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Vocal Learning Revolution: Student Preferences in The Digital Platform Era

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Abstract: This study aims to investigate students' preferences for digital platform features in vocal learning, examine the factors influencing those preferences, and explore their associations with learning motivation and learning outcomes. A quantitative cross-sectional survey design was employed involving 384 university students actively engaged in digital-based vocal learning. Data were collected through structured questionnaires, the construct validity of which was confirmed using confirmatory factor analysis (CFA). The data were subsequently analyzed using descriptive statistics and inferential techniques, including independent-samples t-tests, one-way ANOVA, Pearson correlation analysis, and multiple regression analysis. The findings revealed that audio-visual features received the highest preference rating ($M = 4.32$, $SD = 0.68$), followed by real-time feedback ($M = 4.28$), accessibility ($M = 4.21$), content personalization ($M = 4.15$), discussion forums ($M = 3.97$), and gamification ($M = 3.89$). Education level ($F = 5.83$, $p = .003$) and digital skill proficiency ($F = 12.67$, $p < .001$) significantly influenced students' preferences, whereas gender showed no statistically significant difference ($t = 1.42$, $p = .157$). Furthermore, platform preferences demonstrated significant positive correlations with learning motivation ($r = 0.52$, $p < .001$) and learning outcomes ($r = 0.41$, $p < .001$). These findings provide practical implications for platform developers and educators in designing student-centered vocal learning environments that are responsive to contemporary learners' needs.

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Introduction

The digital era has brought fundamental transformations in the global education landscape, particularly in the context of vocal learning that demands dynamic interaction between instructors and learners. The COVID-19 pandemic substantially accelerated the integration of digital platforms within higher education, establishing a new pedagogical paradigm in which learner preferences occupy a central role in instructional design (Noor et al., 2022). Vocal learning, which has historically depended on direct physical interaction and live demonstration, confronts distinctive challenges when transitioning into digitally mediated environments. Contemporary digital learning platforms provide a diverse array of interactive functionalities including gamification mechanisms, real-time corrective feedback, and adaptive content personalization each of which holds considerable potential for enhancing student motivation and sustained engagement (Biaddang & Caroy, 2024). However, the effectiveness of these platforms largely depends on the extent to which they cater to the diverse learning preferences and needs of students.

Recent research demonstrates that student voice and choice plays a crucial role in strengthening academic engagement and learning outcomes (Conner et al., 2025). In the context of vocal learning, where skill development requires continuous practice and timely corrective feedback, a thorough understanding of students' preferences for various digital

Vol. 12, No. 2 : June 2026
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pp. 898-911
Email: jklppm@undikma.ac.id

platform features becomes particularly critical. Pikhart et al. (2024) identified diverse usage patterns and favorable perceptions of digital tools in foreign language learning, indicating that students hold specific preferences for the digital tools they utilize (Suen & Hung, 2025). Previous studies have established that interactivity, accessibility, and personalization are key determinants of students' preferences for digital learning platforms (Biaddang & Caroy, 2024; Noor et al., 2022). However, the majority of existing research concentrates on general academic learning contexts, with comparatively limited attention directed toward vocal learning a domain with distinctive requirements including visual technique demonstration, high-fidelity audio feedback, and repetitive practice structures. A fundamental limitation within the existing literature is the insufficient examination of how student preferences for particular digital platform features influence the effectiveness of vocal learning and learner motivation (Oroni & Xianping, 2024). Generic digital platforms designed predominantly for broad academic use commonly lack domain-specific functionalities essential to vocal pedagogy, such as high-resolution audio streaming, real-time pitch visualization, AI-driven corrective feedback on vocal technique, and structured repositories for recording comparison. These deficiencies may compromise the quality of instruction, restrict opportunities for self-directed technical refinement, and ultimately diminish student motivation in vocal learning contexts. Consequently, a targeted investigation into the specific platform features that vocal learners prioritize is not only warranted but essential for informing more responsive and effective platform development.

This research aims to fill this gap by thoroughly examining students' preferences for various digital platform features within the context of vocal learning, as well as identifying the factors that shape these preferences. The scientific novelty of this research lies in its integrative approach combining student voice theory, technology preference analysis, and vocal learning pedagogy to develop a comprehensive framework capable of informing the design of more student-centered and effective digital learning platforms. By gaining a deeper understanding of student preferences, educators and platform developers can construct digital learning environments that not only support optimal vocal skill development but also enhance student motivation and satisfaction throughout the learning process.

