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Research Article ♪ Araştırma Makalesi

Academic perspectives on the use of digital platforms and mobile applications in vocal training

Şan eğitiminde dijital platformların ve mobil uygulamaların kullanımına yönelik akademisyen görüşleri

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ABTRACT

This study aims to evaluate the effects of digital platforms and mobile applications on vocal training. Employing qualitative methods, the research analyzed the perspectives of 12 music academics working at various universities in Turkey. Data were collected through semi-structured interviews. The findings revealed that digital platforms provide students with flexibility, enabling time- and location-independent practice, support the development of technical skills, and offer access to an extensive musical repertoire. However, it was also concluded that fundamental elements of vocal training, such as vocal resonance, breath control, and articulation, are taught more effectively through one-on-one feedback under the supervision of an instructor. The study identified that digital platforms fail to fully provide such critical feedback and exhibit pedagogical limitations. The research concluded that digital platforms should be used in a balanced manner alongside traditional methods in vocal training, as academics predominantly view digital tools as supplementary aids. Furthermore, it was suggested that integrating artificial intelligence-supported systems and advanced sound technologies into the educational process could enhance the effectiveness of digital platforms. In this context, the contributions and limitations of digital technologies in vocal training were discussed, and various recommendations were proposed for future research.

Keywords: vocal training, digital platforms, mobile applications

ÖZ

Bu çalışma, dijital platformların ve mobil uygulamaların ses eğitimine etkilerini değerlendirmeyi amaçlamaktadır. Nitel yöntemlerin kullanıldığı araştırmada, Türkiye'deki çeşitli üniversitelerde görev yapan 12 müzik akademisyeninin görüşleri analiz edilmiştir. Veriler yarı yapılandırılmış görüşmeler yoluyla toplanmıştır. Bulgular, dijital platformların öğrencilere zaman ve mekandan bağımsız çalışma imkanı sağlayarak esneklik sunduğunu, teknik becerilerin geliştirilmesini desteklediğini ve geniş bir müzikal repertuara erişim sağladığını ortaya koymuştur. Bununla birlikte, ses rezonansı, nefes kontrolü ve artikülasyon gibi ses eğitiminin temel unsurlarının, bir eğitmen gözetiminde birebir geri bildirimle daha etkili bir şekilde öğretildiği sonucuna varılmıştır. Çalışmada, dijital platformların bu tür kritik geri bildirimleri tam anlamıyla sağlayamadığı ve pedagojik sınırlılıklar sergilediği tespit edilmiştir. Araştırma, ses eğitiminde dijital platformların geleneksel yöntemlerle dengeli bir şekilde kullanılmasının gerektiğini, akademisyenlerin dijital araçları ağırlıklı olarak tamamlayıcı birer yardımcı olarak gördüklerini ortaya koymuştur. Ayrıca, yapay zeka destekli sistemlerin ve ileri ses teknolojilerinin eğitim sürecine entegre edilmesinin dijital platformların etkinliğini artırabileceği önerilmiştir. Bu bağlamda, ses eğitiminde dijital teknolojilerin katkıları ve sınırlamaları tartışılmış ve gelecekteki araştırmalar için çeşitli öneriler sunulmuştur.

Anahtar kelimeler: ses eğitimi, dijital platformlar, mobil uygulamalar

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1. INTRODUCTION

Vocal training is a disciplined process aimed at developing the human voice both technically and artistically, with the objective of maximizing individuals' vocal potential. This training process largely involves the development of voice control, breathing techniques, vocal health maintenance, and musical interpretation skills. At the undergraduate level, vocal training is traditionally conducted through face-to-face lessons involving direct, one-on-one interactions between students and instructors. However, the increasing use of digital technologies in education has paved the way for the emergence of new teaching and learning methods in many fields, including vocal training. Digital platforms and mobile applications (DPMAs) offer various materials and methods to enhance the learning experience, providing students with flexibility and support for individual practice. In the domain of vocal training, where physical voice control and immediate feedback are critical, the effectiveness of these digital tools and their potential to replace traditional methods remain subjects of debate. Digital platforms, while providing accessibility and repeatability for vocal training processes, may not be as effective as face-to-face instruction in delivering personalized guidance and real-time feedback. Elements such as evaluating students' vocal performance and developing breathing control are often more effectively achieved through the direct supervision of instructors, suggesting the limitations of digital technologies in these areas. Nevertheless, digital platforms and mobile applications can make training more flexible by enabling time- and location-independent learning, particularly for specific technical aspects of vocal training.

Understanding the contributions and limitations of DPMAs in vocal training is essential for assessing the impact of digitalization on the quality of education. This study investigates the perspectives of academics on the use of digital platforms and mobile applications in vocal training. The primary objective is to analyze the contributions, limitations, and integration of DPMAs into traditional methods from an academic perspective. Additionally, this research evaluates the effects of digital tools on student motivation, creativity, individual learning processes, and instructor-student interactions. By addressing the impact of digital technologies on vocal training, this study aims to contribute to the development of pedagogical approaches in this field.

1.1. Relevant Researches

The widespread use of digital technologies in education has significantly influenced various disciplines, particularly in recent years, and has garnered substantial attention in academic research. Educational technologies, through distance learning, online platforms, and mobile applications, support educational processes and bring about various transformations. Music education has been one of the fields most affected by digitalization, sparking diverse discussions, especially in disciplines like vocal training, which rely heavily on individual skill development. Digital platforms and mobile applications (DPMAs) offer numerous possibilities for integrating instructional processes in vocal training, presenting the potential to complement traditional teaching methods and provide alternative learning pathways (Shi, 2021). Consequently, studies on the impact of digital technologies on vocal training highlight not only their opportunities but also their limitations.

Vocal training is a highly specialized learning process aimed at equipping students with proper vocal techniques, preserving vocal health, and enhancing musical expression. Traditionally conducted in face-to-face, one-on-one settings, this process is tailored to individual students and their unique vocal characteristics. Numerous studies have examined the effects of vocal training programs on voice quality and vocal health. For instance, research by Hazlett et al. (2011) demonstrated that vocal training improves the voice quality of professional voice users and plays a crucial role in maintaining vocal health. Similarly, Ilomäki et al. (2008) found that vocal training and hygiene education significantly improved voice quality and vocal well-being among teachers.

