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## **EVERYONE CAN LEARN MUSIC: INVESTIGATING THE EFFECTIVENESS OF AI-POWERED MUSIC LEARNING APPS ON ‘NON-MUSICAL’ VOICE STUDENTS AT THE MOUNTAIN TOP UNIVERSITY**

### **ABSTRACT**

*This article examines the efficacy of AI-powered music learning tools on the non-musical students of Mountain Top University. Every student of the school has been saddled with the responsibility of learning to sing or play a musical instrument as a compulsory general course titled “Every Student a Musician (ESM)”. This study explores how mobile-based learning, supported by artificial intelligence, can assist in overcoming cognitive and pedagogical barriers among “non-musical” students. Existing studies on artificial intelligence in music education have largely examined patterns of technology use, attitudes, and general pedagogical possibilities with the use of AI rather than its direct impact on foundational musicianship skills among musical novices. (Waddell and Williamon, 2019; Luo, 2024; Abdullahi and Ibidun, 2025; Mwita and Owino, 2025). Consequently, there remains a significant gap in longitudinal, classroom-based research that investigates the effectiveness of AI-powered music learning apps on amateur voice students within a formal university music instruction. This study seeks to address this gap. Using a longitudinal study, participant observation, and interviews with students, a series of data was collated from the voice class of ESM to track and analyze the progress of students with little or no musical abilities who have had consistent access to musical apps for one academic year. The study draws upon Vygotsky’s Sociocultural Theory to explain how digital tools, supported by human scaffolding, enable students to move from musical inexperience to basic competence. Findings reveal that most of the students are able to improve*

*their musicianship through consistent use of AI-powered apps. It concludes that AI-powered tools, while not replacements for human teachers, present a viable supplement for inclusive and scalable music education. The paper recommends research into other AI-powered apps available for different groups of learners and in various aspects of music.*

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Keywords: ESM, Non-musical, AI-powered Music Learning Apps.

## **Introduction**

Every Student a Musician (ESM) is a compulsory general studies course offered to all undergraduate students at the Mountain Top University, Ogun State, Nigeria, throughout their period of study. The course is designed to foster a musically inclusive and culturally enriched academic community by enabling students from diverse disciplines to acquire basic musical skills and explore their creative potential (Oluwatade and Ogunyemi, 2019). Initially, ESM focused primarily on instrumental instruction, allowing students to select and learn a musical instrument of their choice. However, over time, the university management observed that some students, due to health challenges, cognitive limitations, or a lack of interest in instrumental performance, were better suited to vocal training. Consequently, a voice unit was introduced for students in their second year and above.

This study refers to students enrolled in this voice unit as *non-musical voice students*. These are students who are not enrolled in the music department and typically have little or no prior musical training, but are required to take singing as part of the university's compulsory music curriculum. Upon the commencement of the voice lessons, I served as the course instructor and observed that several of these students exhibited significant foundational challenges, including partial tone deafness and persistent difficulties with pitch accuracy. Reassigning them to instrumental units was not a viable option, as many had previously struggled in those units without success.

At the time of this study, the course carried no credit units and had only recently been upgraded to a one-credit course. In addition, students balance music studies with major departmental courses and various co-curricular engagements, including sports, entrepreneurship training, and spiritual activities. These competing demands make the acquisition of practical musical skills within traditional classroom settings especially challenging.

After several weeks of limited progress using conventional teaching approaches, and in recognition of the potential of artificial intelligence to support personalized learning, immediate feedback, and repeated practice, I decided to explore the integration of digital technology and AI-powered music learning tools. Three applications were introduced: a piano application to support pitch matching, *Sing True*, an AI-powered application designed to improve pitch accuracy, and *Sound Corset*, which assists learners in understanding tempo, rhythm, timing, and tuning. The need for such support is particularly critical given the limited time available for

music instruction within the ESM course. Within one academic semester (approximately ten instructional sessions), noticeable improvements were observed in the students' musicianship, such as the ability to understand and reproduce pitch accurately.

This experience highlighted the potential effectiveness of AI-powered music learning applications in supporting musical development and facilitating the transformation of learners from musical novices toward functional musicianship. Against this backdrop, the growing integration of AI-powered music learning applications presents a complementary instructional approach whose effectiveness, limitations, and pedagogical implications require systematic investigation and documentation.

Existing studies on artificial intelligence in music education have largely examined patterns of technology use, attitudes, and general pedagogical possibilities rather than its direct impact on foundational musicianship skills among musical novices. For instance, Waddell and Williamon (2019) explored musicians' attitudes toward music-learning technologies across amateur, student, and professional populations, focusing primarily on technology acceptance rather than skill acquisition among non-musical learners. Similarly, Luo (2024) provided a broad review of AI applications in music education, emphasizing instructional innovation and system design, but without empirical investigation of voice training outcomes for students with limited or no musical background. Within the African context, Mwita and Owino (2025) and Abdullahi and Ibidun (2025) examined the adoption and potential of AI tools in music education at institutional and educator levels, highlighting awareness, opportunities, and infrastructural challenges; however, these studies did not empirically assess how AI-powered music learning applications support the development of core vocal skills such as pitch accuracy, tone perception, and range control among voice students. Consequently, there remains a significant gap in longitudinal, classroom-based research that investigates the effectiveness of AI-powered music learning apps, in combination with teacher guidance, for transforming voice students within formal university music instruction. This study seeks to address this gap.

