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From Trends to Lived Experience: Cultural Meanings of Digital Platforms in Vocal Pedagogy through Bibliometric and Phenomenological Lenses

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Abstract

This article examines the changing landscape of vocal pedagogy amid accelerating digital transformation, particularly following the COVID-19 pandemic. It investigates publication trends, key contributors, and emerging educational and cultural meanings associated with digital platforms in vocal instruction. A mixed-methods design combines bibliometric analysis of 34 Scopus-indexed journal articles published between 2020 and 2025 with a phenomenologically informed thematic analysis of abstracts from the most highly cited studies. Bibliometric analysis maps publication patterns, influential authors and journals, research domains, and keyword co-occurrence, while thematic analysis examines recurring experiential concerns represented in the literature. Findings indicate substantial growth in research on digitally mediated vocal pedagogy and increasing interdisciplinary engagement across music, education, technology, and health. Three prominent themes emerge: rapid adaptation to online environments; tensions surrounding embodied learning, vocal technique, and musical authenticity; and the dual role of technology as both an enabler of pedagogical innovation and a source of constraint. Persistent concerns regarding equity, access, and cultural inclusivity are also evident. Although digital tools expand opportunities for flexible, accessible, and creative learning, they remain limited in supporting nuanced vocal

technique, individualized feedback, and holistic musical development. The study is limited to English-language Scopus-indexed journal articles and abstract-level qualitative interpretation. Future research should incorporate broader databases, longitudinal evidence, and primary qualitative data from diverse and underrepresented contexts. By integrating bibliometric mapping with phenomenologically informed interpretation, the study connects patterns of scholarly development with the experiential and cultural concerns shaping contemporary digital vocal pedagogy.

Keywords: Digital Platforms, Vocal Pedagogy, Bibliometric Analysis, Phenomenological Analysis, Music Education, Cultural Meaning, Online Teaching, Technology, Vocal Pedagogy

Introduction

The landscape of vocal pedagogy has been dramatically transformed in recent years by the integration of digital platforms, fundamentally reshaping both the delivery and experience of vocal instruction (Li et al., 2025, 2026; G. Xiao & Mazlan, 2026). Digital tools and platforms offer unprecedented flexibility and accessibility, empowering students to engage in vocal training across time and location boundaries, and enabling access to diverse musical repertoires and immediate feedback (Liang, 2025; Şakalar & Gürel, 2024).. These innovations also foster greater creativity and collaboration, supporting sound experimentation, interactive learning, and collective music-making experiences that enrich the learning environment (Hidayatullah et al., 2024; Liang, 2025; Mazlan et al., 2024). At the same time, the importance of vocal pedagogy for educational innovation cannot be overstated. Innovative approaches, ranging from competency-based to personality-oriented learning have demonstrated significant benefits for students' technical skills, creative abilities, and professional motivation (Shumska et al., 2024; Wang & Koning, 2025; Wang, 2024). The adoption of advanced technologies such as big data analytics and IoT devices enables more personalized, precise, and adaptive training environments, improving learning outcomes and supporting holistic education that bridges disciplines from physiology to psychology (Lin, 2025; Sell, 2017). Multidisciplinary and somatic approaches, as well as reflective and peer-based models, further enhance the depth and breadth of modern vocal pedagogy (Latukefu, 2009; Paparo, 2022).

Although digital technologies had already begun to reshape vocal pedagogy, the COVID-19 pandemic accelerated this transformation by turning digitally mediated instruction from an emerging option into an immediate pedagogical necessity. The need for social distancing and educational continuity forced a sudden transition to online and distance learning, prompting educators and institutions to adopt platforms such as Zoom, Microsoft Teams, and other digital resources on an unprecedented scale (Nikolopoulou, 2023; Tani et al., 2023). While this shift posed significant challenges, especially for music disciplines that rely on high-fidelity audio and nuanced feedback, it also drove innovation, including the emergence of hybrid and blended teaching models and increased investment in digital infrastructure (Borodovskaya et al., 2022; Ristivojević & Svalina, 2022).

However, the rapid expansion of digitally mediated vocal instruction has also exposed pedagogical limitations that are particularly consequential in a discipline grounded in embodied, auditory, and interpersonal learning. Despite these advances, ongoing challenges remain. Teachers and students have reported technostress, psychological strain, and persistent gaps in digital access and training (Babieva et al., 2022; Gabbiadini et al., 2023).

Moreover, concerns linger about the limits of digital platforms to fully support critical aspects of vocal development, such as resonance, breath control, and embodied technique, which often require in-person, expert guidance (Şakalar & Gürel, 2024). As the field continues to evolve, there is an urgent need for research that examines both the opportunities and persistent tensions at the intersection of technology and vocal pedagogy, and that seeks best practices for supporting teachers, students, and institutions in this new era (Sato et al., 2024).

Despite the growing adoption of digital platforms in vocal pedagogy, especially following the COVID-19 pandemic, there remain significant gaps in our understanding of how these tools are transforming teaching and learning in practice. While recent innovations promise greater flexibility, creativity, and technical skill development, concerns persist about the adequacy of digital approaches for fostering essential elements of vocal artistry, such as nuanced feedback, embodied technique, and holistic musical growth. Furthermore, the literature is fragmented, with limited bibliometric syntheses capturing overall trends, influential works, and the cultural meanings ascribed to digital vocal pedagogy within the academic community. This fragmentation makes it difficult for educators, researchers, and policymakers to identify the best practices or emerging challenges in this rapidly evolving field.

The novelty of this study lies in integrating bibliometric mapping with a phenomenologically informed thematic interpretation to examine digital vocal pedagogy not only as a developing research domain but also as a socially and culturally situated educational phenomenon. Rather than treating technological adoption primarily in terms of tools or instructional effectiveness, the study connects patterns of scholarly development with questions of embodiment, interpersonal connection, equity, cultural inclusion, and pedagogical adaptation. In doing so, it contributes to the social sciences by demonstrating how digital transformation in a specialized educational field reshapes relationships among technology, teaching practice, learner experience, and cultural meaning. This study aims to:

1. Map and analyze recent publication trends, influential documents, and major research themes related to digital platforms in vocal pedagogy using bibliometric methods.
2. Illuminate experiential and cultural meanings through a phenomenologically informed thematic analysis of influential literature, providing qualitative insight into how digital vocal pedagogy is conceptualized and represented.
3. Identify gaps, challenges, and opportunities for future research, teaching practice, and policy development in digital vocal music education.

Drawing on these aims, the study addresses the following research questions:

1. What are the recent publication trends in digital platforms for vocal pedagogy, and how have they evolved in the post-pandemic era?
2. Who are the most prolific and influential authors, institutions, and countries in this field, and what key themes characterize their work?
3. Which journals are most prominent in publishing research on digital vocal pedagogy, and what subject areas do they cover?
4. What are the most highly cited documents in this field, and what major topics or approaches do they represent?
5. What are the most common author and indexed keywords, and how do these reflect evolving research priorities and conceptual frameworks?