Academics contribute to vocal training by providing immediate feedback on students' voices, aiding in the development of essential skills such as breathing techniques, resonance, and articulation. As such, vocal training requires a personalized educational model where physiological and technical aspects are taught through direct interaction. However, the integration of digitalization into educational processes has led to various experiments and implementations aimed at adapting vocal training to these new technologies. Shi (2021) highlighted that mobile applications and internet platforms enable students to develop auditory skills, accompany recordings in real-time, and engage in diverse musical activities, suggesting that vocal training could align with modern digital trends.

One of the most notable contributions of digital platforms to vocal training is their accessibility (Derda, 2022). These platforms allow students to access a vast musical repertoire, observe performances by various artists, and engage in exercises suited to their technical abilities. Additionally, digital environments offering voice and breathing exercises can play a guiding role during individual practice sessions (Doğanyiğit & İslim, 2021). These applications provide several advantages for developing technical skills, musical interpretation, and analysis processes. Musicality and interpretive skills, integral to vocal training, can be supported by the extensive repertoire and diverse interpretative techniques available through digital platforms, offering students opportunities to enrich their musical expression. Technologies such as mobile applications and internet-based platforms make these possibilities achievable. For instance, Shi (2021) noted that mobile applications allow students to enhance auditory skills, accompany recordings in real time, and explore various musical genres. Research also highlights that digital technologies, particularly online learning platforms, became crucial alternatives during times when face-to-face education was not feasible, such as during the COVID-19 pandemic (Salas-Pilco et al., 2022). Despite these benefits, Zhang (2016) pointed out that the inability to fully teach intricate details such as the physiological control of the voice and vocal production techniques in digital environments constitutes a limitation of these platforms.

Studies on digital vocal training indicate that while digital tools support technical skill development, aspects such as resonance, breath control, and articulation are more effectively learned under face-to-face instructor supervision (Phillips, 1985; Shi, 2021). Given the need for individual feedback and instant corrections in vocal training, digital technologies are not yet capable of providing such feedback comprehensively (Thorpe et al., 1999). Hence, instructor-student interaction remains as significant as the advantages provided by digital platforms. Personalized guidance and real-time performance evaluations by instructors enhance the quality of education. The inability of digital platforms to fully replicate these interactions reinforces the indispensability of face-to-face teaching in vocal training. Some research suggests that the contributions of digital technologies to vocal training extend beyond technical skill development, enhancing student motivation and creativity. Opportunities for students to observe and analyze performances by various artists foster creativity and provide a platform to develop musical expression (Barbot & Lubart, 2012). Digital platforms also allow students to compare professional performances with their own, boosting confidence and fostering self-awareness. Meta-analyses, such as the one by Alshammary and Alhalafawy (2023), indicate that digital platforms generally have a positive impact on learning outcomes and student performance.

Artificial intelligence (AI)-based education platforms are increasingly being explored in vocal training. AI holds potential for offering personalized feedback, conducting voice analyses, and designing vocal exercises tailored to individual needs. By providing real-time feedback, AI technologies can assist students in achieving better vocal control. Vinze et al. (2021) noted that AI-driven vocal training applications can analyze voice recordings, present statistical graphs, and help users correct errors quickly, boosting confidence. Virtual reality (VR) technologies used in voice training allow students to control their breathing naturally and produce stronger and more comfortable vocalizations (Doğanyiğit & İslim, 2021; Zhang et al., 2021). However, the role and effectiveness of AI in vocal training remain under scrutiny, with ongoing debates about whether these technologies can replace human instructors. Traditional teaching methods' personalized guidance cannot yet be fully replicated by AI applications, suggesting their role as supportive tools in instructor-led training.

In conclusion, digital platforms and mobile applications offer significant contributions to vocal training, such as enhancing technical skills, motivation, and creativity. However, the literature emphasizes the necessity of integrating digital tools with traditional methods and highlights that the physiological aspects of vocal training are more effectively taught under face-to-face supervision. The undeniable advantages of digital platforms in supporting technical skill development and promoting practice habits should be balanced with instructor-student interactions to enhance the quality of education. Consequently, the role of digital platforms in university-level vocal training should be considered as a supportive and complementary element under academic guidance.

2. METHOD

This study employed qualitative research methods to examine the perspectives of academics teaching musical vocal training at various universities in Turkey regarding the use of digital platforms and mobile applications (DPMAs) in vocal training. Qualitative research focuses on understanding individuals' experiences and their social worlds, aiming to illuminate participants' subjective meanings and social contexts (Denny & Weckesser, 2022; Fossey et al., 2002). The research was conducted within the framework of a phenomenological design,

emphasizing the experiences of academics and their interpretations of those experiences. Phenomenology, as a method, seeks to understand participants' subjective experiences and perceptions of a particular phenomenon (Yüksel & Yıldırım, 2015), making it a suitable approach for exploring the impacts of digital technologies on vocal training.

2.1. Study Group

The study group consisted of 12 academics providing musical vocal training at various universities in Turkey. Participants were selected using a purposive sampling method. This approach allowed the selection of academics who could provide in-depth insights and share their experiences relevant to the research objectives. Key criteria for participant selection included having academic expertise in vocal training and experience with the use of digital technologies in this field. These criteria ensured that the participants could contribute meaningful and informed perspectives to the study.

2.2. Data Collection Method

The research data were collected using a semi-structured interview technique. This method enables researchers to conduct flexible interviews with participants based on a set of pre-prepared questions related to a specific topic. It also allows researchers to focus on certain themes while engaging in a conversational and adaptable interview format. Semi-structured interviews are particularly effective for understanding participants' motivations, attitudes, and beliefs (Adams, 2015). This technique was chosen because it provides participants with the opportunity to express their thoughts, experiences, and perspectives in detail. The interview questions were designed to cover themes such as the contributions and limitations of digital platforms and mobile applications to vocal training, their potential integration with traditional methods, and their impact on student-teacher interactions. Data were collected from participants through online platforms, digital forms, and face-to-face interviews.

2.3. Data Analysis

The analysis of the collected data was conducted using Maxqda Analytical Pro software. Thematic analysis, a widely used method for identifying patterns and themes within data, was employed to systematically evaluate the information. This approach allows researchers to derive meaningful and detailed insights from the data (Thomas & Harden, 2008).