### **Scope of Study**

This study about the effectiveness of AI powered apps on the success of vocal lessons is limited to the 300 level and 400 level students of the 2024/2025 academic session at the Mountain Top University, Ogun state, Nigeria. These are students from the department of Mass Communication, Computer sciences, Physics, Mathematics, Food Science and Technology, Geosciences and others. They take this ESM course as one of the school's requirement for graduation and have previously in their first and second year on campus received classes in other instruments such as piano, saxophone, violin and guitar before the Voice unit was established by the ESM management at the start of the 2023/2024 academic session.

### **Aim and Objectives**

This study aims to explore the efficacy of AI-powered music educating apps for teaching musicianship and practical singing. The objectives are as follows:

1. To examine AI's potential and means of facilitating music learning
2. To explore the teacher's responsibilities in their students' use of AI for music learning
3. To rate the level of acceptance and effectiveness of AI in comparison to traditional music learning methods
4. To review the height of musicianship that can be acquired by the use of AI

## Research Questions

To understand this study, I ask the following questions:

1. In what way can AI facilitate music learning?
2. What is the input of the teacher/lecturer in AI assisted learning?
3. How do these apps compare to traditional music learning methods in terms of students' acceptance and effectiveness?
4. To what extent or professional level can AI teach music?

With these questions, the study aims to explore the potential of artificial intelligence in the transformation of musical novices to experts.

## Methodology

This study adopts a longitudinal mixed-methods approach combining quantitative performance data with qualitative participant observation to investigate the effectiveness of AI-powered music learning applications among non-musical voice students at Mountain Top University. The methodological orientation of this study is informed by educational and music learning research traditions that emphasize developmental change, skill acquisition over time, and the measurement of learning outcomes within authentic instructional contexts.

This research employs a longitudinal design in which the same cohort of students was observed and assessed over one academic session, spanning September 2024 to June 2025. Longitudinal research involves the repeated observation of the same participants over an extended period and is particularly appropriate for studies that seek to examine learning progression and developmental change rather than isolated performance outcomes. In music education, the acquisition of musicianship skills such as pitch accuracy, tone perception, and vocal control is a gradual process that unfolds over time and through repeated practice (Hallam, 2010 p. 269).

The use of a longitudinal approach allows this study to track changes in students' musicianship as they interacted consistently with AI-powered music learning applications. This design reduces the limitations of cross-sectional methods, which capture only momentary snapshots of ability, and instead provides insight into patterns of improvement, stagnation, or regression.

Longitudinal methods have been widely employed in music education research to examine the effects of sustained musical engagement and instruction, demonstrating their effectiveness in capturing developmental trajectories in musical skills and learning behaviors (McPherson & Williamson, 2016). By observing the same students across an academic session, this study is able to make more meaningful interpretations about the role of AI-assisted learning in musical development.

In addition to its longitudinal structure, the study incorporates participant observation as a core qualitative method. The researcher, who also served as the voice instructor, engaged directly with the students during weekly classes, enabling close observation of their learning behaviors, vocal responses, practice consistency, and engagement with the AI applications. Participant observation is particularly valuable in music education research, as it allows the researcher to document practical musical behaviors that may not be fully captured through numerical scores alone.

Students' progress was further assessed through continuous assessment records, class exercises, and end-of-semester examination results. These assessments provided structured performance data on key areas of musicianship, including pitch matching, tonal accuracy, range control, rhythmic precision, and general vocal confidence. Performance data were collated at multiple points during the academic session to support both qualitative interpretation and quantitative comparison.

To complement the observational data, this study employs a quantitative method to analyze and visually represent changes in students' musical performance over time. Quantitative approaches are widely used in music education research to measure learning outcomes, compare performance levels, and support claims of instructional effectiveness with empirical evidence (Creswell and Creswell, 2018). Numerical scores obtained from continuous assessments and examinations were organized and compared across different stages of the academic session.

Simple descriptive statistics were used to identify patterns of improvement among students, and the results were presented using graphical representations such as line graphs and bar charts. These visual plots made it possible to illustrate trends in students' musicianship development before, during, and after sustained engagement with the AI-powered applications. Graphical representation is particularly effective in longitudinal music education studies, as it allows readers to clearly observe progression, variation among learners, and the cumulative impact of instructional interventions over time (McPherson, Davidson, and Faulkner, 2012).

The integration of quantitative data with participant observation strengthens the methodological rigor of the study by allowing numerical trends to be interpreted alongside lived classroom experiences. This mixed-methods strategy ensures that students' musical development is examined both objectively, through measurable outcomes, and contextually, through direct instructional engagement.