6. What experiential and cultural meanings emerge from a phenomenologically informed thematic analysis of key research articles on digital platforms in vocal pedagogy?
7. What are the main challenges, limitations, and future directions identified for digital vocal pedagogy, based on both quantitative trends and qualitative insights?

Literature Review

The digital transformation of music and vocal pedagogy has accelerated rapidly in recent years, a trend further catalyzed by the COVID-19 pandemic. Contemporary scholarship underscores that digital platforms and technologies now play an increasingly central role in vocal teaching and learning, prompting a substantial body of research, systematic reviews, and empirical studies seeking to map the state of the art, identify innovations, and address persistent challenges.

A substantial portion of the literature has focused on the enhanced flexibility and accessibility afforded by digital platforms. Digital and online tools allow students to practice and engage with learning materials independently of time and location, and such flexibility supports the development of technical skills and expands access to a broader musical repertoire (Hassim & Mazlan, 2023; Liang, 2025; Mazlan, Abdullah, Nor Hashim, et al., 2025; Şakalar & Gürel, 2024). Despite these advances, multiple reviews agree that foundational elements of vocal pedagogy including resonance, breath control, and nuanced articulation are still best taught through direct, real-time instructor feedback and in-person engagement. These studies caution against over-reliance on technology and advocate for a balanced approach, integrating digital tools as supplementary rather than primary instructional methods (Sularso et al., 2023).

The integration of advanced technologies, such as artificial intelligence (AI), big data analytics, and virtual reality (VR), is another theme emerging from recent reviews. Scholars have reported that AI-supported systems, deep learning models, and VR environments can enhance both the personalization and effectiveness of vocal music education, providing real-time feedback and tailored learning experiences. Such innovations have the potential to address some of the traditional limitations of remote learning by making music instruction more interactive and adaptive to individual needs (Gu & Li, 2020; Imam Koning & Mazlan, 2026; Safian et al., 2024; Zhu et al., 2022). Nevertheless, the implementation of these technologies is still in its early stages and demands ongoing professional development for educators to fully realize their pedagogical benefits (Abdul Rahim et al., 2020).

Recent systematic reviews provide valuable syntheses of these trends. For instance, a systematic mapping review of popular music voice teaching (PMVT) literature has revealed both the growing diversity and fragmentation of the field, as well as a persistent English-language and Western methodological bias (Keskinen & Juntunen, 2024). Another systematic review of classical singing pedagogy identified a lack of robust, evidence-based frameworks and highlighted the generally low methodological quality of available studies (Crocco et al., 2017). In terms of health and safety, a review of vocal hygiene interventions found promising, albeit limited, evidence that such programs can improve vocal health parameters for singers but also noted the small number and limited scope of existing studies (Saeedi et al., 2023).

Empirical research since 2020 has increasingly focused on the practical impact of digitalization in vocal and music education. The COVID-19 pandemic forced an unprecedented and rapid adoption of online and distance learning. Studies from Ukraine, Canada, and China describe how teachers and students adapted to new technologies and platforms, often overcoming significant barriers such as unreliable internet connectivity and the challenges of delivering effective feedback in virtual environments (Borodovskaya et al., 2022; Ristivojević & Svalina, 2022; Shaw & Mayo, 2022). Some empirical research has highlighted positive outcomes from the adoption of digital tools, including increased student engagement, the use of mobile apps for self-directed learning, and the potential for hybrid instructional models that blend online and in-person modalities (Lu, 2024; Mazlan & Abdullah, 2020; Wang, 2025).

Qualitative and mixed-methods studies have further illuminated the lived experience of both educators and students. Research conducted in Australia, New Zealand, and Canada has explored the resilience, adaptation, and psychological stress encountered during the transition to remote learning. These studies frequently emphasize the importance of social and emotional support, professional development, and curricular flexibility to maintain educational quality and well-being (Laidlaw, 2023; Merrick & Joseph, 2022; Trafford et al., 2021). Mixed methods research also points to the pedagogical advantages of hybrid models, which allow educators to tailor instruction to individual, and group needs more flexibly (Borodovskaya et al., 2022).

Recent years have witnessed the growing adoption of AI, VR, and mobile applications in vocal pedagogy. AI is increasingly used for automatic assessment, real-time feedback, and adaptive curriculum design, showing considerable promise for both formative and summative assessment. VR technology is enabling the creation of immersive and interactive practice environments, while mobile apps such as Singscope and Yousician provide gamified learning experiences that are particularly effective for independent practice (Cui & Chen, 2024; Wang, 2025). Despite these advancements, multiple challenges and unresolved debates remain. A consistent finding in the literature is that digital platforms often cannot replicate the embodied, real-time feedback crucial for mastering vocal technique. Many instructors, especially those with traditional training, require further digital literacy development to maximize the pedagogical potential of these tools (Liu & Weng, 2023). Issues of equity and access are also prominent, with socioeconomic disparities in technology and internet access limiting the democratizing potential of digital learning environments (Sularso et al., 2023). Furthermore, scholars emphasize that digital pedagogy must be culturally sensitive and inclusive, with particular attention to addressing Eurocentric biases, language barriers, and local traditions (Qi, 2024; Xie, 2024).

The literature also identifies key research gaps. There is a notable lack of longitudinal and meta-analytic studies examining the long-term impacts of technology integration in vocal pedagogy. Moreover, the best practices for culturally responsive and inclusive digital music education remain underexplored. In summary, the literature demonstrates that while digital platforms and advanced technologies offer substantial opportunities for innovation, flexibility, and engagement in vocal pedagogy, they also introduce new complexities and require ongoing critical evaluation. Achieving an optimal balance between traditional and digital approaches, ensuring equity and access, and developing culturally attuned teaching methods are pressing priorities for future research and practice in the field.

While recent research provides valuable insights into the integration of digital platforms in vocal pedagogy, much of the existing evidence is limited by regional concentration, with an overrepresentation of studies from Western or English-speaking contexts. Additionally, many studies employ short-term or cross-sectional designs, leaving gaps regarding long-term outcomes and sustained adoption of technology in vocal education. The predominance of survey and case study methodologies also signals a need for more robust experimental and longitudinal research.

Methods

This study employs a mixed-methods approach, combining bibliometric analysis with a phenomenologically informed thematic analysis to explore the evolving landscape and experiential and cultural meanings associated with digital platforms in vocal pedagogy. The research is designed to map publication trends, influential themes, and key contributors through quantitative bibliometric techniques, while also examining experiential meanings and cultural implications through qualitative thematic analysis of highly cited literature (Mazlan et al., 2025b; Ramdan et al., 2024; Xiao & Mazlan, 2024). This integrated methodology enables both a broad quantitative overview and a nuanced, meaning-centered understanding of current practices and challenges in digital vocal education.