Based on the background that has been described, this study aims to: (1) identify and analyze students' preferences for various features of digital platforms in vocal learning; (2) investigate the factors that affect students' preferences for digital platforms, including technological, pedagogical, and individual aspects; (3) explore the relationship between students' preferences for digital platforms and their learning motivation and achievement of vocal learning outcomes (Liu et al., 2021; Naveed et al., 2021).

The results of this study are expected to make a significant contribution theoretically and practically. Theoretically, this study enriched the literature on *digital learning platforms* with a special focus on vocal learning and the role of *student preferences*, as well as developing a conceptual framework that integrates *student voice* theory, educational technology, and vocal learning pedagogy. Practically, the research findings can be a guide for educators in designing more effective vocal learning strategies by utilizing digital platforms according to student preferences, providing input for digital learning platform developers to create more *user-centered* and responsive features to vocal learning needs, and assisting educational institutions in making decisions related to technology adoption and implementation Appropriate digital learning for vocal learning programs.

Vol. 12, No. 2 : June 2026
E-ISSN: 2442-7667
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Email: jklppm@undikma.ac.id

Research Method

This study adopted a quantitative approach utilizing a cross-sectional survey design to explore students' preferences for digital platforms in vocal learning. The quantitative approach was selected for its capacity to objectively measure variables and yield findings generalizable to a broader population (Ahmed, 2024). The research population comprised students enrolled in vocal learning programs across multiple universities, with the inclusion criterion of having actively utilized a digital platform for a minimum of one academic semester. Participants were selected through purposive sampling to ensure that all respondents possessed direct and demonstrable experience with digital platforms in vocal learning contexts (Makwana et al., 2023). Given that the total population of vocal learning students across the participating institutions could not be precisely enumerated, sample size determination followed Cochran's formula for unknown population proportions at a 95% confidence level with a margin of error of 5%, yielding a minimum requirement of 384 respondents. This approach ensured adequate statistical power for the planned inferential analyses while remaining methodologically consistent with the non-probability sampling design employed.

The data collection instrument consisted of a structured questionnaire developed on the basis of student voice theory and relevant educational technology literature. The questionnaire encompassed four principal sections: demographic characteristics of respondents, prior experience with digital platforms, preferences for specific platform features, and students' motivation to engage in vocal learning, as well as self-assessed vocal learning outcomes. Learning outcomes were operationalized through students' self-perceived academic achievement in vocal learning, measured by a dedicated subscale asking respondents to evaluate the extent to which their use of digital platforms contributed to improvements in their vocal technique, theoretical comprehension, and overall academic performance in vocal courses, consistent with established practices in educational technology research (Naveed et al., 2021). A five-point Likert scale (1 = strongly disagree to 5 = strongly agree) was employed to measure respondents' level of agreement with each statement, in accordance with the recommendation that five-point scales represent an optimal choice for educational and social research (Nadler et al., 2015). Content validity was assessed through expert judgment involving three specialists in educational technology and vocal pedagogy, while construct validity was examined via confirmatory factor analysis (CFA). Internal reliability was measured using Cronbach's alpha coefficients, with a minimum threshold of 0.70 as an acceptable indicator of internal consistency (Malapane & Ndlovu, 2024).

Data collection was conducted online through digital survey platforms to maximize participant reach and minimize response bias. Prior to completing the questionnaire, all respondents received informed consent documentation detailing the research purpose, data collection procedures, confidentiality guarantees, and the right to withdraw at any time without consequence. The collected data underwent systematic cleaning involving inspection for missing values, outliers, and response inconsistencies to ensure data integrity. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics were employed to characterize the sample and summarize variable distributions. Inferential analyses included independent samples *t*-tests and one-way ANOVA to examine differences in platform feature preferences across demographic groupings, Pearson correlation analysis to assess associations between preference variables and outcome variables, and multiple regression analysis to identify significant predictors of learning motivation and learning outcomes. In the regression models, students' ratings of digital platform features specifically audio-visual capability, real-time feedback, content

Vol. 12, No. 2 : June 2026
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Email: jklppm@undikma.ac.id

personalization, accessibility, discussion forums, and gamification functioned as independent variables, while learning motivation and self-perceived learning outcomes served as dependent variables. Normality of data distribution was verified through the Kolmogorov-Smirnov and Shapiro-Wilk tests, and homogeneity of variance was assessed via Levene's test prior to executing parametric analyses (Zangger, 2025). All research procedures adhered to the principles of research ethics, with institutional ethics committee approval obtained prior to data collection.