## Theoretical Framework

This study is anchored on Lev Vygotsky's Sociocultural Theory, particularly his concept of the Zone of Proximal Development (ZPD). Vygotsky (1978) posits that learning is inherently a social and mediated process, emphasizing that individuals develop cognitive abilities first through interaction with more knowledgeable others and later through internalization. Central to this theory is the idea of the ZPD, which refers to the distance between what a learner can accomplish independently and what they can achieve with the support of guidance, tools, or collaboration.

In the context of this research, the students at Mountain Top University who lack formal musical training are considered to be at the lower threshold of their ZPD in relation to vocal musicianship. This refers to the learners' current level of independent performance, from which assisted instruction enables progression toward higher levels of musicianship. The AI-powered music learning applications serve as mediating tools within the students' learning environment, providing assisted instruction that adapts to their level of skill and supports progressive development. These apps such as *SingTrue*, *Sound Corset*, and the mobile *Piano* offer immediate feedback, personalized challenges, and repetitive exercises that enable learners to gradually internalize musical concepts.

Moreover, the instructor's role in this learning process aligns with Vygotsky's notion of scaffolding, whereby the educator introduces and explains the use of AI tools, monitors student engagement, and provides additional guidance in areas the apps cannot address such as vocal posture, breathing techniques, and interpretative musicality. The collaboration between students, teachers, and technological tools illustrates a dynamic learning system where learners are actively guided toward greater musical competence.

This theoretical framework helps explain the observed transformation in the students' vocal ability and musicianship as documented over one academic session. It emphasizes that while the students began as musical novices, the combination of human support and intelligent digital tools enabled them to perform tasks that were initially beyond their unaided capabilities.

## Literature Review

As the global education sector continues to integrate artificial intelligence (AI) into teaching and learning processes, its application within music education is gaining scholarly attention. Particularly, the use of AI-powered music learning apps has shown promise in supplementing traditional teaching, especially for learners with limited musical backgrounds. This review focuses on three key studies that align with the goals and methodology of this research.

### **1. Merchán Sánchez-Jara et al. (2024): Artificial Intelligence-Assisted Music Education: A Critical Synthesis of Challenges and Opportunities.**

Merchán Sánchez-Jara et al. (2024), in this study present a comprehensive synthesis of existing scholarship on the application of artificial intelligence in music education through a systematic literature review (SLR). Drawing from interdisciplinary sources across music education, arts pedagogy, and computer science, the authors examine current trends in the technological development and pedagogical integration of AI within music learning environments. Their review highlights the growing capacity of AI-driven systems to support core learning processes such as pitch detection, rhythmic analysis, and performance feedback, positioning AI as an emerging instructional tool within contemporary music education.

The authors further conceptualize AI as a potential “cognitive mirror,” capable of providing learners with immediate, data-driven feedback that can support self-regulation and guided practice (Merchán Sánchez-Jara et al., 2024, pp. 5–6). This framing situates AI tools as mediational resources that may assist learners in identifying errors and refining performance through repeated interaction. At the same time, the review underscores the limitations of AI in addressing interpretive, expressive, and embodied aspects of musical performance, areas that continue to require human pedagogical intervention (pp. 7–8). Consequently, the authors advocate for an integrated instructional model in which AI functions as a supportive learning aid rather than a replacement for the teacher. This perspective aligns with sociocultural approaches to learning, in which technological tools operate within the learner’s Zone of Proximal Development while human instructors provide essential scaffolding (Vygotsky, 1978).

### **2. Uludağ & Satır (2023): Seeking Alternatives in Music Education: The Effects of Mobile Technologies on Students’ Achievement in Basic Music Theory**

Uludağ and Satır, in their study *Seeking Alternatives in Music Education: The Effects of Mobile Technologies on Students’ Achievement in Basic Music Theory*, examine the role of mobile technologies within undergraduate music education contexts. Using a quasi-experimental design, the authors investigate how mobile applications can be integrated into music instruction to support students’ engagement with foundational musical concepts such as rhythm, tempo, and theoretical understanding. Their work contributes to the growing body of literature that considers mobile technologies as supplementary tools capable of extending learning beyond traditional classroom settings.

The authors also discuss the potential of mobile applications to encourage self-paced learning and increased learner engagement, particularly by providing flexible access to instructional content and opportunities for independent practice (Uludağ & Satır, p. 8). In addition, the study emphasizes the importance of instructional balance, noting that while mobile technologies can support the acquisition of basic musical skills, effective learning environments are those in which technological tools are integrated alongside active teacher involvement. The authors argue that teacher guidance remains essential for contextual interpretation, feedback, and the development of musical understanding beyond technical accuracy (p. 10). This perspective reinforces a

blended instructional approach in which digital tools function as learning supports within a broader pedagogical framework rather than as standalone instructional substitutes.