Search Strategy

A comprehensive literature search was conducted in the **Scopus database** to identify articles related to digital platforms in vocal pedagogy. The following search string was used: *ALL (("vocal pedagogy" OR "voice teaching") AND ("digital platform" OR "online")*). The search was refined by applying several filters: only articles published between 2020 and 2025 were included, with the document type limited to journal articles and the language restricted to English. To further enhance the relevance of the results, records were filtered by keywords such as “voice”, “singing”, “vocal pedagogy”, “music”, “voice training”, “vocal cord”, “vocal music”, “voice pedagogy”, “vocal cords”, “music technology”, “vocals”, “vocalization”, “vocal training”, “vocal performance”, “singing voices”, “singers”, “opera”, and “choir”.

Data Collection

After applying the above search parameters, 46 records were identified and exported from Scopus in CSV format. Titles and abstracts of these articles were independently screened for direct relevance to digital, online, or remote vocal pedagogy. Articles focusing solely on unrelated topics (e.g., clinical voice science, speech pathology, general technology without a pedagogical context) were excluded. After this screening, 12 articles were removed as not relevant, resulting in a final dataset of 34 articles for bibliometric analysis.

Data Cleaning and Harmonization

Following the initial data export from the Scopus database, the dataset was imported into Bibliomagika for bibliometric analysis. To ensure the validity and coherence of the results, an additional step of data cleaning and harmonization was performed, particularly focusing on the author keywords and indexed keywords. Keyword harmonization was achieved by manually reviewing and standardizing variations, synonyms, and inconsistent capitalizations (e.g., unifying “voice training” and “Voice Training”). Redundant or irrelevant keywords were excluded to better reflect the actual research landscape (Karimi et al., 2021).

Bibliometric Measures

The bibliometric analysis was conducted on the final dataset of 34 articles using BiblioMagika (Ahmi, 2024). The analysis included the extraction of key bibliometric indicators such as the number of publications by year, citation metrics (total citations, citations per paper, h-index, g-index, m-index), and the number of contributing authors. Publication trends were analyzed based on the distribution of articles and citations across the years 2020–2025. Subject area classifications were mapped using metadata from Scopus to identify the disciplinary scope of the retrieved literature. Source title analysis was performed to determine the most productive and influential journals contributing to the field of digital platforms in vocal pedagogy. Highly cited documents were identified using total citation counts, and the top 20 articles were screened for direct relevance to the study's focus. Authorship analysis was conducted to examine the prevalence of single author versus multi-author articles over time. Lastly, author keywords co-occurrence analysis and indexed keywords are also included. This is mainly because indexed keywords are more effective than author keywords alone (Deka & Sarmah, 2020).

Reporting

Results are presented through descriptive tables and visualizations. Interpretation of findings follows the guidelines for impactful bibliometric research, synthesizing not just descriptive numbers but their implications for the field of vocal pedagogy and future research directions.

Tools

All bibliometric analyses, including data extraction, performance analysis, keyword mapping, and visualization (tables, word clouds, and charts), were conducted using biblioMagika® version 2.10.1 (Ahmi, 2024). For the harmonization and cleaning of keywords, including duplication and normalization of author and indexed keywords, ChatGPT model 4.1 was utilized to support accurate grouping and to generate publication-ready visualization. Recent research demonstrates that large language models like ChatGPT can facilitate literature review, clustering, and summarization tasks, often streamlining workflows in academic research settings (Thelwall, 2024; Zimmermann et al., 2024). In this study, ChatGPT-4.1 assisted in the harmonization and cleaning of indexed and author keywords, thematic extraction, and the efficient generation of graphical outputs for data presentation (Vazquez, 2024).

Phenomenological Thematic Analysis

To address the "lived experience" and cultural meaning of digital platforms in vocal pedagogy, a qualitative thematic analysis was performed on the abstracts of the top 20 most-cited documents in the dataset. The phenomenological analysis in this study is based on the available abstracts and key statements within the top-cited documents, rather than full-length interviews or participant narratives. As such, interpretations of lived experience are inherently limited by the scope and depth of the source materials (Crawford, 2020; Creswell & Poth, 2018; Ozuem et al., 2022).

Limitations

This study is subject to certain limitations. The bibliometric and phenomenological analyses are based on published abstracts and metadata, which may not capture the full complexity of

lived experiences or nuanced methodological details. Additionally, the exclusion of non-English publications may limit the generalizability of findings to non-Western contexts.