The analysis process began with the transcription of interview data, after which the datasets were coded. During the coding process, careful attention was given to identifying meaningful units and expressions that addressed the research questions. In the thematic analysis phase, participants' experiences and perspectives regarding digital platforms and mobile applications were categorized under specific themes. These themes included:

- Contributions of digital technologies to vocal training,
- Limitations of digital platforms,
- Effects on student motivation and creativity,
- Integration with traditional methods, and
- Impacts on teacher-student interaction.

This systematic thematic approach ensured a comprehensive understanding of the data and its relevance to the research objectives.

2.4. Reliability and Validity

The reliability and validity of the research were ensured through meticulous execution of data collection and analysis processes. The semi-structured interview questions were developed with input from field experts to ensure clarity, comprehensibility, and alignment with the research objectives. Flexibility in scheduling was provided to allow participants to express their thoughts comfortably. During data analysis, the coding process was reviewed by multiple researchers to ensure consistency and accuracy across codes. Continuous feedback was obtained throughout the coding process to maintain coherence. Additionally, the accuracy of the findings

was cross-verified with relevant literature, and the consistency among codes was further evaluated in this context. These measures collectively enhanced the credibility and robustness of the research findings.

2.5. Ethical Issues

The research was conducted in strict adherence to ethical guidelines. Before initiating the study, ethical approval was obtained from the Ethics Committee for Social and Human Sciences of Kahramanmaraş Sütçü İmam University, dated June 6, 2024, with decision number 317685.

Prior to the data collection process, participants were fully informed about the study. It was explicitly communicated that their participation was voluntary, that they could withdraw from the research at any time, and that their personal information would be kept confidential. The data were anonymized during analysis to protect participants' identities, ensuring that their personal details remained private. Throughout the research process, ethical principles and confidentiality were upheld diligently.

3. FINDINGS

The findings of the study were presented within the framework of themes, categories, and codes developed to analyze the impacts of digital platforms and mobile applications on vocal training. To ensure a systematic evaluation of the findings, these elements were organized into matrices.

In the matrices, the rows represented the themes, categories, and codes identified in the research, while the columns were designated for participants. To maintain anonymity, participants were labeled with abbreviations such as "P1," "P2," and so on. This arrangement facilitated a clearer and more traceable presentation of the findings. The themes and categories reflected the core perspectives and experiences of participants regarding the role of digital technologies in vocal training. This structured approach provided a comprehensive and organized representation of the data, making the results easier to interpret and analyze.

3.1. Findings Related to General Attitudes Towards Digital Platforms and Mobile Applications

Matrix 1

General approach to digital platforms and mobile application

Code System	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	SUM
Theme 1. General Approach to DPMA								■					1
Practical Benefits of Digital Platforms in Education													0
Flexibility and individualised learning					■			■					2
Time management and accessibility		■			■			■			■		4
Academics' Concerns about Digitalisation													0
Lack of personal interaction	■			■			■						3
Inadequacy Perception	■			■									2
Suitability of Digital Technologies for Singing Education													0
Sound quality and the personal nature of training	■			■									2
Partial benefits	■			■							■	■	4
Openness and Acceptance of Digital Technologies								■					1
Progress in education with technology			■		■	■	■	■					5
Finding useful	■	■	■			■		■		■			7
Σ SUM	5	2	2	4	3	2	2	7	0	1	2	1	31

Participants exhibited a diverse range of perspectives regarding digital platforms and mobile applications (DPMAs) in vocal training. Matrix 1 illustrates the general attitudes of participants towards digital platforms and mobile applications. Some participants expressed that DPMAs could have positive effects on vocal training and contribute to the educational process when used appropriately. However, the majority indicated that digital technologies cannot fully replace traditional face-to-face vocal training and should instead be utilized as complementary tools. These approaches reflect participants' perceptions of the role of DPMAs in education, as well as their evaluations of the benefits and limitations of these technologies.

A significant portion of participants acknowledged that DPMAs offer certain advantages in the context of vocal training. Notably, these platforms provide opportunities for time- and location-independent practice, helping students develop individual study habits. Participants highlighted that digital platforms enable students to learn at their own pace and practice areas of weakness more effectively due to the platforms' replay features. The necessity of DPMAs during the COVID-19 pandemic was particularly emphasized, as they served as a critical alternative for continuing vocal training when face-to-face education was not possible. During this period, these platforms significantly facilitated the continuation of students' education. These advantages were found to be particularly beneficial in vocal training, which demands intensive individual learning and practice. Despite these benefits, participants pointed out that DPMAs should primarily be used to develop technical skills and in specific areas, as they are limited in addressing the core elements of vocal training. Given that vocal training relies on physical and physiological skills, such as proper breathing techniques, vocal resonance, and vocal control, participants generally agreed that these aspects cannot be effectively taught through digital platforms. Some noted that the subtleties of voice are better taught through one-on-one, instructor-supervised sessions, and that digital tools are insufficient in providing the detailed feedback required for these aspects. Participants also emphasized that the lack of real-time feedback from digital platforms is a major limitation, especially in guiding students through critical technical details of vocal training. Consequently, most participants agreed that DPMAs should not be viewed as a replacement for traditional vocal training but rather as complementary resources.

Another significant finding was the concern among participants regarding the pedagogical implications of DPMAs. While some acknowledged that digital platforms encourage individual practice, they cautioned that these tools may lack sufficient pedagogical guidance and could lead students to adopt incorrect techniques. According to these participants, the risk of students progressing with improper techniques in a digital learning environment is substantial, and such errors can only be corrected through direct instructor intervention. This issue is particularly relevant in vocal training, where individual differences and personalized approaches are paramount. Digital platforms may fail to provide feedback tailored to the needs of every student, potentially causing students to overlook critical mistakes and continue practicing with incorrect techniques.