### **Waddell and Williamon (2019): Technology Use and Attitudes in Music Learning**

Waddell and Williamon (2019), in their study *Technology Use and Attitudes in Music Learning*, investigate how musicians at different levels of expertise engage with digital technologies in their learning and practice routines. Using a survey-based empirical approach, the authors examine patterns of technology use among amateur, student, and professional musicians, with particular attention to learners' perceptions, attitudes, and acceptance of music-related technologies. Their study contributes to the literature by shifting focus from instructional outcomes to the ways learners interact with and perceive technology as part of their musical development.

The authors situate their analysis within the Technology Acceptance Model (TAM), exploring factors such as perceived usefulness, ease of use, and learners' willingness to integrate digital tools into regular practice. Their findings highlight the growing presence of digital technologies in music learning environments and suggest that learners increasingly rely on technological tools to support practice, feedback, and self-regulation. However, the study does not focus on specific pedagogical interventions or the measurement of skill development over time, nor does it examine learners with little or no prior musical training.

By emphasizing attitudes and patterns of adoption rather than instructional effectiveness, Waddell and Williamon's work provides important insight into the conditions under which music learners are receptive to technology-enhanced learning. This perspective is valuable for understanding how digital tools may be positioned within music education contexts, while also indicating the need for further research that examines how such technologies function pedagogically within formal instructional settings and among novice learners.

The above-reviewed literatures demonstrates a growing scholarly interest in the integration of artificial intelligence and digital technologies within music education, encompassing both conceptual analyses and empirical investigations. Systematic reviews such as Merchán Sánchez-Jara et al. (2024) provide a broad theoretical understanding of the capabilities and limitations of AI in music learning, emphasizing its role as a supportive instructional tool rather than a replacement for human pedagogy. Empirical studies, including Uludağ and Satır's examination of mobile technologies in music theory instruction and Waddell and Williamon's investigation of technology use and attitudes among musicians, further highlight the potential of digital tools to support learning and shape learners' engagement with music education. These studies provide robust theoretical and empirical support for the idea that AI can enhance basic music learning, especially among novice or "non-musical" learners. They align with the present study's observations that consistent app usage, when combined with strategic teacher input, can lead to measurable gains in vocal musicianship. Furthermore, they validate the application of Sociocultural Theory by illustrating how technology can serve as a mediating tool in musical development, helping students move progressively within their Zone of Proximal Development (ZPD). However, these studies primarily focus on trained musicians, music students, or general learner populations, and often emphasize technology adoption, attitudes, or short-term

instructional outcomes. Collectively, they reveal a lack of longitudinal, classroom-based research that examines the pedagogical effectiveness of AI-powered music learning applications in developing foundational vocal musicianship skills among non-musical university students. This study addresses this gap by investigating how AI-assisted learning, combined with teacher guidance, supports the progressive development of pitch accuracy, tone perception, and vocal control among non-musical voice students within a formal university music program.

## **Analysis and Results**

The 2023/2024 academic session marked the introduction of the voice unit within the ESM program at Mountain Top University, following my reassignment from the saxophone unit to coordinate vocal instruction. As the voice unit was newly established and first-year (100-level) students were not eligible to enroll, instruction was limited to upper-level students, with one additional instructor appointed. Prior to the commencement of teaching, a curriculum was developed in collaboration with the ESM coordinator to guide instructional content and assessment procedures.

At the onset of the program, an initial diagnostic assessment was conducted to determine students' vocal range, pitch perception, and basic tonal accuracy. This assessment involved having students reproduce single pitches and simple melodic patterns played on the piano. The diagnostic exercise revealed that several students exhibited partial tone deafness and significant difficulty in pitch matching, often requiring multiple attempts to reproduce a single pitch accurately, while a few students were unable to achieve correct pitch despite repeated guidance. These observations informed subsequent instructional and assessment strategies.

Throughout the academic session, students' musicianship development was assessed across four core areas: pitch accuracy, tone perception, vocal range control, and rhythmic understanding. Pitch accuracy was assessed by students' ability to match and sustain given pitches accurately, while tone perception was evaluated through listening and response exercises that required students to identify and reproduce pitch differences. Vocal range control was assessed by observing students' ability to sing comfortably within their identified vocal range without strain. Rhythmic understanding was evaluated through clapping, vocalization, and performance exercises involving tempo and rhythmic patterns.

Assessment was conducted using a simple performance-based rubric that categorized students' responses as accurate, partially accurate, or inaccurate. Improvement was determined by increased consistency in accurate pitch production, reduced time required to achieve correct

pitch, and improved confidence and stability in vocal delivery. These criteria were applied consistently during weekly classes and formal assessments.

To support instruction and practice, three digital applications were integrated into the learning process. *Sound Corset* was introduced during the first semester to support the teaching of rhythm, tempo, timing, and tuning. The application was used both during class demonstrations and individual student practice to provide auditory and visual feedback on rhythmic precision and pitch stability. A few weeks later in the same semester, a mobile *Piano* application was introduced to help students hear and reproduce correct pitches, particularly when practicing the chromatic scale. This enabled students to play reference pitches and attempt accurate vocal imitation independently.