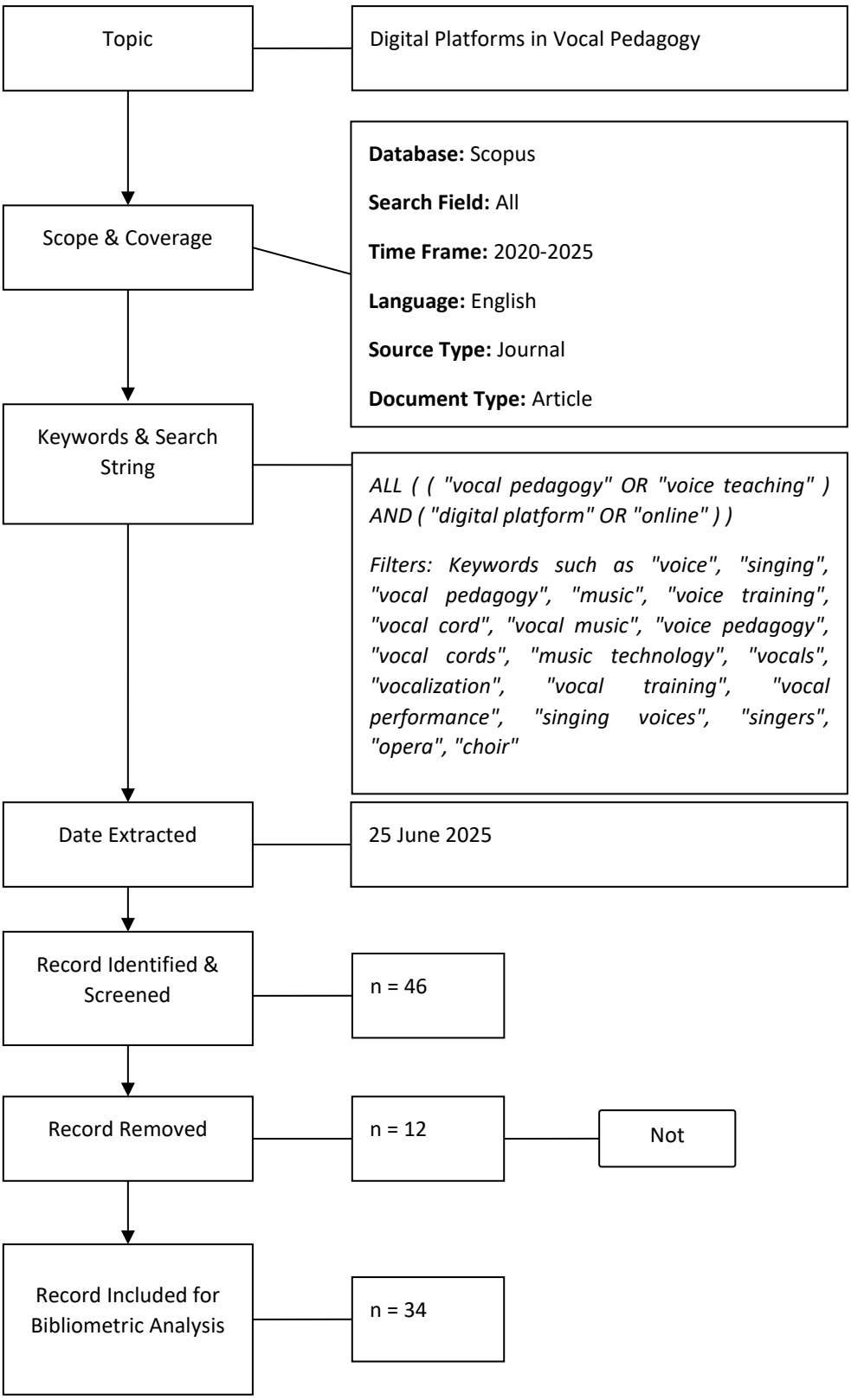

Figure 1. Flow diagram of the search strategy.
Source: Moher et al. (2009); Zakaria et al. (2021)

Results

This section of the results reports both quantitative bibliometric trends and qualitative themes identified through a phenomenological reading of the most influential articles. Together, these findings offer a nuanced picture of the evolving landscape of digital vocal pedagogy.

Documents Profiles

Table 1 summarizes the basic bibliometric profile of the 34 journal articles included in this review. All articles were published between 2020 and 2025, with a total of 94 contributing authors and 160 citations across the dataset. The average number of citations per paper was 4.71, and the h-index for the collection is 7, reflecting the field's growing impact. All documents were published as journal articles and written in English, ensuring consistency in document type and accessibility for an international scholarly audience.

Table 1
Citation Metrics

Main Information	Data
Publication Years	2020 - 2025
Total Publications	34
Citable Year	6
Number of Contributing Authors	94
Number of Cited Papers	25
Total Citations	160
Citation per Paper	4.71
Citation per Cited Paper	6.40
Citation per Year	32.00
Citation per Author	1.70
Author per Paper	2.76
Citation sum within h-Core	145
h-index	7
g-index	11
m-index	1.167

Source: Generated by the author(s) using biblioMagika® (Ahmi, 2024)

Table 2 below presents the distribution of the 34 included articles by subject area. Most publications are classified as Arts and Humanities (44.12%), followed by Social Sciences (32.35%), and Medicine (26.47%). Other represented fields include Health Professions, Computer Science, Biochemistry, Engineering, Physics and Astronomy, Business and Economics, and several additional disciplines, each contributing less than 15% of the total. This distribution highlights the multidisciplinary nature of research on digital platforms in vocal pedagogy, with strong representation from both the arts and sciences. The breadth of subject areas underscores the diverse perspectives and academic contexts in which digital vocal pedagogy is being studied.

Table 2
Subject Area

Subject Area	Total Publications	Percentage (%)
Arts and Humanities	15	44.12%
Social Sciences	11	32.35%
Medicine	9	26.47%
Health Professions	8	23.53%
Nursing	7	20.59%
Computer Science	5	14.71%
Biochemistry, Genetics and Molecular Biology	3	8.82%
Engineering	3	8.82%
Physics and Astronomy	3	8.82%
Business, Management and Accounting	1	2.94%
Chemistry	1	2.94%
Economics, Econometrics and Finance	1	2.94%
Environmental Science	1	2.94%
Mathematics	1	2.94%
Multidisciplinary	1	2.94%
Psychology	1	2.94%

Source: Generated by the author(s) using biblioMagika® (Ahmi, 2024)

Publication Trends

Figure 1 illustrates the annual distribution of total publications and total citations for articles on digital platforms in vocal pedagogy from 2020 to 2025. The number of publications increased steadily from 4 in 2020 and 2021 to a peak of 10 in 2023, indicating a growing scholarly interest in this area. The total citations were highest for publications in 2020 (80 citations), with a noticeable decline in citations for more recent years, reflecting the natural lag in citation accrual for newer articles. These trends highlight both the rapid expansion and the evolving influence of research on digital vocal pedagogy in recent years.

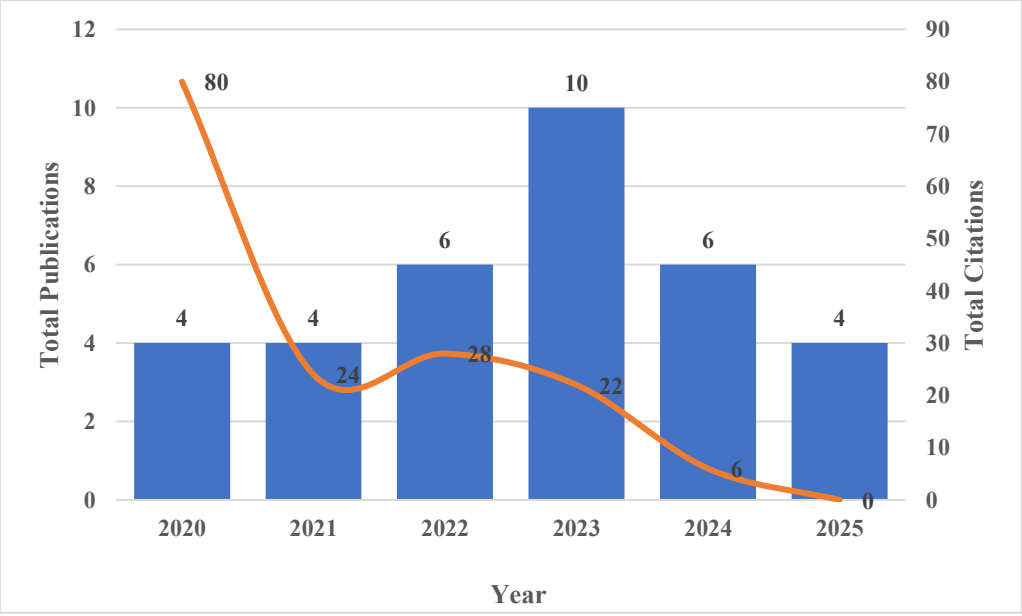

Figure 2. Total Publications and Citations by Year
Source: Generated by the author(s) using biblioMagika® (Ahmi, 2024)

Next, Figure 2 below presents the cumulative growth of total publications on digital platforms in vocal pedagogy from 2020 to 2025. The growth curve demonstrates a consistent upward trajectory, with the cumulative number of publications rising from 4 in 2020 to 36 by 2025. The fitted linear trend line ($R^2 = 0.9834$) suggests a strong, sustained increase in research activity in this field, underscoring its emergence as a significant area of academic inquiry.

