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RESEARCH ARTICLE

An Exploratory Analysis of how Vocaloid's Synthesized Vocals can be used as an Innovative Music Education Method in Teaching Sight–Singing

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ABSTRACT

The researchers investigated how Vocaloid's synthesized vocals could be used to develop a primary sight–signing learning system. The sample consisted of 80 music program students learning sight–singing. Tools used for data collection consisted of Zoltán Kodály's '333 Reading Exercises' and Vocaloid. For the development of this research, the researcher created an innovative learning management process based on the principles from Seels and Glasgow, combined with music teaching concepts from Kodály. Results revealed that the post-course assessment using Vocaloid's innovative technology and the authors' instructional design methods initially had a students' average score was 7.78 with a standard deviation of 0.43, indicating relatively consistent performance among the group. Following the instructional method's implementation, the average score rose to 8.16, with a slightly higher standard deviation of 0.60. This increase in average score suggests an overall improvement in student learning outcomes, supporting the instructional method's effectiveness in enhancing their listening skills and reading musical notes.

INTRODUCTION

Examining the Cultural Significance of Vocaloid

Vocaloid, a voice synthesizer software developed by Yamaha Corporation, has emerged as a transformative force in modern music production and fan culture (Tomonori, 2021). This introduction delves into the cultural phenomenon of Vocaloid, exploring its profound impact on music creation, the dynamics of its vibrant fan communities, and its role in shaping cultural and individual identities across diverse global contexts. Drawing insights from academic research, online discourse, and firsthand accounts from Vocaloid producers, this exploration underscores the multifaceted significance of Vocaloid in contemporary music and digital culture.

Vocaloid: A Technological Revolution in Music Production

Vocaloid technology has significantly democratized music production, allowing individuals without traditional musical training to compose and produce music (Tomonori, 2021). By enabling users to compose and produce songs using synthesized vocals, Vocaloid breaks down traditional barriers that previously required extensive musical training or access to professional recording studios (Tomonori, 2021). Central to Vocaloid's functionality are voicebanks—databases composed of recordings from voice actors and singers—which the software manipulates to generate vocal tracks (Figure 1).

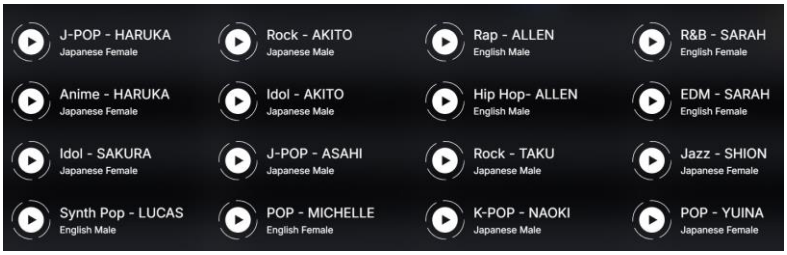

Figure 1: VOCALOID6's voicebank covers vocal parts of various genres.

Users can adjust parameters such as pitch, duration, and timbre, granting unprecedented creative control and fostering experimentation across a spectrum of musical styles and genres. This flexibility broadens the scope of musical expression and cultivates a vibrant and diverse creator community who push the boundaries of what is possible in music production.

Hatsune Miku: The Rise of a Virtual Idol

Among the most emblematic figures in the Vocaloid universe is Hatsune Miku, whose rise to prominence epitomizes Vocaloid's cultural resonance. Miku, a turquoise-haired, anime-style character, transcends conventional pop stardom by existing as a digital persona animated through Vocaloid software and an expansive array of fan-created content (Isfiaty, 2020). Her meteoric ascent highlights the influential role of social media platforms in shaping modern music culture. Several factors contribute to Miku's prominence:

1. Fan-Driven Content Creation: Miku's popularity thrives on user-generated content, with fans producing and disseminating songs, animations, and artwork that feature her image (Isfiaty, 2020). This participatory culture fosters a collaborative environment that continually evolves her persona and artistic repertoire.

2. Social Media Platforms: Platforms such as Niconico and YouTube have been instrumental in Miku's ascendancy (Kenmochi, 2012), facilitating the connection and collaboration among fans and the widespread sharing of creative content (Tomonori, 2021).

3. The Concept of "Moe": Miku's design leverages the Japanese concept of "moe," which denotes a deep affection for fictional characters (Galbraith, 2014). Her appealing visual aesthetics, youthful demeanor, and open-ended backstory resonate with fans, fostering emotional investment and personalized interpretations.

Vocaloid and Cultural Identity: A Global Phenomenon with Local Adaptations

Originally a Japanese innovation, Vocaloid has transcended geographical boundaries to become a global cultural phenomenon. Its adoption across various regions illustrates a dynamic interplay between global influences and local cultural identities. In China, for instance, the Vocaloid character Luo Tianyi was initially portrayed as an extraterrestrial figure but has been reimagined by fans to embody Chinese cultural elements (Le, 2014; Yin, 2018). This localization reflects how diverse communities integrate their cultural values and musical traditions into Vocaloid, reshaping its global narrative.