Subsequently, *Sing True*, an AI-powered vocal training application, was introduced to support daily practice. The application offers structured listening, pitch-matching, and vocal exercises designed to develop pitch awareness and tonal accuracy. Students were instructed to engage with the applications for a minimum of ten minutes daily to encourage consistency and repeated exposure, which are essential for vocal skill development.

Students' progress was documented through weekly classroom observations and informal reflective check-ins. During these sessions, students were asked about their frequency of app usage, the types of exercises practiced, and challenges encountered. New exercises were also introduced to be explored using the applications and students' questions were addressed regarding their functionality. Observations focused on changes in pitch accuracy, response time, vocal confidence, and engagement with learning tasks.

These weekly records, alongside continuous assessment scores and examination results, formed the primary data set for the study. The documentation process enabled the tracking of individual and collective progress over time and provided both qualitative and quantitative evidence of changes in students' musicianship. This systematic approach ensured that the analysis was grounded in observable parameters.

## **Data Collation**

### **Participants**

The participants for this study were undergraduate students enrolled in the voice unit of the Every Student a Musician (ESM) program at Mountain Top University. Although the total class population consisted of 39 students, this analysis focuses on three overlapping groups based on initial diagnostic assessment outcomes:

1. 17 students identified as partially or fully tone-deaf at the beginning of the study;
2. 6 students who exhibited significant challenges with vocal range control; and
3. All 39 students, whose confidence levels in vocal performance were monitored throughout the academic session.

None of the participants had prior formal music education, and all were non-music majors taking the course as part of the university's compulsory general studies curriculum.

### **App Usage Requirements and Monitoring**

Following the introduction of the AI-powered music learning applications (*Sound Corset*, *Piano App*, and *Sing True*), students were instructed to engage in daily personal practice using a minimum of two applications for at least 10 minutes each, amounting to 20 minutes of practice per day. Students who adhered to this instruction accumulated a minimum of 120 minutes (2 hours) of app-assisted practice per week.

App usage frequency was monitored through weekly check-ins during class sessions, where students reported how often they practiced using the applications. Based on these self-reports, corroborated by observed progress in class, students' usage patterns were categorized as Daily use (5–7 days per week), Alternate-day use (3–4 days per week), Weekly use (1–2 days per week), or (less than once per week). These categories formed an important parameter for interpreting performance outcomes.

### **Parameters for Assessment**

Students' progress was evaluated using the following parameters:

- Tone matching accuracy: ability to reproduce a given pitch correctly within one or two attempts;
- Response time: speed with which a student could adjust and correct pitch after feedback;
- Consistency: ability to reproduce accurate pitches repeatedly across different sessions;
- Vocal confidence: willingness to attempt pitches audibly and participate actively in vocal exercises.

Assessments were conducted through weekly in-class vocal exercises, continuous assessment scores, and end-of-session examinations. Observational records and assessment outcomes were collated to determine levels of improvement.