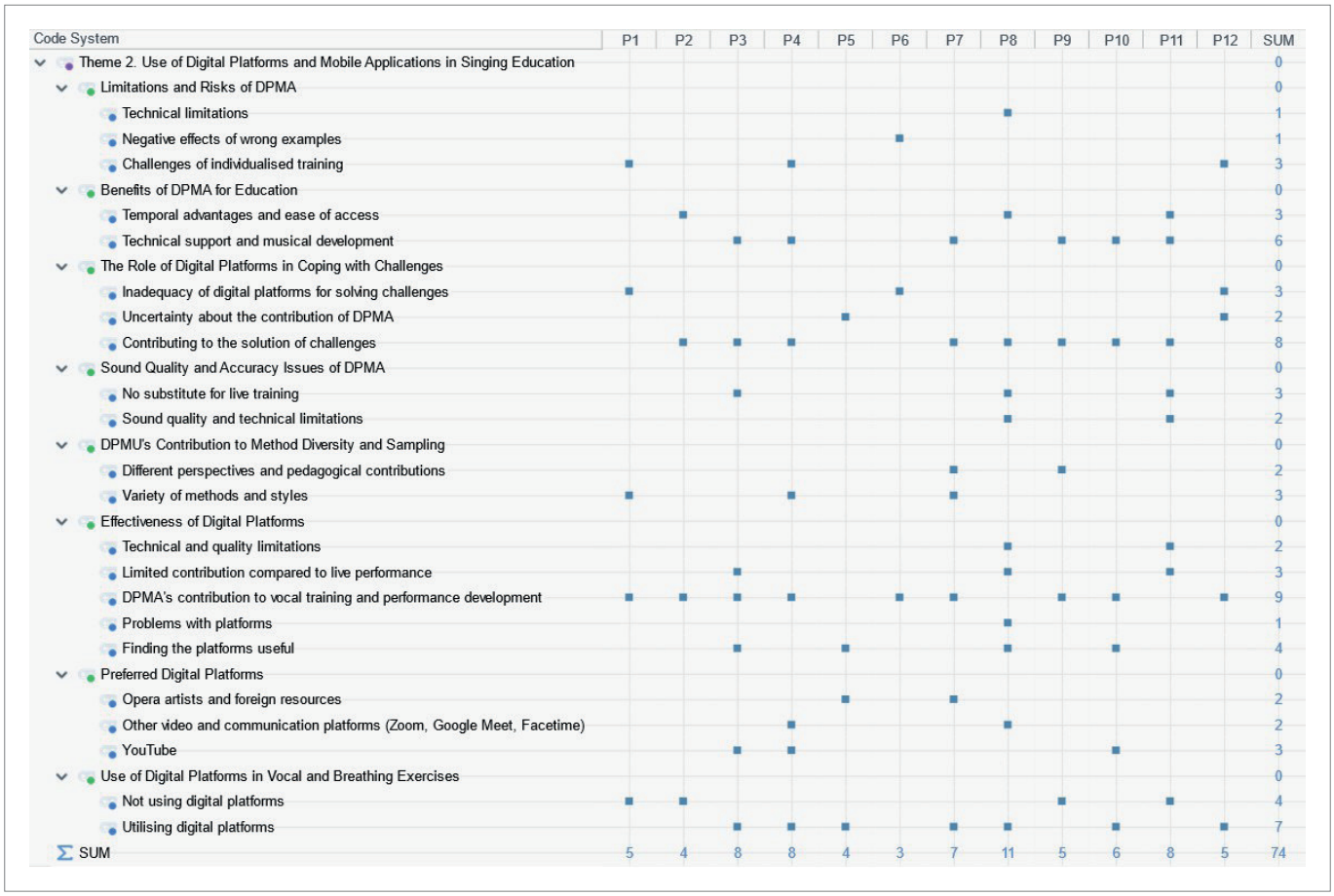
An additional notable finding was the recognition of the potential of DPMAs in education, paired with the necessity of integrating these technologies with traditional methods. Some participants suggested that digital platforms could be effectively used as supportive tools, offering students a more flexible and enriched learning experience when combined with traditional methods. However, there was a general consensus that digital tools cannot replace instructors. While these platforms may assist in areas such as exercises, vocal control, and musicality, they cannot fully substitute the depth of teacher-student interaction that is crucial in vocal training. Several participants indicated that DPMAs would be more effective if integrated as part of one-on-one vocal lessons with an instructor. From this perspective, digital platforms can be beneficial for enhancing technical skills and providing access to extensive musical content, but face-to-face instruction remains indispensable for delivering the physiological feedback fundamental to vocal training. Participants emphasized that digital technologies alone are inadequate for teaching proper vocal techniques and that the personalized corrections provided by instructors are essential components of vocal training.

The findings on participants' general approaches to DPMAs offer both positive and critical evaluations of these technologies' impact on vocal training. While most participants acknowledged the flexibility and opportunities for independent practice offered by digital platforms, they also consistently noted that these tools cannot replace traditional methods. The contributions of DPMAs to vocal training are largely limited to supporting technical skill development and facilitating individual practice, while their lack of pedagogical guidance and real-time feedback represents a significant limitation. Therefore, participants advocated for the balanced use of DPMAs alongside traditional methods to ensure the quality and effectiveness of vocal training.

3.2. Findings on the Use of Digital Platforms and Mobile Applications in Vocal Training

Matrix 2

Coding for the use of digital platforms and mobile applications in singing education



Code System	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	SUM
Theme 2. Use of Digital Platforms and Mobile Applications in Singing Education													0
Limitations and Risks of DPMA													0
Technical limitations								■					1
Negative effects of wrong examples						■							1
Challenges of individualised training	■			■								■	3
Benefits of DPMA for Education													0
Temporal advantages and ease of access		■						■			■		3
Technical support and musical development			■	■			■		■	■	■		6
The Role of Digital Platforms in Coping with Challenges													0
Inadequacy of digital platforms for solving challenges	■					■						■	3
Uncertainty about the contribution of DPMA					■							■	2
Contributing to the solution of challenges		■	■	■			■	■	■	■	■		8
Sound Quality and Accuracy Issues of DPMA													0
No substitute for live training			■					■			■		3
Sound quality and technical limitations								■			■		2
DPMU's Contribution to Method Diversity and Sampling													0
Different perspectives and pedagogical contributions							■		■				2
Variety of methods and styles	■			■			■						3
Effectiveness of Digital Platforms													0
Technical and quality limitations								■			■		2
Limited contribution compared to live performance			■					■			■		3
DPMA's contribution to vocal training and performance development	■	■	■	■		■	■		■	■		■	9
Problems with platforms								■					1
Finding the platforms useful			■		■			■		■			4
Preferred Digital Platforms													0
Opera artists and foreign resources					■		■						2
Other video and communication platforms (Zoom, Google Meet, Facetime)				■				■					2
YouTube			■	■						■			3
Use of Digital Platforms in Vocal and Breathing Exercises													0
Not using digital platforms	■	■							■		■		4
Utilising digital platforms			■	■	■		■	■		■		■	7
Σ SUM	5	4	8	8	4	3	7	11	5	6	8	5	74

Matrix 2 analyzes the use of digital platforms and mobile applications in vocal training. The use of digital platforms and mobile applications (DPMA) in vocal training stands out for its advantages such as flexibility, ease of access, and extensive learning opportunities. However, when compared to traditional educational processes, certain limitations are also evident. Participants approached the usage of DPMA from various perspectives, discussing how these technologies contribute to student development, teacher-student interaction, and the processes of acquiring technical skills. These findings provide an in-depth analysis of the opportunities presented by DPMA and evaluate its role in education.