Results and Discussion

Respondent Characteristics

This study involved 384 students from various universities who actively utilized digital platforms in vocal learning. The distribution of respondents reflected a reasonably balanced composition, with 58.3% female and 41.7% male participants, and the majority falling within the 19–22 age range (67.4%). Most respondents were enrolled at the undergraduate education level (73.2%), with the remainder comprising diploma (15.6%) and postgraduate (11.2%) students. Regarding platform experience, 45.8% of respondents had utilized digital platforms for vocal learning for a period of one to two years, 32.3% for less than one year, and 21.9% for more than two years. These demographic characteristics suggest that the majority of respondents represent the digital native generation, a cohort inherently familiar with online learning technologies.

Table 1. Demographic Characteristics of Respondents (N=384)

Characteristics	Categories	Frequency	Percentage (%)
Gender	Male	160	41.7
	Female	224	58.3
Age	18 years old	42	10.9
	19-22 years old	259	67.4
	>22 years old	83	21.6
Education Level	Diploma	60	15.6
	Bachelor	281	73.2
	Postgraduate	43	11.2
User Experience	<1 year	124	32.3
	1-2 years	176	45.8
	>2 years	84	21.9

Digital Platform Experience

Survey results indicated that Google Classroom was the most widely utilized platform (68.5%), followed by Zoom (62.8%), YouTube (58.1%), and vocal-specific applications such as Smule and Vocal Coach (34.6%). The average weekly duration of digital platform use reached 8.4 hours, with the majority of respondents (71.6%) accessing their platforms four to six times per week. Self-reported digital skill levels were predominantly high, with 52.3% of respondents rating themselves as proficient, 38.5% as moderately proficient, and only 9.2% as less proficient. These findings indicate that students not only engage with digital platforms on a regular basis but also possess adequate digital competencies to make meaningful use of the available features.

Student Preferences for Digital Platform Features

Preference analysis revealed that audio-visual features obtained the highest rating (M = 4.32, SD = 0.68), reflecting the fundamental importance of visual technique demonstration and audio feedback in vocal learning. Real-time feedback was also highly valued (M = 4.28, SD = 0.71), as this feature enables students to receive direct and immediate corrective guidance from instructors. Preferences for content personalization yielded elevated scores (M

= 4.15, *SD* = 0.74), indicating a strong desire among students for learning pathways individually tailored to their specific needs. Platform accessibility was similarly regarded as important (*M* = 4.21, *SD* = 0.69), confirming that ease of access constitutes a crucial consideration in students' platform evaluations. Notably, the gamification feature elicited a positive response (*M* = 3.89, *SD* = 0.82), though it was rated comparatively lower than the core instructional features.

Table 2. Student Preferences for Digital Platform Features (N=384)

Feature Categories	M	SD	Ranking
Audio-Visual Features	4.32	0.68	1
Real-time Feedback	4.28	0.71	2
Accessibility	4.21	0.69	3
Content Personalization	4.15	0.74	4
Discussion Forum	3.97	0.78	5
Gamification	3.89	0.82	6

Note: On a scale of 1-5 (1=Strongly Disagree, 5=Strongly Agree)

Factors Affecting Preferences

Independent samples *t*-test results indicated no statistically significant difference in feature preferences based on gender ($t = 1.42$, $p = .157$); however, education level exerted a significant influence ($F = 5.83$, $p = .003$), with graduate students tending to assign greater value to personalization features relative to diploma-level students. Platform usage experience demonstrated a significant positive correlation with preferences for advanced features ($r = 0.34$, $p < .001$), suggesting that students with greater accumulated experience progressively develop stronger inclinations toward more sophisticated platform functionalities. Digital skill proficiency also significantly shaped preferences ($F = 12.67$, $p < .001$), with students possessing higher digital competencies exhibiting a stronger preference for interactive features and gamification elements.