## **Results**

### **Tone Matching**

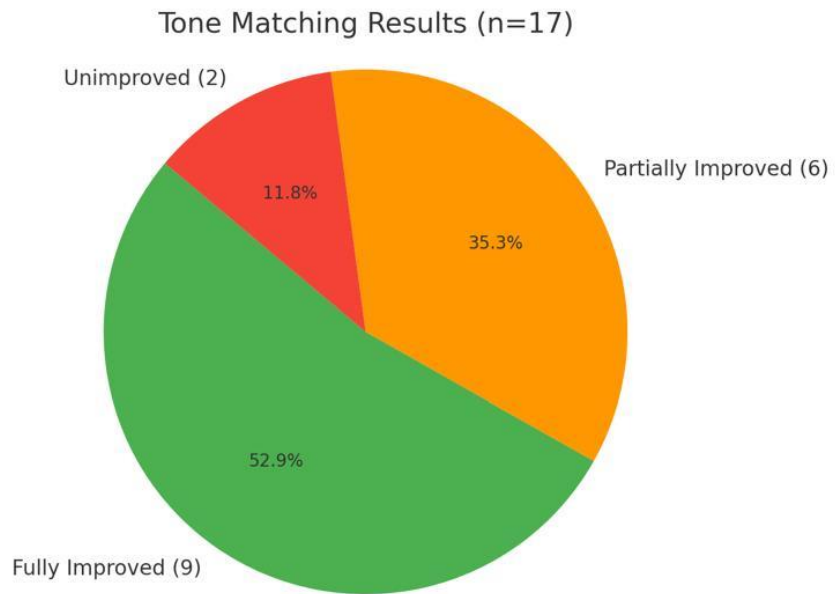


Figure 1: Tonality and Pitch matching improvement chart. n=17

At the beginning of the study, 17 out of 39 students were identified as partially or fully tone-deaf based on diagnostic pitch-matching exercises. By the end of the academic session, varying levels of improvement in tone matching were observed among the 17 students initially identified as partially or fully tone-deaf. Nine of these students demonstrated substantial improvement, consistently reproducing correct pitches within one or two attempts. These students reported engaging with the AI-powered applications on a daily or alternate-day basis. Six students exhibited partial improvement, marked by better pitch recognition but occasional inaccuracies in pitch reproduction. Their reported usage of the applications was primarily weekly or alternate-day. In contrast, two students showed no significant improvement in tone matching. Both students reported irregular use of the applications and had inconsistent class attendance, factors which limited sustained exposure to guided practice and instructional support. The results indicate a clear relationship between frequency of app usage and level of improvement in tone matching, with more consistent engagement correlating with better outcomes.

### Vocal Range Control and Confidence

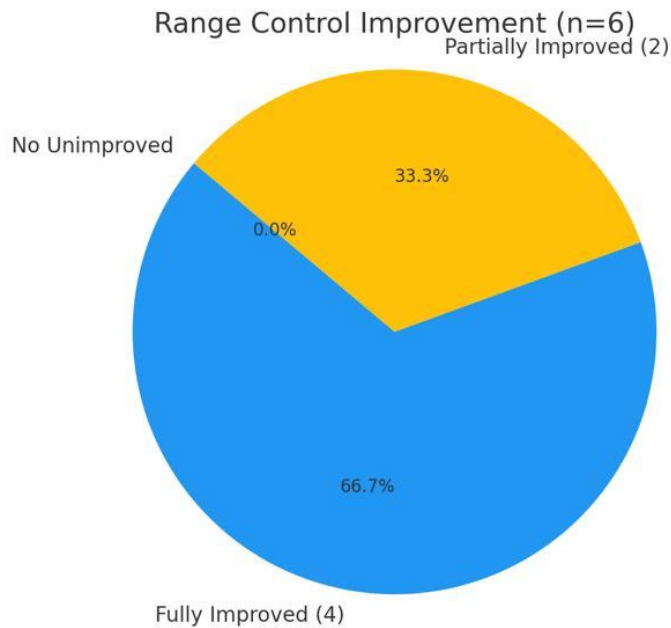


Figure 2: Range Control Improvement among Affected Students (n=6)

Figure 2 demonstrates the improvement recorded among students initially identified as having challenges with range control. At the beginning of the study, six students were identified as having difficulties with vocal range control. These students, all female, demonstrated limited comfort and stability within the alto tessitura required for ensemble singing and consistently attempted to sing below their natural vocal range, often gravitating toward tenor or baritone pitch levels. Diagnostic vocal range exercises revealed that these students were unable to sustain pitches above their lower register without strain, pitch instability, or vocal drop-off.

After approximately three months of consistent engagement with the piano and Sing True applications, four of the six students demonstrated clear improvement in vocal range control. These students were able to accurately pitch and sustain tones at least one octave higher than their initial comfortable range, maintaining pitch stability within the standard alto tessitura during class exercises. In addition, they showed improved register transition and reduced vocal strain when ascending melodic passages.

The remaining two students exhibited moderate but steady improvement. By the end of the academic session, these students were able to extend their usable vocal range by approximately a major second to a perfect fourth, achieving more consistent pitch accuracy within the lower alto range, though occasional instability persisted at higher pitches. No student remained at their initial level of vocal range limitation, indicating overall progress across this group.

Across the entire class population of 39 students, an overall increase in vocal confidence was observed. Students became more willing to attempt vocal exercises, participate in group singing,