Most participants emphasized that DPMA plays a significant role in developing technical skills in vocal training. Digital platforms offer a wide variety of content focusing on the core elements of vocal training, such as vocal exercises, breath control, and vocal techniques, which support students in their individual practice. Certain technical exercises, particularly those involving voice and breath control, become repeatable through digital platforms, allowing students to practice more frequently. Participants noted that DPMA is particularly effective for beginner students in vocal training, as it allows them to work on specific technical skills independently of the teacher and reinforce these skills through repetition, providing flexibility in the learning process.

Another significant contribution of DPMA to vocal training is the opportunity it provides for working independently of time and location. Participants highlighted that digital platforms were especially beneficial during times like the pandemic, when face-to-face education was interrupted, offering a vital alternative for continuing educational processes. During this period, students were able to continue their studies independently of their teachers via digital platforms and mobile applications, maintaining an uninterrupted educational experience. This flexibility supported students' individual practice while also enabling instructors to remotely monitor student progress. The freedom offered by DPMA increased students' individual responsibility and allowed them to shape their learning processes at their own pace.

Participants also noted that one of the greatest advantages of digital platforms in vocal training is access to a wide musical repertoire and the development of musical interpretation skills. Digital platforms provide students with the ability to access a broad spectrum of musical genres and to watch and analyze the performances of various artists. This was seen as playing an important role in the development of students' musical expression. Participants mentioned that by observing the interpretations of professional artists, students could learn new things from both technical and aesthetic perspectives, and by analyzing different styles, they could improve their own interpretations. It was emphasized that while such extensive access is limited in traditional face-to-face education, digital platforms offer students the opportunity to easily observe different artists and styles.

Another notable contribution of DPMA is the opportunity for individual feedback and self-assessment. Digital platforms and mobile applications allow students to record their voices, analyze these recordings, and evaluate their performances. This process helps students closely monitor their progress and critically assess themselves. Participants noted that by listening to their own performances, students became more aware of their mistakes and took on more responsibility in correcting these errors, which boosted their confidence. The self-assessment opportunities provided by DPMA enabled students to recognize their technical mistakes independently and follow a more conscious practice process.

However, participants also pointed out the limitations of DPMA in vocal training. The lack of personalized feedback was cited as one of the major disadvantages of digital platforms. In a learning process like vocal training, which is based on individual and physiological differences, each student's vocal structure, technical development, and pedagogical needs vary. Participants stated that DPMA does not sufficiently account for these individual differences, and students working with generalized content may face pedagogical risks. In particular, the failure to detect incorrect practices in a timely manner in areas such as technical skills and proper voice usage could lead to the development of faulty techniques and pose a risk to vocal health. Therefore, it was suggested that DPMA should be strengthened with technologies that can provide more individualized feedback.

Participants also expressed concerns regarding the lack of interaction and insufficient real-time feedback offered by digital platforms. Vocal training is an area in which real-time feedback between teacher and student is of great importance, and the subtle technical details of the voice need to be corrected immediately. Participants noted that digital platforms are inadequate in providing such feedback and that students may find themselves working alone during individual practice sessions. The inability of the teacher to intervene instantly could result in technical errors going unnoticed, which was seen as a significant pedagogical shortcoming. It was especially emphasized that issues like voice resonance, breath control, and articulation should be addressed through one-on-one training under the supervision of an instructor.

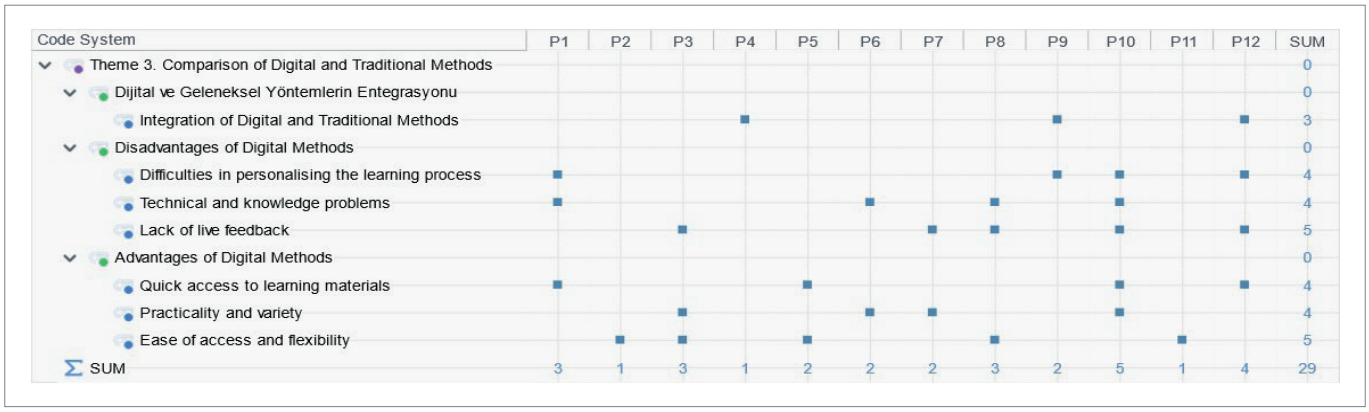
Finally, participants stressed the importance of integrating digital platforms with traditional methods. While acknowledging the significant advantages of digital platforms in developing technical skills and supporting individual study, it was emphasized that these platforms cannot replace teacher-student interaction. Participants argued that digital platforms should be used as part of vocal training alongside traditional face-to-face education. Especially in technical areas that require personalized feedback and real-time correction, teacher-student interaction is considered indispensable. It was suggested that digital platforms should be used as complementary and supportive tools in these processes.