The Relationship of Preferences to Motivation and Learning Outcomes

Pearson correlation analysis revealed significant positive associations between digital platform feature preferences and learning motivation ($r = 0.52$, $p < .001$) as well as learning outcomes ($r = 0.41$, $p < .001$). Multiple regression analysis further demonstrated that preferences for audio-visual features ($\beta = 0.28$, $p < .001$) and real-time feedback ($\beta = 0.24$, $p < .001$) emerged as the strongest predictors of learning motivation, with the model collectively accounting for 38.4% of motivational variance ($R^2 = .384$). For learning outcomes, the combined contribution of content personalization ($\beta = 0.21$, $p = .002$) and accessibility ($\beta = 0.19$, $p = .006$) proved statistically significant, with the model explaining 27% of outcome variance ($R^2 = .27$). These findings confirm that when digital platforms are purposefully designed to align with student preferences, the resultant positive impact on both motivation and academic achievement becomes substantially more pronounced.

Instrument Validity and Reliability

Confirmatory factor analysis (CFA) yielded a well-fitting measurement model ($\chi^2/df = 2.14$, CFI = 0.94, RMSEA = 0.054), confirming the construct validity of the research instrument. All questionnaire dimensions demonstrated excellent internal reliability, with Cronbach's alpha values ranging from 0.82 to 0.91, substantially exceeding the minimum acceptable threshold of 0.70. The audio-visual features preference dimension recorded the highest reliability ($\alpha = 0.91$), followed by real-time feedback ($\alpha = 0.88$), content personalization ($\alpha = 0.86$), accessibility ($\alpha = 0.84$), and gamification ($\alpha = 0.82$). These results collectively indicate that the research instrument possesses strong internal consistency and is capable of accurately measuring the targeted constructs.

Vol. 12, No. 2 : June 2026
E-ISSN: 2442-7667
pp. 898-911
Email: jklppm@undikma.ac.id

Discussion

Interpretation of Characteristics and Usage Patterns

The study findings reveal that the majority of respondents (67.4%) fall within the 19–22 age range, with a predominantly female composition (58.3%), reflecting demographic characteristics commonly observed within Indonesian higher education contexts. The varied platform usage experience with 45.8% of respondents having engaged with digital learning tools for one to two years suggests a meaningful degree of maturity in students' interactions with educational technologies. This pattern aligns with the findings of Lin et al. (2022), who identified high readiness among students and professionals for adopting digital learning applications in communication and health-related disciplines, with 98.8% of participants expressing willingness to utilize a Digital Learning Toolbox application. The intensity of platform engagement, averaging 8.4 hours per week at a frequency of four to six sessions weekly, confirms that digital platforms have become an integral component of students' learning routines rather than merely supplementary tools. This degree of engagement reflects a broader transformation in the educational paradigm a shift from traditional face-to-face instruction toward a hybrid learning ecosystem in which technology is seamlessly woven into the fabric of daily academic activity.

The predominance of Google Classroom (68.5%) and Zoom (62.8%) as primary platforms mirrors a clear preference for tools offering flexibility and ease of access, consistent with the observations of Xu et al. (2022), who emphasized that the development of online teaching resources must be sensitive to the diverse needs of student populations and should offer varied curriculum materials. Notably, YouTube's emergence as the third most utilized platform (58.1%) affirms its established role as a powerful resource for self-directed learning. Suryati (2021) highlighted that the incorporation of YouTube as an accompaniment medium in vocal learning enhances both interest and instructional effectiveness, as students are empowered to practice autonomously and exercise greater expressive control in their improvisations. The utilization of vocal-specific applications such as Smule and Vocal Coach by 34.6% of respondents further signals students' awareness of the value of purpose-built tools for vocal development. These platforms offer distinctive capabilities including real-time pitch correction, sound wave visualization, and community-based features that facilitate virtual collaboration across geographic boundaries. The high prevalence of digital proficiency (52.3% proficient, 38.5% moderately proficient) represents a considerable asset in enabling students to engage meaningfully with the sophisticated features these platforms provide, a finding consistent with Azizah et al. (2024), who demonstrated the critical importance of alignment between digital media design and users' cognitive capacities through the development of music media grounded in Edwin Gordon's Auditory Learning Theory, Jean Piaget's Constructivism, and Sweller's Cognitive Theory of Multimedia Learning. Mona (2021) noted that in online vocal learning environments, students frequently encounter difficulties in grasping singing techniques and note recognition due to the constraints of mediated interaction; however, sufficient digital literacy can substantially reduce these barriers by enabling more purposeful exploration of available platform functionalities. The digital native characteristics of the study's respondents position them as learners who not only consume digital content but are actively capable of co-creating their own learning experiences, thereby fostering more interactive and individually responsive learning dynamics.