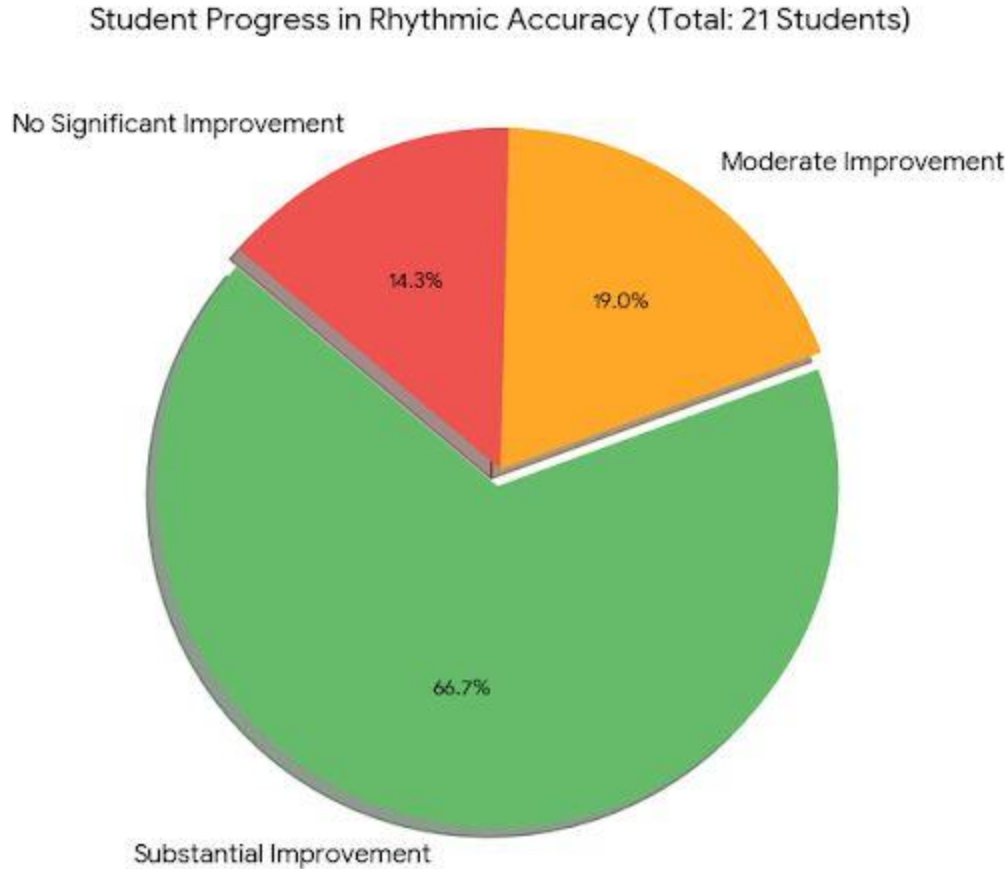
and perform individually during class sessions. Increased confidence was particularly evident among students who engaged regularly with the AI applications, suggesting that repeated, private practice supported by immediate feedback reduced performance anxiety.

### **Rhythmic Understanding**

Figure 3 below illustrates the distribution of rhythm-learning outcomes among students identified with initial rhythmic difficulties.

At the outset of the study, twenty-one students were identified as having difficulties with rhythmic accuracy. Diagnostic rhythm exercises revealed persistent challenges in maintaining a steady tempo, inaccurate beat placement, and inconsistent execution of basic rhythmic values within simple meters (e.g., 4/4). Many students were unable to align vocal entries with a metronomic pulse and frequently accelerated or decelerated during short melodic phrases.

By the end of the academic session, fourteen of the twenty-one students demonstrated substantial improvement in rhythmic competence. These students were able to maintain a stable tempo throughout complete vocal exercises, accurately align vocal entries with a metronomic pulse, and execute basic rhythmic patterns such as crotchets, quavers, and rests consistently within simple meters. Their performances demonstrated minimal tempo drift and improved internalization of pulse, allowing for accurate synchronization with accompaniment and ensemble singing.



**Figure 3: Improvement in Rhythmic Accuracy**

Four students exhibited moderate but steady improvement in rhythmic accuracy. By the final assessment, these students demonstrated improved tempo awareness and more consistent beat placement, particularly in slower tempi and less complex rhythmic patterns. However, occasional tempo fluctuations and inaccuracies in beat subdivision persisted, especially during faster passages or when rhythmic complexity increased.

In contrast, three students showed no significant improvement in rhythmic accuracy. These students continued to display unstable tempo, inconsistent beat alignment, and difficulty maintaining rhythmic continuity during vocal performance, indicating limited internalization of rhythmic structures over the duration of the study, despite reporting engagement with the app and showing improvement in other areas. The chart shows that 66.7% of the students demonstrated substantial improvement, 19.0% exhibited moderate improvement, while 14.3% showed no measurable improvement by the end of the academic session.

**Summary of Findings**

The findings of this study indicate that consistent engagement with AI-powered music learning applications, particularly daily or alternate-day practice was associated with measurable

improvements in tone matching, rhythmic accuracy, vocal range control, and performance confidence among non-musical voice students. Students who practiced regularly demonstrated greater gains in pitch accuracy, pitch consistency, and tempo stability than those with irregular app usage or inconsistent class attendance, highlighting the importance of sustained and structured engagement in AI-assisted music learning.

In addition to practice frequency, three key factors emerged as central to students' progress: individualized pacing enabled by the applications, consistent use of the digital tools, and active teacher involvement. While the AI applications provided immediate feedback, repetition, and self-paced learning, the instructor played a critical mediating role by introducing and contextualizing the apps, guiding practice routines, and addressing aspects of vocal technique beyond the scope of AI feedback, such as posture, breathing, and vocal placement. These findings underscore the effectiveness of a blended instructional model in which AI-supported learning operates alongside human pedagogy to support the development of foundational musicianship skills within a limited instructional timeframe.

## **Discussion**

The findings demonstrate that AI-powered music learning applications can function as effective mediational tools within learners' Zones of Proximal Development (ZPD) by providing immediate, incremental, and adaptive feedback.