In conclusion, digital platforms and mobile applications contribute significantly to the development of technical skills, the enhancement of individual practice opportunities, and musical analysis in vocal training. However, pedagogical limitations such as the lack of personalized feedback and real-time corrections must be carefully considered when using these platforms. Participants indicated that the balanced use of DPMA in conjunction with traditional methods would yield more effective results in vocal training.

3.3. Findings Related to the Comparison of Digital and Traditional Methods

Matrix 3

Coding for the comparison of digital and traditional methods



Code System	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	SUM
Theme 3. Comparison of Digital and Traditional Methods													0
Dijital ve Geleneksel Yöntemlerin Entegrasyonu													0
Integration of Digital and Traditional Methods				■					■			■	3
Disadvantages of Digital Methods													0
Difficulties in personalising the learning process	■								■	■		■	4
Technical and knowledge problems	■					■		■		■			4
Lack of live feedback			■				■	■		■		■	5
Advantages of Digital Methods													0
Quick access to learning materials	■				■					■		■	4
Practicality and variety			■			■	■			■			4
Ease of access and flexibility		■	■		■			■			■		5
Σ SUM	3	1	3	1	2	2	2	3	2	5	1	4	29

Matrix 3 presents findings related to the comparison of digital and traditional methods. The use of digital platforms and mobile applications (DPMAs) in vocal training offers advantages such as flexibility, accessibility, and extensive learning opportunities, while also presenting certain limitations compared to traditional educational methods. Participants provided varied perspectives on how DPMAs are utilized in vocal training and their contributions to student development, teacher-student interaction, and the acquisition of technical skills.

Many participants emphasized the significant role of DPMAs in enhancing technical skills in vocal training. These platforms provide diverse content tailored to fundamental elements of vocal training, such as vocal exercises, breath control, and vocal techniques, thereby supporting individual practice. Exercises such as voice and breathing practices can be repeated through digital platforms, enabling students to practice more frequently. Participants noted that DPMAs are particularly effective tools for beginners, as they allow students to work independently on specific technical skills and reinforce them through repetition, offering considerable flexibility in the educational process.

Another key contribution of DPMAs is the ability to facilitate time- and location-independent learning. Participants highlighted that during disruptions to face-to-face education, such as the COVID-19 pandemic, digital platforms served as critical tools for maintaining the continuity of education. Students were able to continue their practice independently using DPMAs, while educators could remotely monitor their progress. This flexibility supported students' individual learning while fostering accountability and enabling them to shape their learning processes according to their own pace. Participants also acknowledged the value of DPMAs in providing access to a broad musical repertoire and fostering musical interpretation skills. These platforms allow students to explore extensive repertoires and observe and analyze performances by different artists, which plays a significant role in enhancing their musical expression. Participants observed that by studying professional artists' interpretations, students could learn new techniques and aesthetics while developing their own interpretive styles. This breadth of access, often unavailable in traditional face-to-face education, is facilitated by digital platforms, enabling students to engage with a variety of styles and performances.

DPMAs also offer opportunities for self-feedback and self-assessment. Digital platforms enable students to record, analyze, and evaluate their performances, helping them monitor their development more closely and critically assess themselves. Participants noted that listening to their own performances and identifying errors empowered students to take greater responsibility for their learning, enhancing their confidence. This self-assessment capability allows students to identify technical mistakes independently and adopt a more conscious approach to practice.However, participants also highlighted significant limitations of DPMAs in vocal training. The lack of individualized feedback was identified as a major drawback. Given that vocal training is highly personalized and dependent on physiological and technical differences among students, the standardized content provided by DPMAs may not adequately address each student's unique needs. Participants emphasized that reliance on generalized content could pose pedagogical risks, particularly in developing technical skills and ensuring correct vocal techniques. Misapplications that go unnoticed during independent practice could lead to the development of faulty techniques and even jeopardize vocal health. To mitigate these risks, participants suggested that DPMAs be augmented with technologies capable of delivering personalized feedback.

Another concern raised was the insufficient interaction and real-time feedback provided by DPMAs. Vocal training relies heavily on immediate feedback between instructors and students, especially for correcting nuanced technical details in real time. Participants indicated that the inability of digital platforms to provide such feedback could leave students unsupported during individual practice, potentially allowing technical errors to persist. Issues such as resonance, breath control, and articulation require direct supervision and individualized correction by an instructor, which digital platforms currently fail to deliver effectively. Participants stressed the importance of integrating digital platforms with traditional methods. While acknowledging the advantages of DPMAs in enhancing technical skills, supporting independent practice, and facilitating musical analysis, they agreed that these tools cannot replace teacher-student interaction. Instead, participants advocated for the balanced use of DPMAs alongside face-to-face instruction, emphasizing that instructor-student interaction is indispensable for technical topics requiring individualized feedback and immediate correction. DPMAs, therefore, should be employed as complementary tools that enhance and support traditional methods.

In conclusion, DPMAs provide significant contributions to vocal training by supporting technical skill development, facilitating independent practice, and enabling musical analysis. However, limitations such as the lack of personalized feedback and real-time correction highlight the need for caution in their use. Participants emphasized that integrating DPMAs with traditional methods would lead to more effective outcomes in vocal training, ensuring that these tools serve as supportive and complementary resources in the educational process.

3.4. Findings on the personal and pedagogical effects of digital platforms in vocal training

Matrix 4

Coding for the personal and pedagogical effects of digital platforms in vocal training