Analysis of Student Preferences for Platform Features

Student preferences for audio-visual features, which obtained the highest rating (M = 4.32, SD = 0.68), reflect a fundamental pedagogical necessity in vocal learning a discipline

Vol. 12, No. 2 : June 2026
E-ISSN: 2442-7667
pp. 898-911
Email: jklppm@undikma.ac.id

that relies heavily on the concurrent integration of visual technique demonstration and high-fidelity audio feedback. Hausknecht et al. (2024) highlighted the considerable complexity of vocal assessment, identifying 292 distinct terminologies in singing voice evaluation that could be reduced by up to 61% through systematic lexical grouping. This underscores the critical value of audio-visual features, as they allow students to observe vocal techniques with precision and access accurate auditory references without the confusion generated by inconsistent terminology. In the context of vocal education, the simultaneous observation of postural alignment, diaphragmatic engagement, and oral articulation alongside real-time sound quality evaluation creates a multisensory learning experience that verbal instruction alone cannot replicate. Widowati & Handayaningrum (2022) explained that the acquisition of vocal expression competencies necessitates mastery across multiple voice registers including chest voice, spoken voice, diaphragmatic voice, nasal voice, and head voice each producing a distinct emotional timbre that can only be comprehensively understood through explicit audio-visual demonstration. This feature further enables students to engage in self-assessment by comparing their own recordings against instructor-provided model demonstrations, cultivating a critical awareness of their vocal output quality. Azizah et al. (2024) found that digital music media satisfying the ACTION criteria (Access, Cost, Technology, Interactivity, Organization, Novelty) with a validation score of 90% effectively enhanced music education quality, confirming that the purposeful integration of audio-visual elements exerts a significant influence on learning outcomes.

The strong preference for real-time feedback (M = 4.28, SD = 0.71) reflects students' desire for immediate corrective guidance to refine their vocal technique a need well-supported by Cahalan et al. (2022), who demonstrated that an online breathing retraining and vocal exercise intervention delivered over ten weeks yielded significant improvements in breathlessness symptoms ($p < .001$), fatigue ($p = .03$), and sound quality ($p = .01$), attesting to the effectiveness of sustained corrective feedback within digital vocal interventions. The absence of timely feedback carries considerable risk, as students may persistently reproduce technical errors that progressively consolidate into entrenched muscular habits that are subsequently difficult to remediate. Platforms incorporating real-time feedback mechanisms empower instructors to address issues of postural alignment, breathing technique, and articulatory precision as they arise, thereby creating a more productive and effective learning cycle. Siqueira et al. (2022) identified variables including inattentive interlocutors, ambient noise in the working environment, and insufficient vocal training as significant predictors of vocal fatigue, indicating that timely corrective feedback not only enhances technical proficiency but also functions as a preventive measure against vocal injury resulting from inappropriate voice use. In digital vocal learning environments, real-time feedback may be operationalized through diverse mechanisms: automated spectral analysis presenting immediate pitch and timbre visualizations, instructor commentary delivered via live chat or video annotation, and machine learning algorithms capable of identifying deviations from established vocal technique standards and generating targeted corrective suggestions. Arnidah et al. (2023) emphasized the importance of achieving excellence-level validation in both content and media quality to ensure the effectiveness of video-based instruction, underscoring the principle that the technical quality of the delivery platform directly determines the speed and accuracy with which feedback reaches learners.

Content personalization (M = 4.15, SD = 0.74) reflects students' recognition that each individual possesses unique vocal characteristics demanding a differentiated learning approach. Xu et al. (2022) observed that individualization in online learning contexts is particularly salient, with 56.43% of students preferring condensed 15-minute instructional

Vol. 12, No. 2 : June 2026
E-ISSN: 2442-7667
pp. 898-911
Email: jklppm@undikma.ac.id

videos while 43.57% favored full 45-minute sessions; logistic regression analysis further confirmed that video duration preferences were significantly associated with content characteristics and timing of use. Within vocal learning, personalization encompasses repertoire selection aligned with each student's vocal range, practice tempo calibration according to technical proficiency, and targeted emphasis on individual areas requiring development. Features enabling the customization of learning pathways on the basis of initial assessment results are therefore likely to enhance both instructional efficiency and learner satisfaction. Lin et al. (2022) reported that participants responded positively to application functionalities enhancing utility including tutorials, quality ratings, content and topic filters, and diverse digital formats affirming the centrality of personalization in elevating the relevance of learning content. Suryati (2021) further demonstrated that through the use of YouTube as an accompaniment platform, students exhibit greater discipline in vocal expression and improvisation, as they retain the autonomy to select accompaniment tracks suited to their individual ability levels and preferences, thereby generating a more genuinely personalized learning experience. Platforms offering adaptive learning pathways responsive to student performance data, algorithm-generated practice recommendations, and adjustable content difficulty levels are therefore positioned to more effectively address the heterogeneous learning needs of vocal students. Personalization also carries important psychological dimensions: students who feel that their individual uniqueness is recognized and accommodated rather than constrained by a uniform, one-size-fits-all learning trajectory are more likely to develop intrinsic motivation and a strong sense of ownership over their own learning development.