Thailand serves as another illustrative case. The availability of Thai-language Vocaloid voicebanks—such as Nene, Sukiyaki, and Mikoto—demonstrates Vocaloid's adaptability and the localized efforts to cater to Thai-speaking audiences. These voicebanks enable the creation of Thai-language music, expanding Vocaloid's accessibility and fostering a unique cultural expression within the Thai Vocaloid community. This localization process exemplifies how Vocaloid's global reach is augmented by tailored adaptations that respect and incorporate regional linguistic and cultural nuances.

Distinctive Characteristics of Vocaloid

Vocaloid distinguishes itself from other music production software through several unique characteristics that contribute to its cultural footprint:

Synthesized Vocals as a Primary Focus: Vocaloid is engineered explicitly for singing synthesis unlike general-purpose digital audio workstations (DAWs) that may emphasize instrumental sounds or rely on recorded human vocals. This specialization positions the Vocaloid as a unique tool for creating realistic and expressive vocal performances without needing a human singer.

Voicebanks as the Foundation: Vocaloid's voicebanks are central to its functionality, representing curated collections of vocal fragments from real voice actors. Marketed as distinct characters with unique personalities, these voicebanks form the basis for the synthesized vocals, allowing users to craft performances that reflect the chosen voice's inherent characteristics.

Character Voice Model: The introduction of the "character voice model" in Vocaloid2 marked a significant evolution, transforming Vocaloid from a mere voice synthesizer into a repository of embodied characters. This integration with anime and manga culture, particularly the "moe" aesthetic, deepened the emotional connection between users and Vocaloid characters (Galbraith, 2014).

Accessibility for Beginners: Vocaloid's user-friendly interface and intuitive workflow make it accessible to individuals without extensive musical training (Princen, 2024). This inclusivity attracts a broad user base, including amateurs and hobbyists, thereby expanding the reach and influence of Vocaloid beyond professional musicians.

Community-Driven Culture: The vibrant and collaborative Vocaloid community, primarily facilitated by online platforms, is crucial in its sustained popularity. Fans contribute to the ecosystem by creating and sharing songs, animations, and illustrations, fostering a culture of shared creativity and innovation.

Global Reach and Local Adaptations: Vocaloid's international recognition is further solidified by localized adaptations that cater to different languages and cultural contexts. The development of Thai-language voicebanks exemplifies this trend, enhancing Vocaloid's global impact while honoring local traditions and linguistic diversity.

Vocaloid as a Tool for Musical Education

Beyond its role in music production and fan culture, Vocaloid holds significant potential as an educational tool, which, according to Thubeault (2017), is that educators can best approach Miku as a medium for musical expression, development, and learning. It can be integrated into music education to teach various aspects of musical composition and production:

1. Composition and Arrangement: Students can experiment with melody, harmony, and song structure by composing pieces using Vocaloid, fostering creativity and a deeper understanding of musical composition.

2. Lyric Writing: Creating lyrics for Vocaloid characters encourages students to develop storytelling and poetic skills, enhancing their songwriting abilities.

3. Understanding Vocal Techniques: Manipulating Vocaloid's settings provides insights into pitch, tone, and dynamics, enriching students' comprehension of vocal techniques applicable to human singing.

4. Music Technology Skills: Utilizing Vocaloid requires familiarity with DAWs and sound synthesis, offering practical experience with modern music technology (Clarke, 2021).

5. Collaboration and Feedback: Vocaloid projects can be collaborative endeavors, promoting teamwork and peer feedback within educational settings (Ward et al., 2018).

6. Genre Exploration: The versatility of Vocaloid across various musical genres allows students to explore and understand different styles and their unique characteristics (Princen, 2024).

7. Performance Practice: Creating virtual performances with Vocaloid equips students with experience in stage presence and performance techniques, even within a digital format. Incorporating Vocaloid into music education can render learning more engaging and relevant, merging traditional music theory with contemporary technological practices.

The Role of Social Media in Hatsune Miku's Success

Social media platforms have been instrumental in the meteoric rise of Hatsune Miku. Platforms like Niconico and YouTube have created content creation and sharing spaces, enabling fans to disseminate their creations widely (Steinberg, 2017). This user-generated content has been pivotal in propelling Miku from a niche digital creation to a mainstream cultural icon (Princen, 2024). These platforms' collaborative and interactive nature has facilitated community building, fostering fans' sense of belonging and collective creativity.

Niconico, in particular, played a crucial role in Miku's early success with features like real-time commenting and tagging systems that enhanced user engagement and facilitated viral spread within the Japanese fandom. Moreover, social media has allowed Miku to bypass traditional media gatekeepers, reaching a global audience directly and establishing her as an "independent" artist with a "crowd-sourced" image.

The success of songs like "Tell Your World," which gained widespread recognition through fan-made videos on Niconico before being featured in larger platforms (Lam, 2016), exemplifies the power of social media in elevating Vocaloid content from grassroots to mainstream success (Roseboro, 2019). Additionally, the rise of "utaite" (Japanese cover vocalists) and "youtaite" (non-Japanese cover vocalists) through platforms like YouTube has further expanded the Vocaloid subculture, enhancing its global influence and appeal (Roseboro, 2019).

