacy.

At the same time, the study highlights key challenges that must be addressed. Limited teacher digital literacy, technical infrastructure gaps, and insufficient training hinder the full potential of digital integration. These findings call for targeted professional development and systemic support to ensure that digital platforms are effectively aligned with curricular goals and pedagogical strategies.

Moving forward, digital tools should be viewed not merely as technological add-ons, but as integral components of culturally responsive music education. Continued collaboration among educators, policymakers, and developers is essential to ensure accessibility, sustainability, and pedagogical relevance. By thoughtfully embedding digital platforms into the classroom, music education can evolve into a more inclusive, immersive, and culturally meaningful experience.

References

Banut, M., & Albulescu, I. (2024). Technology-enhanced thinking scaffolding in musical education. *Journal on Efficiency and Responsibility in Education and Science, 17*(4),

273-285. https://doi.org/10.7160/eriesj.2024.170401

Bauer, W. I. (2014). *Music learning today: Digital pedagogy for creating, performing, and responding to music*. Oxford University Press.

Björk, C., Ruthmann, S. A., Granfors, M., Högväg, J., & Andersson, S. (2021). The potential of a mixed-methods approach for research on learning to theorise music. *Music Education Research, 23*(3), 374-390. https://doi.org/10.1080/14613808.2020.1853085

Camlin, D. A., & Lisboa, T. (2021). The digital 'turn' in music education (Editorial). *Music Education Research, 23*(2), 129-138. https://doi.org/10.1080/14613808.2021.1908792

Campbell, P. S. (2004). *Teaching music globally: Experiencing music, expressing culture*. Oxford University Press.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

Deliyannis, I., Özarslan, Y., Toulis, I., Longo, R., Emmanouil, M., & Mylonas, N. (2024). Navigating digital frontiers in music education: The MUSENSE project's contribution to e-learning. *European Journal of Contemporary Education and E-Learning, 2*(2), 57-64. https://doi.org/10.59324/ejceel.2024.2(2).05

Elliott, D. J., & Silverman, M. (2015). *Music matters: A philosophy of music education*. Oxford University Press.

Good, A., Sims, L., Clarke, K., & Russo, F. A. (2021). Indigenous youth reconnect with cultural identity: The evaluation of a community- and school-based traditional music program. *Journal of Community Psychology, 49*(2), 588-604. https://doi.org/10.1002/jcop.22481

Himonides, E., & Purves, R. (2021). *Digital learning environments in music education: Challenges and opportunities*. Oxford University Press.

Ho, W. C. (2021). Digitalization and music learning: Innovations, challenges, and future trends. *International Journal of Music Education, 39*(4), 478-495.

Joseph, D., & Merrick, B. (2021). Australian music teachers' reflections and concerns during the pandemic: Resetting the use of technologies in 21st century classroom practice. New *Zealand Journal of Teachers' Work, 18*(2), 109-126. https://doi.org/10.24135/teacherswork.v18i2.325

Kayaoglu, M. N. (2015). Cultural awareness in foreign language teaching: A perspective from Turkish EFL teachers. *Procedia - Social and Behavioral Sciences, 199*, 682-687. https://doi.org/10.1016/j.sbspro.2015.07.597

Laithong, T., Udtaisuk, D., & Khlaisang, J. (2025). Needs and solutions for secondary music teachers in Thailand through the lens of TPACK framework. *Korean Journal of*

Research in Music Education, 54(1), 333-350. https://doi.org/10.30775/KMES.54.1.333

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Ng, D. T. K., Ng, E. H. L., & Chu, S. K. W. (2022). Engaging students in creative music making with musical instrument application in an online flipped classroom. *Education and Information Technologies, 27*(1), 45-64. https://doi.org/10.1007/s10639-021-10568-2

Prest, A., Goble, J. S., Vazquez-Cordoba, H., & Tuinstra, B. (2021). Enacting curriculum 'in a good way:' Indigenous knowledge, pedagogy, and worldviews in British Columbia music education classes. *Journal of Curriculum Studies, 53*(5), 711-728. https://doi.org/10.1080/00220272.2021.1890836

Rexhepi, F. G., Breznica, R. K., & Rexhepi, B. R. (2024). Evaluating the effectiveness of using digital technologies in music education. *Journal of Educational Technology Development and Exchange, 17*(1), 273-289. https://doi.org/10.18785/jetde.1701.16

Richardson, T. L. (2012). Programming tips from HBCUs for engaging African-American students at predominantly White institutions (PWIs). *Campus Activities Programming, 45*(1), 32-33.

Rucsanda, M. D., Belibou, A., & Cazan, A.-M. (2021). Students' attitudes toward online music education during the COVID-19 lockdown. *Frontiers in Psychology, 12*, 753785. https://doi.org/10.3389/fpsyg.2021.753785

Savage, J. (2010). Crosscurrents: Developments in technology-assisted music learning. *British Journal of Music Education, 27*(2), 177-188.

Schippers, H. (2010). *Facing the music: Shaping music education from a global perspective*. Oxford University Press.

Schmidt, P. (2012). Music education as transformative practice: Creating new frameworks for learning music through engagement with culture. *International Journal of Music Education, 30*(2), 99-103.

Schuitema, J., & Veugelers, W. (2011). Multicultural contacts in education: A case study of an exchange project between different ethnic groups. *Educational Studies, 37*(1), 101-114. https://doi.org/10.1080/03055691003729252

Selwyn, N. (2022). The future of AI and education: Some cautionary notes. *European Journal of Education, 57*, 620-631. https://doi.org/10.1111/ejed.12532

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning, 2*(1), 3-10.

Sinaga, S. S., Widayanti, M., Andaryani, E., & Muchsin, I. (2023). Simple arrangement of children's song with trilingual characters as learning media for PGSD and PGMI students. *Jurnal Seni Musik, 12*(2), 240-246. https://doi.org/10.15294/jsm.v12i2.76556

Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. SAGE Publications.

Webster, P. (2011). Construction of music learning in online and face-to-face environments: A comparative analysis. *Journal of Music, Technology & Education, 4*(2-3), 231-247.