Factors Shaping Preferences

The absence of statistically significant differences in preferences by gender ($t = 1.42$, $p = .157$) suggests that in the contemporary digital learning environment, both male and female students maintain largely equivalent expectations regarding platform features a finding that challenges traditional assumptions about gender-based disparities in technological orientation. Nonetheless, education level exerted a significant influence ($F = 5.83$, $p = .003$), with graduate students demonstrating a stronger appreciation for personalization features relative to diploma-level counterparts. This differential may be attributed to greater academic maturity, heightened awareness of discipline-specific learning needs, and more extensive experience in identifying effective learning approaches. Lin et al. (2022) similarly documented significant generational variation in platform feature preferences ($H_3 = 9.309$, $p = .03$) and inter-professional differences ($H_3 = 8.006$, $p = .046$), with Generation X exhibiting stronger valuation of security features compared to Generation Z ($p = .04$), the latter of which prioritizes ease of access illustrating how demographic and professional backgrounds shape divergent expectations of platform functionality. Hausknecht et al. (2024) reported that only 24 out of 114 vocal assessment terminologies appeared in at least 20% of online sources, with non-uniform distribution of similarity ratings, suggesting that educational experience and background shape how individuals conceptualize and interpret vocal concepts, which in turn influences their preferences for platform features capable of accommodating their terminological frameworks.

The significant positive correlation between platform usage experience and preference for advanced features ($r = 0.34$, $p < .001$) reflects a natural developmental trajectory, whereby more experienced users acquire the capacity to recognize and capitalize on complex functionalities that may initially appear inaccessible or intimidating to novice learners. Siqueira et al. (2022) found that occupational vocal workload characteristics including daily vocal demands, elevated vocal loudness requirements, and insufficient vocal training were

Vol. 12, No. 2 : June 2026
E-ISSN: 2442-7667
pp. 898-911
Email: jklppm@undikma.ac.id

significant predictors of perceived vocal fatigue, indirectly indicating that sustained user experience cultivates a heightened awareness of specific learning needs and greater sensitivity toward platform features that can address those needs. Students with extensive platform experience develop a nuanced understanding of the limitations of basic tools and increasingly seek sophisticated functionalities such as voice analyzers, pitch correction visualization, and recording comparison features that enable an in-depth analysis of their vocal progress. Xu et al. (2022) demonstrated that while the majority of students prefer condensed mini-videos for pre-class active learning (65.00% and 59.29% across two measurement points), a meaningful proportion continue to favor full-length videos (17.14% and 25.71%) or both formats (17.86% and 15.00%), indicating that prior experience and content familiarity shape content duration preferences over time. Widowati & Handayaningrum (2022) further clarified that self-assessment in vocal expression learning demands a thorough understanding of diverse vocal registers and the distinct emotional qualities each generates competencies achievable only through sustained practice and reflection made possible by extensive platform engagement. Azizah et al. (2024) found that digital music media implemented in classroom settings not only satisfied but exceeded established conformity standards according to educator evaluations, affirming the principle that experience with high-quality digital media progressively elevates users' expectations and their inclination toward more advanced platform features.