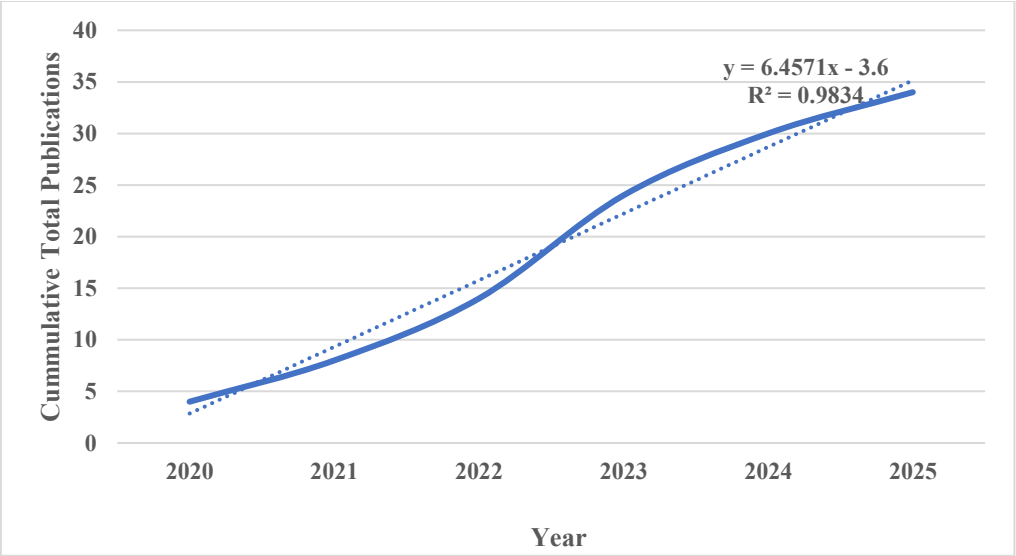

Figure 3. Publication Growth
Source: Generated by the author(s) using biblioMagika® (Ahmi, 2024)

Publications by Source Titles

Figure 4 presents the most productive source titles for articles on digital platforms in vocal pedagogy published between 2020 and 2025. The Journal of Voice is the leading source, publishing 6 articles, followed by Voice and Speech Review with 4 articles. All other journals in the dataset contributed one article each, reflecting the emerging and dispersed nature of research in this field. These results highlight the prominence of specialized journals focused on voice, speech, and music education, while also indicating that relevant research is published across a diverse range of scholarly outlets.

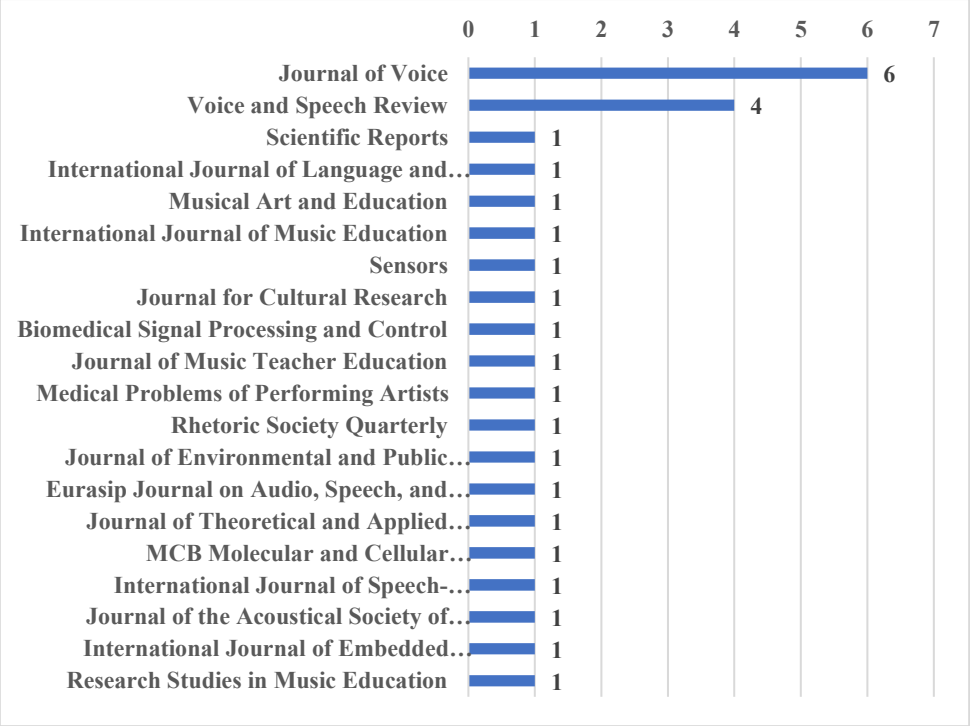

Figure 4. Most Productive Source Title
Source: Generated by the author(s) using biblioMagika® (Ahmi, 2024)

Table 4 presents the ranking of source journals according to their total citation counts within the dataset. The Journal of Voice stands out as the most influential journal, with six articles collectively cited 56 times, demonstrating both high productivity and impact in the field of digital vocal pedagogy. The International Journal of Speech-Language Pathology (four articles, 42 citations) and Voice and Speech Review (four articles, 21 citations) are also prominent contributors. Other journals, such as *Eurasip Journal on Audio, Speech, and Music Processing*, *Mobile Information Systems*, and *Biomedical Signal Processing and Control*, each contributed one article with 8 or more citations, indicating notable individual influence. This distribution highlights the central role of specialist journals in shaping scholarly discourse on digital platforms in vocal music teaching, while also reflecting the multidisciplinary and international character of research in this area.