Code System	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	SUM
Theme 4. Personal and Pedagogical Effects of Digital Platforms on Singing Education													0
DPMA's Limitations on Musical Expression													0
The importance of face-to-face education and limitations	■			■				■			■		4
Musical Expression and Technical Education													0
Contribution of the technique to musical expression	■			■									2
DPMU's support for technical development						■	■				■		3
Effects of DPMU on Musical Expression													0
DPMA's contribution to intellectual development			■	■								■	3
Factors favourably affecting musical expression		■	■				■		■	■		■	6
The Role of Teacher Guidance in Self-Confidence and Creativity													0
Importance of guidance and feedback				■								■	2
The Impact of Digital Platforms on Self-Confidence													0
Negative effects on self-confidence				■			■				■		3
Self-confidence boosting features		■	■			■			■			■	5
The Impact of Digital Platforms on Creativity													0
Uncertainty about creativity	■						■	■					3
Can positively affect creativity			■	■		■			■				4
Academic Guidance in Interaction with DPMA													0
Academic support and guidance	■			■							■	■	4
Limitations of DPMA on Interaction													0
Risk of weakening interaction						■	■				■		3
The importance of face-to-face interaction				■			■				■		3
DPMA's Contributions to Student-Academician Interaction													0
Technical and organisational facilities		■						■	■				3
Enhancing interaction and communication	■	■	■						■	■		■	6
Reproducibility and Independent Working Possibilities of Digital Platforms													0
The effect of independent work on motivation								■					1
Opportunities for repetition and independent study	■		■			■		■				■	5
The Effect of Digital Platforms on Practising Habits													0
Limitations of practice habits							■	■			■		3
Supporting practice habits	■	■	■			■			■			■	6
The Effect of Digital Platforms on Student Motivation													0
Loss of motivation and its limitations							■	■			■		3
Motivation-enhancing features	■	■	■	■		■			■	■		■	8
Suitability of Digital Platforms to Personal Needs													0
Failure to consider individual differences	■											■	2
Adaptability to individual needs		■				■					■		3
Student-Academic Interaction and the Importance of Feedback													0
Need for feedback			■	■							■	■	4
The Potential of Digital Platforms to Personalise Singing Education													0
Those who think that DPMA is limited in terms of personalisation	■		■	■							■	■	5
Those who think that DPMA contributes to personalisation		■				■		■			■	■	5
Σ SUM	10	8	10	11	0	9	8	8	7	3	12	13	99

Matrix 4 focuses on the personal and pedagogical effects of digital platforms. Participants emphasized the limitations of digital platforms in fostering musical expression, suggesting that face-to-face education is more effective in this area. They highlighted the stronger connection between musical expression and technical training established through in-person interactions. Digital tools were noted to be less effective in facilitating the development of musical expression, particularly in helping students enhance their emotional expressiveness and incorporate it into their performances. However, some participants acknowledged that digital platforms are beneficial for developing technical skills. They pointed out that these tools enhance opportunities for independent practice, allowing students to repeatedly perform technical exercises and improve their abilities. This independent practice may indirectly support the development of musical expression, although the lack of teacher guidance can weaken the connection between technical growth and expressive development. Participants stressed that teacher guidance is a critical factor for building confidence and fostering creativity. They noted that while digital platforms can occasionally support creativity, their inability to provide adequate guidance without teacher involvement can have both positive and negative impacts on student confidence. Further research is needed to clarify the effects of digital tools on creativity. Participants also discussed the limitations of digital platforms in facilitating student-teacher interaction. While acknowledging the technical and

organizational conveniences provided by digital tools, they noted that academic guidance might be weakened when mediated through these platforms. Although digital tools have the potential to enhance communication, they cannot fully replace face-to-face interaction. The ability to replay and practice independently was identified as one of the strongest features of digital platforms. These features can boost student motivation and are particularly useful for fostering consistent practice habits. However, the lack of guidance may limit the effectiveness of this process and increase the need for direction among some students.

The impact of digital tools on student motivation was another critical topic of discussion. Participants recognized the motivational potential of digital platforms, which offer various features to engage students. However, they also cautioned that ignoring individual differences in their design could lead to a loss of motivation. Participants emphasized the importance of structuring digital tools with pedagogical designs that support individual student motivation. They also addressed the limitations of digital platforms in accommodating personal needs. While these tools have the potential to support individualized learning processes, they may fall short in addressing the specific needs of some students. Developing content tailored to individual requirements was suggested as a way to enhance the effectiveness of digital platforms in education.

The most frequently emphasized themes among participants included the effects of digital platforms on confidence and creativity, the opportunities for repetition and independent practice, and changes in student-teacher interaction. Participants concluded that while digital platforms offer benefits in these areas, their limitations must be carefully considered to optimize their role in education.

3.5. Findings on the development of digital platforms and future expectations

Matrix 5

Coding for the development of digital platforms and future expectations

Code System	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	SUM
Theme 5. Development of Digital Platforms and Future Prospects													0
Use of DPMA in Combination with Traditional Methods													0
DPMA's support for traditional methods		■							■		■	■	4
Suggestions for Effective Use of DPMA by Students													0
Guiding students according to their individual needs											■	■	2
Students should be careful in the use of technology	■	■	■										3
Suggestions for Educators and Students for Effective Use of DPMA													0
The importance of instructor-student interaction				■					■		■	■	4
Trainers' learning and implementation processes of DPMA				■		■	■				■	■	5
Suitable Integration Models for Singing Education													0
Interdisciplinary and eclectic approaches				■			■						2
Personalised and flexible usage		■		■	■								3
Contributions of Digital Platforms to Vocal Training													0
Artificial intelligence and virtual trainers	■			■									2
DPMA's supportive role in technical education					■	■				■			3
Combined Use of Digital Technologies and Traditional Methods													0
Main importance of traditional methods				■			■		■		■	■	5
Balanced use of digital and traditional methods		■	■						■		■		4
Integration with Interdisciplinary and Traditional Methods													0
Interdisciplinary projects and combination with traditional methods		■	■						■		■		4
Improvements for Instructor and Academic Needs													0
Individualisation of applications and control mechanisms					■							■	2
Role of trainers and human-centredness of platforms	■			■							■		3
Special Content and Functions for Singing Education													0
Joint musical works and academic contents										■	■		2
Exercises suitable for voice groups and repertoire					■						■		2
Technological Developments Proposed for DPMA													0
Applications based on the use of sense organs			■										1
Use of artificial intelligence and virtual trainers				■								■	2
Synchronisation and real-time applications								■					1
More advanced applications for voice and breathing exercises		■			■				■				3
SUM	3	6	4	8	5	2	3	1	6	2	10	7	57

Matrix 5 reflects participants' views on the development of digital platforms and future expectations. Participants emphasized that digital platforms should play a supportive role in vocal training, complementing traditional methods. They acknowledged that digital tools provide significant advantages, particularly

in technical training, but stressed the critical importance of their pedagogically balanced integration with traditional approaches. Digital platforms were viewed as tools that cannot fully replace essential elements of face-to-face education, such as interaction and guidance, which form its foundation.

Several recommendations were made to enhance the effective use of digital platforms by students and educators. First, participants highlighted the need for digital tools to offer personalized content tailored to individual needs. Such content was seen as essential for making learning processes more efficient and supportive for students. Second, they suggested that educators should adopt a more active role in integrating digital platforms into teaching and application processes. By combining digital tools with pedagogical guidance, educators could enrich the learning experience for their students. The importance of maintaining educator-student interaction was also emphasized, with this interaction considered a fundamental element that supports the use of digital tools.