The significant influence of digital skill proficiency on platform preferences (F = 12.67, p < .001) underscores technology literacy as a critical determinant of platform utilization quality. Students with higher digital competencies demonstrate greater interest in interactive features and gamification elements, largely because their technical confidence enables them to explore diverse platform functionalities freely, without the apprehension of errors that might disrupt their learning experience. Mona (2021) noted that in online vocal learning environments, students frequently encounter challenges in comprehending singing techniques and identifying musical notes due to the constraints of mediated interaction, difficulties further compounded by limited digital skills. Practical solutions such as multimedia PowerPoint presentations were recommended for their superior accessibility and small file size, as they do not require a continuous internet connection. This highlights the imperative for digital literacy development to proceed in parallel with platform implementation, ensuring equitable access to advanced features for all learners regardless of their initial skill levels. Arnidah et al. (2023) demonstrated that learning video development incorporating team-based project and case method approaches was classified as indispensable, with content, material, and media validation rated in the excellent category, affirming that the ability to engage with and integrate multiple media formats constitutes a crucial determinant of instructional effectiveness. Lin et al. (2022) identified participants' concerns regarding technical challenges, data protection, resource quality, and application sustainability, illustrating that digital skills extend beyond operational proficiency to encompass critical literacy concerning security, privacy, and the evaluation of digital content quality. Cahalan et al. (2022) noted that SingStrong program sessions were recorded for participants unable to attend in real time, enabling flexible access; however, optimal utilization of these recordings requires sufficient digital skills for navigation, review, and integration into an independent self-paced practice routine.

Implications of Preferences on Motivation and Learning Outcomes

The significant positive associations between platform feature preferences and learning motivation (r = 0.52, p < .001) and learning outcomes (r = 0.41, p < .001) confirm that alignment between platform capabilities and student needs exerts a direct impact on

Vol. 12, No. 2 : June 2026
E-ISSN: 2442-7667
pp. 898-911
Email: jklppm@undikma.ac.id

learning results, consistent with self-determination theory's emphasis on the foundational roles of autonomy, competence, and relatedness in sustaining learning motivation. Cahalan et al. (2022) demonstrated that a structured online vocal program incorporating breathing retraining and progressive vocal exercises yielded significant improvements across multiple outcome domains including breathlessness at rest ($p < .001$), during dressing ($p = .01$), and stair climbing ($p < .001$), as well as fatigue ($p = .03$), normal daily activity ($p = .04$), pain and disability ($p = .03$), sound quality ($p = .01$), and communication and cognition ($p = .04$) affirming the effectiveness of need-responsive digital vocal interventions among participants with a minimum attendance of 50%. The psychological mechanisms underlying this association involve heightened perceptions of control and self-efficacy when learners experience platform features as genuinely supportive of their learning styles, generating a state of flow in which presented challenges align with individual competency levels, producing deep engagement and intrinsic satisfaction. Suryati (2021) found that employing YouTube as an accompaniment platform for Pop Jazz vocal learning enhances student interest and instructional effectiveness, demonstrating that when platforms facilitate self-directed learning, intrinsic motivation is strengthened as students gain greater agency over the timing, setting, and pace of their practice.

The identification of audio-visual feature preferences ($\beta = 0.28$, $p < .001$) and real-time feedback ($\beta = 0.24$, $p < .001$) as the strongest predictors of learning motivation collectively accounting for 38.4% of motivational variance indicates that these features address students' fundamental psychological needs for competence and immediate reinforcement, establishing a positive feedback loop that sustains long-term engagement. Azizah et al. (2024) found that digital music media developed in accordance with the Cognitive Theory of Multimedia Learning effectively elevated music education quality, achieving an overall validation score of 90% rated as highly appropriate in graphic and linguistic dimensions and partially appropriate in content and presentation, supporting the premise that evidence-based platform design exerts a meaningful impact on learner engagement and academic outcomes. Real-time feedback in particular creates a rewarding learning cycle in which students can observe the immediate consequences of their efforts, reinforcing constructive behaviors and encouraging consistent practice. Widowati & Handayaningrum (2022) demonstrated that self-assessment within vocal expression learning proves effective precisely because students can independently evaluate their command of various registers and recalibrate their practice on the basis of the feedback received, thereby sustaining a self-reinforcing learning cycle. Siqueira et al. (2022) found that declining vocal quality perceptions and heightened vocal volume demands in home office contexts were associated with increased vocal fatigue, indicating that feedback mechanisms enabling students to optimize their vocal technique not only enhance technical performance but also serve a protective function helping to prevent fatigue and injury, which in turn preserves long-term motivation by enabling students to practice consistently without adverse consequences for their vocal health.