Table 4
Most Influential Source Title by Total Citations

Source Title	TP	NCA	NCP	TC	C/P	C/CP	*h*	*g*	*m*
Journal of Voice	6	23	6	56	9.33	9.33	5	6	0.833
International Journal of Speech-Language Pathology	1	2	1	42	42.00	42.00	1	1	0.167
Voice and Speech Review	4	4	4	21	5.25	5.25	2	4	0.333
Eurasip Journal on Audio, Speech, and Music Processing	1	5	1	8	8.00	8.00	1	1	0.250
Mobile Information Systems	1	1	1	7	7.00	7.00	1	1	0.250
Biomedical Signal Processing and Control	1	3	1	6	6.00	6.00	1	1	0.200
Journal of Environmental and Public Health	1	1	1	5	5.00	5.00	1	1	0.250
International Journal of Language and Communication Disorders	1	5	1	4	4.00	4.00	1	1	0.333
Sensors	1	3	1	2	2.00	2.00	1	1	0.200
Research Studies in Music Education	1	3	1	2	2.00	2.00	1	1	0.500
Medical Problems of Performing Artists	1	5	1	1	1.00	1.00	1	1	0.333
Journal for Cultural Research	1	1	1	1	1.00	1.00	1	1	0.167
International Journal of Embedded Systems	1	1	1	1	1.00	1.00	1	1	0.500
Journal of Music Teacher Education	1	1	1	1	1.00	1.00	1	1	0.333
Journal of the Acoustical Society of America	1	7	1	1	1.00	1.00	1	1	0.333
Rhetoric Society Quarterly	1	1	1	1	1.00	1.00	1	1	0.333
Music Education Research	1	1	1	1	1.00	1.00	1	1	0.333
Update: Applications of Research in Music Education	1	1	0	0	0.00	0.00	0	0	0.000
Linguistics and Education	1	1	0	0	0.00	0.00	0	0	0.000
International Journal of Music Education	1	2	0	0	0.00	0.00	0	0	0.000

Notes: TP=total number of publications; NCA=Number of contributing authors; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/CP=average citations per cited publication; h=h-index; g=g-index; m=m-index.
Source: Generated by the author(s) using biblioMagika® (Ahmi, 2024)

Highly Cited Documents

Table 5 presents the 20 most highly cited articles on digital platforms in vocal pedagogy, as identified from the screened dataset of 34 articles. All articles listed were selected based on their direct relevance to the review topic, following a careful screening of citation data, titles, and abstracts. Citation counts for these articles range from 14 to 0, with the highest-cited work ("Associations of Education and Training with Perceived Singing Voice Function Among Professional Singers" by Zuim et al. (2021) accruing 14 citations. Other influential contributions include Vickers (2020), focused on online theatre voice pedagogy, and Xu et al. (2022), examining machine learning in classical tenor solo singing voice analysis. The table details article titles, authors, source journals, total citations and citations per year. These top-cited publications reflect a diversity of research approaches including online and AI-driven pedagogical strategies, assessment of virtual and hybrid teaching environments, and innovative technological applications in vocal music education. The inclusion of recent articles with fewer citations highlights the emerging and rapidly evolving nature of research on digital platforms in vocal pedagogy.

Table 5
Top 20 highly cited articles

No.	Authors	Title	Source Title	Cites	Cites per Year
1	(Zuim et al., 2021)	Associations of Education and Training with Perceived Singing Voice Function Among Professional Singers	Journal of Voice	14	**2.80**
2	(Vickers, 2020)	Online Theatre Voice Pedagogy: A Literature Review	Voice and Speech Review	14	**2.33**
3	(Xu et al., 2022)	Paralinguistic singing attribute recognition using supervised machine learning for describing the classical tenor solo singing voice in vocal pedagogy	Eurasip Journal on Audio, Speech, and Music Processing	8	**2.00**
4	(Jing, 2022)	Application of Artificial Intelligence Algorithm and VR Technology in Vocal Music Teaching	Mobile Information Systems	7	**1.75**
5	(Zhang, 2022)	Environment-Friendly Vocal Music Ecological Education: Sustainable Development of Vocal Music Education from the Perspective of Building	Journal of Environmental and Public Health	5	**1.25**
6	(Zuim et al., 2023)	Independence of Vocal Load From Vocal Pathology Across Singing Genres	Journal of Voice	5	**1.67**
7	(Murdaugh et al., 2022)	In-Person or Virtual? – Assessing the Impact of COVID-19 on the Teaching Habits of Voice Pedagogues	Journal of Voice	5	**1.25**
8	(Fletcher et al., 2024)	Examining the empathic voice teacher	Research Studies in Music Education	2	**1.00**

9	(Daken, 2021)	Transcreation of the Accent Class to the Online Platform	Voice and Speech Review	2	**0.40**
10	(Angelakis et al., 2021)	Towards a singing voice multi-sensor analysis tool: System design, and assessment based on vocal breathiness	Sensors	2	**0.40**
11	(Vurma et al., 2023)	The intensities of vowels and plosive bursts and their impact on text intelligibility in singinga)	Journal of the Acoustical Society of America	1	**0.33**
12	(Han, 2024)	Information intelligent teaching method and its influence on vocal music teaching effect	International Journal of Embedded Systems	1	**0.50**
13	(Fetokaki, 2023)	Whiteness, interpellation, and embodied technique in western classical vocal pedagogy	Music Education Research	1	**0.33**
14	(Kingsbury, 2023)	What Wizardry is this?: Somatic Listening and Verbal Metaphor in an Undergraduate Voice Studio	Rhetoric Society Quarterly	1	**0.33**
15	(Mercado, 2023)	Preservice Music Educators' Perceptions of Online Synchronous Fieldwork: A Case Study	Journal of Music Teacher Education	1	**0.33**
16	(Baughman & Jordan, 2024)	Teaching the whole singer: An examination of methods used to address student wellness in the collegiate voice studio	International Journal of Music Education	0	**0.00**
17	(Juntunen et al., 2023)	Expression in popular music singing as embodied and interpersonal	Frontiers in Education	0	**0.00**
18	(Hou et al., 2025)	Dense dynamic convolutional network for Bel canto vocal technique assessment	Scientific Reports	0	**0.00**
19	(Xiao, 2025)	Using Artificial Intelligence Software for Correcting Incorrect Intonation in Singing	Journal of Theoretical and Applied Information Technology	0	**0.00**
20	(Nguyen, 2025)	Voicing decolonial dialogues: Indigenous teachers' translanguaging in the mainstream classroom	Linguistics and Education	0	0.00

Source: Generated by the author(s) using biblioMagika® (Ahmi, 2024)

Co-authorship Analysis

Figure 5 shows the annual distribution of single-author and multi-author articles on digital platforms in vocal pedagogy from 2020 to 2025. Multi-author publications outnumbered single author works in most years, particularly in 2023, which saw the highest count of multi-author articles (n=6) and the highest overall publication output. This trend suggests a

collaborative research environment, with increasing co-authorship reflecting the interdisciplinary and multifaceted nature of recent scholarships in this field. While single-author articles remain present each year, the predominance of multi-author contributions indicates a shift toward teamwork and joint investigation in studies of digital vocal pedagogy.