The integration of digital tools into vocal training was seen as requiring interdisciplinary and eclectic approaches. Flexible models that cater to individual needs were considered vital. Given the highly individualized nature of vocal training, these models should be designed to meet the expectations of both students and instructors effectively. Participants also discussed the contributions of digital platforms and their relationship with emerging technologies. Artificial intelligence (AI)-supported applications were identified as having the potential to provide individualized feedback, thereby contributing to students' technical and intellectual development. Advanced digital applications featuring vocal and breathing exercises tailored to vocal training were seen as tools that could enhance independent learning processes. Additionally, synchronized platforms capable of delivering real-time feedback were highlighted as having the potential to improve educational quality. A human-centered approach to the development of tools tailored to the needs of instructors and students was emphasized. Participants advocated for integrating personalized control mechanisms and custom content into digital platforms, noting that these features could enhance student motivation and support individual learning goals.

Specific suggestions were made regarding the content and functionality of digital platforms for vocal training. Participants recommended enriching digital platforms with collaborative musical activities and academic content. They emphasized the need for making specialized exercises, tailored to vocal groups and repertoire, more accessible on digital platforms. Such content, they argued, would contribute not only to technical skill development but also to improving musical expression. Key topics highlighted by participants included the role of educators in relation to digital platforms, the use of AI-supported technologies, and the personalization of digital tools. The consensus centered on the need for a balanced use of digital and traditional methods. Participants concluded that achieving this balance would enhance the effectiveness of digital tools in vocal training.

4. DISCUSSION

The findings of the study examined the impacts of digital platforms and mobile applications (DPMAs) on vocal training from multiple dimensions, highlighting both their advantages and limitations. Key advantages included the ability of digital platforms to provide students with flexible, time- and location-independent learning opportunities and access to a broad musical repertoire. However, fundamental aspects of vocal training—such as breath control, vocal resonance, and articulation—were found to require one-on-one instruction under the guidance of an instructor. This underscores the inability of digital platforms to deliver real-time, individualized feedback, a limitation that poses significant pedagogical challenges, particularly in areas like vocal training that necessitate a personalized approach.

The advantages of digital platforms in supporting technical skill development and independent practice were linked to their potential to increase student motivation and enable self-paced learning. As noted by Noor et al. (2022), the flexibility provided by digital tools can positively influence student motivation. Nevertheless, as Zhang (2016) emphasized, the inability to fully teach nuanced aspects such as physiological vocal control through digital platforms limits their overall effectiveness. In disciplines like vocal training, where teacher-student interaction is critical, the inability of digital platforms to meet such needs strengthens the argument for the indispensability of face-to-face instruction. The study also explored the influence of digital platforms on the development of musical expression. While participants acknowledged that digital tools support technical skill acquisition, they expressed concerns about their insufficiency in fostering musical expression. This finding suggests that face-to-face interaction is more effective in developing emotional expressiveness

and interpretative skills. Although studies like those by Barbot and Lubart (2012) suggest that digital platforms have the potential to support creativity, the study found that this potential remains limited. Despite these pedagogical and technical limitations, the research proposed that advancements in artificial intelligence (AI) and sophisticated digital applications could help overcome these challenges. As highlighted by Vinze et al. (2021), AI-based applications can contribute to students' technical and intellectual development by providing personalized feedback. However, whether these technologies can fully replace instructors remains a topic of debate within the study.

In conclusion, the study emphasized that digital platforms should serve a complementary role in vocal training. A balanced integration of digital and traditional methods was identified as a critical strategy for enhancing the quality of vocal training. While the flexibility and accessibility offered by digital tools cannot replace teacher-student interaction, their proper integration can support individual student development and enrich learning experiences. This balance is key to maximizing the educational potential of digital technologies. The study calls for further research in this area, presenting a significant starting point for understanding how digital platforms can be utilized more effectively in future educational processes.

5. CONCLUSION AND RECOMMENDATIONS

The study comprehensively evaluated the contributions and limitations of digital platforms and mobile applications (DPMAs) in vocal training. It was demonstrated that digital tools offer students opportunities for time- and location-independent learning, support the development of technical skills, and encourage individual practice habits. However, the lack of personalized feedback and real-time correction emerged as the most significant pedagogical limitations of these platforms. Fundamental skills in vocal training, such as breath control, vocal resonance, and articulation, were found to be more effectively taught under the supervision of an instructor in a face-to-face setting. The study emphasized that digital platforms should complement traditional methods rather than replace them. Instructor-student interaction was identified as a critical component of the vocal training process, underscoring the need for digital tools to be integrated with instructor guidance. To enhance the pedagogical effectiveness of digital technologies, the development of personalized content and the integration of AI-supported feedback mechanisms were proposed. These advancements could make digital tools more responsive to individual differences and better equipped to meet students' specific needs.

Digital platforms were also recognized for their ability to provide access to a broad repertoire and opportunities to analyze performances by various artists, which are valuable for developing musical expression. However, the study found that these tools have limited contributions to fostering musical creativity and emotional expressiveness, areas where face-to-face instruction remains indispensable. While the positive impacts of digital technologies on student motivation were highlighted, it was noted that the absence of personalized approaches could diminish this motivation.

In conclusion, digital platforms and mobile applications should be viewed as supportive and complementary tools in vocal training. These tools need to be integrated with traditional methods in a balanced manner. Training programs for instructors should be developed to promote the pedagogical use of these technologies, and guidance should be provided on their effective and accurate implementation. Furthermore, integrating advanced technologies such as AI and virtual reality to offer personalized feedback and enhance technical skill development could significantly increase the effectiveness of digital tools in education. The study underscores the need for further research on the development of digital platforms and the optimization of these technologies in pedagogical contexts. The findings provide a foundation for the more effective use of digital technologies in future vocal training processes and highlight the importance of expanding research efforts in this area.

Ethical approval

The study was approved by Ethics Committee for Social and Human Sciences of Kahramanmaraş Sütçü İmam University (date: 06.06.2024 number: 317685).

Author contribution

Study conception and design: AŞ, SG; data collection: SG; analysis and interpretation of results: AŞ, draft manuscript preparation: AŞ, SG. All authors reviewed the results and approved the final version of the article.

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