The significant contributions of content personalization ($\beta = 0.21$, $p = .002$) and accessibility ($\beta = 0.19$, $p = .006$) to learning outcomes ($R^2 = .27$) suggest that when students can access level-appropriate content at their own convenience, the learning process becomes substantially more efficient, as they are able to progress at their individual optimal pace without the pressure of conforming to a collective class tempo that may be either too rapid or too gradual. Arnidah et al. (2023) underscored the importance of flexibility in project-based and case method learning environments, where students require access to resources capable of supporting both independent and collaborative problem-solving; their study found that

Vol. 12, No. 2 : June 2026
E-ISSN: 2442-7667
pp. 898-911
Email: jklppm@undikma.ac.id

learning video development was categorized as indispensable, with product validation rated as very good. In the context of vocal development, platform accessibility empowers students to engage in practice beyond formal instructional hours a dimension that is critical for developing muscle memory and vocal stamina, both of which depend on consistent and repetitive exercise. Xu et al. (2022) found that students' selection of videos of varying durations across different temporal contexts before, during, and after class sessions was significantly associated with the characteristics of the content itself, confirming that accessibility to a diverse range of content formats enables learners to select materials best suited to their immediate learning circumstances. Lin et al. (2022) reported that a substantial majority of participants responded positively to application settings enabling the sharing of digital resources via social media links (87.8%), the management of push notifications (79.3%), and the reporting of technical issues (97.6%), illustrating that accessibility is valued not only as a means of content retrieval but also as a mechanism for participating in learning communities and obtaining timely technical support. Mona (2021) highlighted that multimedia learning tools requiring neither a continuous internet connection nor large file sizes offer superior accessibility, particularly for students with constrained technological infrastructure, thereby ensuring more equitable access to meaningful learning opportunities.

Conclusion

This study illuminates the evolving dynamics of student preferences for digital platforms in vocal learning, revealing a meaningful transformation in the contemporary music education paradigm. Among the features evaluated, audio-visual capability emerged as the most highly valued element, affirming that vocal pedagogy is inherently multisensory in nature demanding platforms capable of providing integrated visual and auditory learning experiences that verbal instruction alone cannot replicate. Real-time feedback was identified as functionally indispensable, given that the capacity for immediate corrective guidance is critical to preventing the entrenchment of technically erroneous vocal habits and to accelerating the trajectory of skill acquisition. Content personalization and platform accessibility were further recognized as central determinants of learner satisfaction, as they enable individually responsive learning pathways that honor the distinct vocal characteristics and developmental needs of each student. The findings collectively affirm that when digital platforms are purposefully designed to align with student preferences, the resulting impact on both learning motivation and academic achievement is substantial and meaningful. Education level and digital skill proficiency were demonstrated to be significant shapers of preference patterns, whereas gender proved to be a negligible differentiating factor a reflection of the broad democratization of technology access characteristic of the digital native generation. The positive relationship between accumulated platform experience and appreciation for more sophisticated features further underscores the importance of developing scalable platforms that progressively accommodate the growing competencies and evolving expectations of both novice and experienced learners.

Recommendation

Based on the findings of this study, several recommendations are directed toward relevant stakeholders in vocal education and digital platform development.

For educators and instructors, it is recommended to strategically integrate digital platforms prioritizing audio-visual richness and real-time feedback mechanisms into vocal learning curricula. Instructors should leverage platforms that allow students to record, review, and compare their vocal performances against model demonstrations, thereby supporting self-

Vol. 12, No. 2 : June 2026
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pp. 898-911
Email: jklppm@undikma.ac.id

directed assessment and continuous improvement. Differentiated instructional strategies should also be employed to accommodate variations in students' digital skill levels and educational backgrounds.

For platform developers, the findings underscore the importance of investing in domain-specific features tailored to vocal learning, including high-fidelity audio streaming, AI-assisted pitch and timbre analysis, adaptive learning path generation, and multiformat accessibility across devices and varying network conditions. Interfaces should be designed with scalability in mind, offering entry-level functionality for novice users while progressively unlocking advanced features for more experienced learners.

For educational institutions, it is advisable to incorporate digital literacy development programs as a complementary component of vocal learning curricula, ensuring that all students possess the foundational competencies required to engage meaningfully with available platform features. Institutions should also periodically reassess the digital platforms currently in use to verify their continued alignment with evolving student needs and emerging pedagogical best practices.

For future researchers, this study recommends longitudinal designs capable of tracking changes in student preferences and learning outcomes across extended periods of platform use. Additionally, qualitative approaches such as in-depth interviews or focus group discussions would provide richer contextual insights into the experiential dimensions of digital vocal learning that quantitative methods alone cannot fully illuminate. Cross-institutional and cross-cultural comparative studies would further enhance the generalizability of the findings presented in this investigation.

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