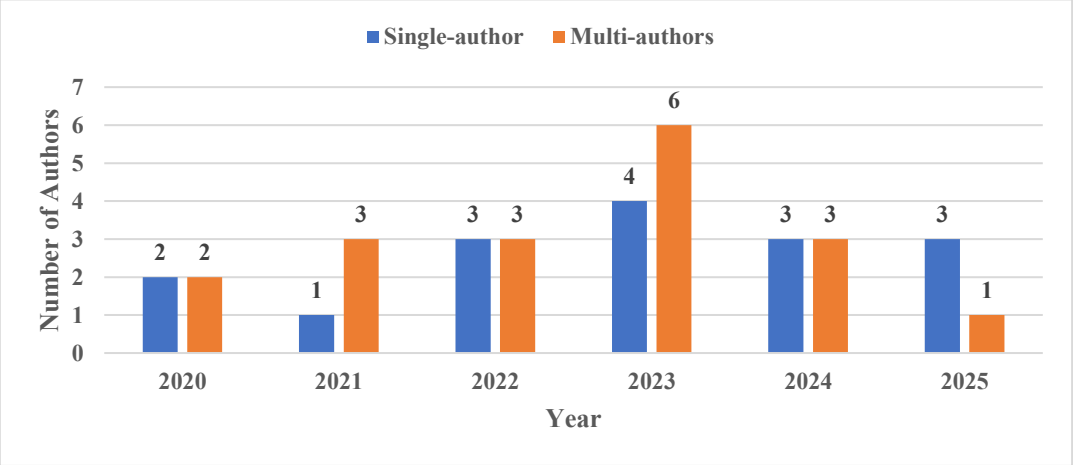

Figure 5. Single author versus multi-authors
Source: Generated by the author(s) using biblioMagika® (Ahmi, 2024)

Authors Keywords Co-occurrence Analysis

The analysis of author keywords, following harmonization to remove duplicates and variant forms, identified "voice" (n=11), "vocal pedagogy" (n=10), and "singing" (n=7) as the most frequently used terms in the literature (Table 6, Figure 6). These core keywords highlight the central themes in contemporary research on digital platforms for vocal music education. Notably, terms such as "vocal training," "performance," and "music" further underscore the technical and artistic dimensions prevalent in this research area. The presence of keywords like "online learning," "COVID-19," and "artificial intelligence" (just outside the top 10) suggests a growing scholarly interest in technology integration and the impact of recent global events on vocal pedagogy. This trend is consistent with the field's rapid adaptation to digital teaching modalities and evolving educational contexts.

Table 6
Frequency of Top 10 Author Keywords

No.	Keyword	Frequency
1	voice	11
2	vocal pedagogy	10
3	singing	7
4	vocal training	4
5	performance	4
6	music	3
7	choir	2
8	online learning	2
9	singers	2
10	COVID-19	2

Source: Authors

Figure 6. Top 10 harmonized author keywords
Source: Authors

Indexed Keywords Co-occurrence Analysis

Table 7 displays the most frequently occurring indexed keywords, harmonized to exclude generic or non-thematic terms, as identified from the included literature on digital platforms in vocal pedagogy. "Human" was the most prominent indexed keyword (n=452), reflecting the participant-centered focus of much of the research. "Singing" (n=339), "voice" (n=261), and "voice disorder" (n=233) were also highly prevalent, indicating a strong emphasis on both the artistic and clinical dimensions of vocal music teaching. Keywords such as "music," "voice training," "pedagogics," and "phonation" further underscore the interdisciplinary nature of the field, spanning music education, vocal technique, and voice health.

Table 7
Frequency of Top 20 Indexed Keywords

No.	Keyword	Frequency
1	Human	452
2	Singing	339
3	Voice	261
4	Adult	189
5	Voice Disorder	233
6	Music	213
7	Voice Training	188
8	Male	167
9	Female	167
10	Voice Quality	118
11	Pedagogics	89
12	Phonation	81

Source: Authors

Additionally, Figure 7 below visualizes the frequency of the top indexed keywords using a word cloud, where the relative size of each term corresponds to its frequency within the dataset. The visualization illustrates the dominance of participant descriptors ("human,"

"adult," "male," "female") as well as core subject areas ("singing," "voice," "music," "voice disorder," "voice training"). The presence of terms such as "pedagogics," "voice quality," and "phonation" highlights the diversity of research perspectives, ranging from pedagogy and music performance to voice science and health, represented in recent scholarly work on digital platforms for vocal pedagogy.

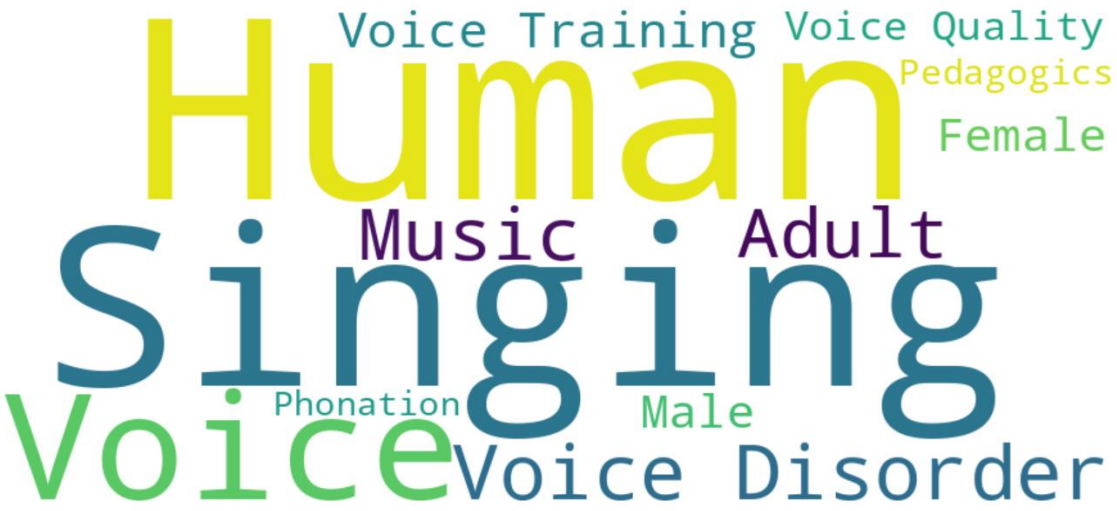

Figure 7. Indexed Keywords Word Cloud
Source: Authors

Phenomenological Themes from Highly Cited Literature

A thematic reading of the top 20 most-cited articles revealed several core experiential and meaning-centered themes in the lived experience of digital vocal pedagogy. Through multiple studies, adaptation and resilience emerged as dominant motifs, with both teachers and students rapidly adjusting to online or hybrid modes of instruction. This process was often accompanied by mixed feelings, opportunities for innovation were balanced against a sense of loss and disruption in established pedagogical relationships (Vickers, 2020; Zuim et al., 2021).