In relation to the study's first objective to examine the potential of AI-assisted tools in improving foundational musicianship skills among non-musical voice students, the results indicate measurable effectiveness in pitch accuracy, pitch consistency, rhythmic stability, and vocal range control. The longitudinal design of the study further allowed for the observation of gradual developmental trajectories, confirming that musicianship development in adult beginners is a cumulative process rather than an immediate outcome.

Addressing the second objective, which sought to explore the teachers' responsibilities in their students' use of AI for music learning, the findings reveal a clear association between teacher instruction, including the introduction of app usage, and higher levels of improvement. Students who consistently attended classes and followed the teachers' instructions regarding practice demonstrated significantly stronger gains across all assessed indicators compared to those who practiced irregularly. This pattern underscores the importance of physical coaching and mentorship alongside pedagogical models that prioritize distributed practice over intensive but infrequent learning sessions. The findings emphasize that AI-assisted learning is most effective when embedded within a blended instructional model. While the applications successfully supported some technical aspects of musicianship, they were insufficient for addressing expressive and physiological components of singing, including posture, breathing, and vocal placement. The teacher's role in introducing the applications, modeling correct techniques, interpreting feedback, and providing corrective intervention was therefore indispensable. This

confirms that AI functions best as an augmentative tool rather than an autonomous instructional agent in music education.

The study also responds to its objective of examining the level of acceptance and effectiveness of AI in comparison to traditional music learning method. The generation of students and young instructors like me have been exposed to technology since childhood or adolescence. This has helped to aid acceptance. During this study, no student complained about the use of the apps. Instead they appreciated the concept of learning at their pace and space. The use of these models enhanced learner confidence and motivation. Increased vocal confidence across the cohort suggests that AI-supported practice environments reduce performance anxiety by allowing learners to rehearse privately, receive non-judgmental feedback, and track incremental progress. However, the study finds that there is a limitation to the height of musicianship that could be attained by merely engaging with the artificial models. Because this course was a general course, not too much is expected from the students in areas of performance unlike their counterparts who are music majors. Hence, this model was quite effective for the level of results they need. For example, improved students can learn music by ears because of their ability to reproduce exact sound but they cannot learn a new music by themselves from the sheet neither can they perform professional pieces well enough because of the absence of enough vocal techniques.

In summary, this study demonstrates that AI-powered music learning applications, when strategically integrated into formal instruction, can effectively support the development of foundational musicianship skills and confidence among non-musical voice students. By combining digital mediation with human pedagogy, the study contributes to emerging discourse on inclusive and technology-enhanced music education, particularly within university-level general music programs. It also addresses a notable gap in existing research by focusing on non-music majors within a structured institutional context similar, thereby offering a model for educational settings seeking scalable and flexible approaches to music instruction.

## **Conclusion**

This study shows that AI-powered music learning apps can play a valuable role in developing basic musicianship skills among non-musical voice students when used alongside classroom teaching. Through regular and guided use, the apps supported improvements in pitch accuracy, rhythm control, vocal range, and performance confidence over one academic year. These gains were most evident among students who practiced consistently, confirming that steady engagement is central to musical growth.

The findings also highlight the relevance of Vygotsky's Sociocultural Theory in modern music education. The AI tools acted as learning aids within the students' Zones of Proximal Development by offering instant feedback and repeated practice opportunities, while the teacher remained central as a guide, mentor, and interpreter of musical meaning. Skills that require physical awareness and musical judgment, such as posture, breathing, tone placement, and expression continued to depend on human instruction.

Importantly, the study demonstrates that AI is not a replacement for music teachers but a support system that extends learning beyond limited class time. For students with no formal music background and competing academic demands, AI-assisted practice created a low-pressure space for daily learning, increased confidence, and encouraged independent engagement with music.

By focusing on non-music majors within a compulsory university music course, this research fills an important gap in music education literature. It provides evidence that a blended model combining AI tools with teacher-led instruction can make music learning more inclusive, effective, and achievable within institutional constraints. The study therefore offers practical insights for universities and educators seeking flexible approaches to music instruction in the digital age.

## Recommendations

Based on the findings of this study, further research is recommended to deepen understanding of AI-assisted music education across diverse learning contexts. First, broader studies involving multiple institutions and varied student populations are necessary to determine the generalizability of these findings beyond a single university setting. Such studies would help to identify contextual factors that influence the effectiveness of AI-supported music learning.

Second, comparative research examining the effectiveness of different AI-powered music learning applications is recommended. Evaluating multiple platforms using consistent assessment criteria would provide clearer insights into which app features most effectively support musicianship development and learner engagement.

Third, future research should investigate long-term learning outcomes, particularly the retention of musical skills and the potential of AI-assisted tools to support advanced or expert-level musical development over extended periods. Longitudinal studies extending beyond one academic year would be especially valuable in addressing this gap.

Finally, there is a need for structured curriculum development that formally integrates AI-assisted music learning into institutional music education programs. Such curricula should clearly define the roles of digital tools and instructors, establish practice guidelines, and align assessment strategies with both technological and pedagogical objectives to ensure effective and sustainable implementation.

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