Embodiment and authenticity presented significant challenges, as the digital format was frequently reported to constrain embodied learning, affect vocal health, and limit authentic musical connection between participants (Fetokaki, 2023; Juntunen et al., 2023). Emotional engagement and empathy also remained central concerns, with several authors emphasizing the increased emotional labor required to support student wellbeing and foster interpersonal connection in virtual spaces (Baughman & Jordan, 2024; Fletcher et al., 2024).

Furthermore, a smaller subset of articles addressed issues of equity and inclusion, calling attention to social justice, decolonial perspectives, and the need to amplify marginalized voices and integrate non-Western traditions within digital learning environments (Nguyen, 2025). Finally, technology itself was understood both as an agent of transformation and as a source of new barriers. Authors noted that while digital platforms facilitated innovative pedagogical practices, they also introduced challenges related to identity, access, and the ongoing negotiation of effective teaching and learning strategies (Jing, 2022; Xu et al., 2022).

Table 8
Main Phenomenological Themes in Highly Cited Literature

Theme	Key References	Summary Insight
Adaptation and Resilience	(Vickers, 2020; Zuim et al., 2021)	Shift to online required new strategies, rapid adjustment
Embodiment & Authenticity	(Fetokaki, 2023; Juntunen et al., 2023)	Embodied, sensory experience challenged in digital space
Empathy & Emotional Engagement	(Baughman & Jordan, 2024; Fletcher et al., 2024)	Interpersonal connection is vital in all modalities
Equity & Inclusion	(Nguyen, 2025)	Call for broader, more diverse pedagogical perspectives
Technology as Transformation/Barrier	(Jing, 2022; Xu et al., 2022)	Technology offers both promise and new hurdles

Source: Authors

Discussion

The integration of bibliometric trends with phenomenological insights provides a multi-layered understanding of digital vocal pedagogy. Studies such as Vickers (2020) and Zuim et al. (2021) document how the pandemic-driven move to online teaching required rapid adaptation and often blurred boundaries between personal and professional identities. Work by Fetokaki (2023) and Juntunen et al. (2023) emphasizes the struggle to preserve embodied, authentic musical experience in technologically mediated environments. Meanwhile, Fletcher et al. (2024) and Baughman & Jordan (2024) foreground the role of empathy, emotional engagement, and wellness as core to both traditional and digital instruction. Finally, Nguyen (2025) and others remind us that digital transformation must go together with greater cultural inclusivity and critical reflection on power dynamics in music education.

Integration of Quantitative Trends and Lived Experience

The bibliometric mapping underscores the rapid evolution and hybridization of vocal pedagogy in the digital era. Major trends such as the widespread shift to online teaching, the emergence of AI/VR-supported training, and increased attention to health and wellness are both responses to external drivers (e.g., the COVID-19 pandemic) and catalysts for pedagogical innovation (Jing, 2022; Murdaugh et al., 2022). Thematic analysis of the most cited articles reveals several core axes:

- Health, Technique, and Digital Adaptation: Several studies explore the relationship between vocal load, pathology, and lifestyle/health factors in the context of increased digital teaching (Zuim et al., 2023), with technology sometimes introducing both new opportunities and challenges for monitoring and supporting student well-being.
- AI and Algorithmic Assessment: The integration of machine learning and AI for singing voice analysis, intonation correction, and personalized feedback demonstrates the field's increasing openness to technological augmentation (Jing, 2022; Xiao, 2025).
- Embodiment, Equity, and Identity: A significant thread in the literature addresses phenomenological aspects such as reported experiential concerns of students and teachers, issues of embodied technique, and cultural meanings. These are especially prominent in discussions of equity and social justice in Western vocal pedagogy (Fetokaki, 2023; Nguyen, 2025).

Insights from the Phenomenological Lens

Articles grounded in phenomenological or qualitative approaches provide unique insight into how digital platforms shape the lived realities and cultural meanings of vocal pedagogy. These studies suggest that while technology can democratize access and enable innovation, it also challenges notions of authenticity, embodiment, and interpersonal connection (Fetokaki, 2023; Juntunen et al., 2023). For example, empathy and embodied engagement remain central to effective teaching, whether online or in-person (Fletcher et al., 2024). Meanwhile, the shift to online learning requires new strategies for fostering presence, feedback, and community, which sometimes described as “transcreation” of traditional pedagogical methods to the virtual space (Daken, 2021; Mercado, 2023).

Thematic Shifts and Hot Topics

Analysis of author keywords shows "vocal pedagogy," "voice," and "singing" as core themes, but with growing prominence of "AI," "virtual reality," and "online teaching." Harmonization of indexed keywords further highlights concepts such as "voice training," "voice quality," "vocal health," and "machine learning" as emerging subfields.

Gaps and Future Direction

While rapid adoption of technology in vocal pedagogy offers substantial benefits, the field continues to grapple with challenges related to assessment validity, training effectiveness, and cultural/individual difference. Most bibliometric hotspots cluster around English-language, Western-oriented research, with few studies centring non-Western or indigenous experiences (Nguyen, 2025). The experiential concerns represented in the analysed literature highlight the ongoing negotiation between tradition and innovation, between embodiment and mediation, and between equity and access.

Methodological Strengths & Limitations

This study's strength lies in rigorous screening and harmonization, ensuring that only documents directly relevant to vocal pedagogy were analysed, following bibliometric measures. However, the relatively small dataset (n=34) reflects the focused scope but may limit the breadth of network visualizations. This can be addressed by expanding inclusion years or supplementing with a narrative literature review for richer context.

Conclusion

This study demonstrates that digital platforms have transformed the field of vocal pedagogy, creating both new opportunities for innovation and new challenges in maintaining authentic, embodied learning. Bibliometric mapping reveals a vibrant research community at the intersection of technology, health, and music education, while phenomenological analysis brings forward the voices and experiences of teachers and students navigating this transition. Moving forward, research must continue to blend quantitative and qualitative perspectives, especially by including marginalized voices and non-Western pedagogies, which to ensure that the future of digital vocal education is both effective and meaningful. Future research should prioritize international and cross-cultural studies to overcome regional biases and to better understand the global applicability of digital pedagogical tools. Longitudinal designs are needed to examine the sustained impact of technological integration on vocal learning outcomes. Moreover, the field would benefit from qualitative research that foregrounds the experiences of underrepresented or marginalized communities in digital vocal education.

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Consent to Participate
Not applicable

Consent to Publish
Not applicable

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Competing Interests
No potential conflict of interest was reported by the author.

Declaration of Generative Ai And Ai-Assisted Technologies
During the preparation of this work, the authors used ChatGPT for language refinement, paraphrasing, and selected text-based analytical support. Following the use of this tool, the authors reviewed, verified, and edited the generated content as necessary and took full responsibility for the accuracy, integrity, and final content of the publication.

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