"Moe" and the Design of Vocaloid Characters

The concept of "moe" is deeply entwined with the design and appeal of Vocaloid characters, particularly Hatsune Miku. "Moe" refers to a Japanese term encapsulating a strong affection or emotional attachment to fictional characters, often those portrayed in anime and manga styles (Galbraith, 2014).

Vocaloid characters are meticulously designed to evoke "moe" through distinctive visual cues and adherence to popular anime archetypes. Miku's signature turquoise twin-tails, large expressive eyes, and youthful appearance align with established "moe" tropes, eliciting a sense of cuteness and endearment from fans (Figure 2). The deliberate crafting of her design to trigger emotional responses facilitates a profound connection between the character and her audience.

Figure 2: Virtual music idol Hatsune Miku
Source: Amazon

Furthermore, the "character voice model" introduced in Vocaloid2 amplifies "moe" by embodying Vocaloid voicebanks as full-fledged characters with unique visual identities and minimal backstories (Roseboro, 2019). This approach allows fans to project their desires and fantasies onto the characters, fostering personalized interpretations and deep emotional investments. The absence of a defined backstory provides a blank slate, granting fans the creative liberty to shape the narrative and identity of their chosen Vocaloid, thereby enhancing the "moe" appeal.

Vocaloid and Global Cultural Exchange

Vocaloid's influence extends beyond technological innovations and global cultural exchange (Pang, 2022; Princen, 2024). As Vocaloid spreads to different regions, it adapts to local cultural contexts, reflecting and integrating local values, traditions, and musical styles. This adaptability facilitates a rich exchange of cultural practices, allowing Vocaloid to serve as a medium for cross-cultural dialogue and collaboration (Pang, 2022).

In Thailand, for example, the development of Thai-language voicebanks such as Nene, Sukiyaki, and Mikoto exemplifies Vocaloid's localization efforts. These voicebanks enable Thai users to create music in their native language, promoting Thai linguistic and cultural expression within the global Vocaloid community. This localization not only enhances the accessibility of Vocaloid but also contributes to the preservation and innovation of Thai musical traditions, demonstrating how global technologies can be adapted to support and enrich local cultures.

Vocaloid is a testament to the intersection of technology, music, and fan-driven culture. Its innovative approach to music production democratizes the creative process, while the vibrant surrounding community continuously pushes the boundaries of artistic expression. The global adaptations of Vocaloid, exemplified by localized voicebanks and culturally resonant content, demonstrate its versatility and enduring relevance across diverse cultural landscapes. Furthermore, the strategic design elements rooted in the concept of "moe" ensure a deep emotional connection between Vocaloid characters and their audience, cementing Vocaloid's place as a significant cultural phenomenon. As both a technological tool and a cultural artifact, Vocaloid continues to shape contemporary music landscapes, influence fan identities, and inspire new creative collaboration worldwide.

Problem Statement

Listening, reading, and writing Western music notation are crucial skills for all music students (Karpinski, 2000). These are fundamental for music education and must be continually developed and refined for students' future growth in playing instruments, studying music theory, and composing music. Institutions offering music programs emphasize the importance of listening and reading music skills, making essential listening and music-reading courses mandatory for all students in music-related programs, including performance, music education, musicology, and commercial music studies (White, 2020).

In light of this, the researchers have studied the teaching processes of these courses to identify issues and obstacles. It was found that the scope of teaching in essential listening and music notation courses varies. For example, students are expected to sight-read music in multiple parts simultaneously or to sing and transcribe melodies by ear. These requirements differ according to the structure and objectives of each institution's curriculum. Through interviews and group questionnaires with instructors of listening and music reading courses, several common teaching challenges were identified across various institutions, summarized as follows:

1. Students taking introductory listening courses often need help practicing sight-reading and singing, especially those who cannot play the piano or have limited piano skills. These students face difficulties using the piano as a guide for vocal practice, resulting in longer practice times compared to those who can simultaneously play and sing the exercises.
2. Students need help to sing two-part exercises effectively. This is due to the imbalance in the ratio of women to men students, which sometimes requires female students to practice with multiple partners, as there may be fewer female students compared to male students, or vice versa, depending on the institution.
3. Many students struggle with singing complex exercises, particularly those requiring the Movable Do solfège system. Students who lack precision in pitch recognition and memory find it difficult to perform exercises with modulations and intricate melodic lines.

Given these challenges, the researcher collected data from listening and reading courses across several higher education institutions, focusing on courses that use Zoltán Kodály's Reading Exercises as the primary teaching material (Szanto, 2021). This research led to the development of a solution by innovating a basic vocal practice system using the Vocaloid program.

Research Objectives

RO1: To develop an innovation for essential vocal practice using the Vocaloid program.

RO2: To determine the effectiveness of the developed vocal practice innovation.

CONCEPTUAL FRAMEWORK

The Vocaloid Program

Vocaloid is a voice synthesis program developed by Yamaha, first released in 2004 (Roseboro, 2019), which allows music creators to input melodies and lyrics, which are then synthesized using character voicebanks (Gupta & Goto, 2022). The first commercially available Vocaloid voice, Leon and Lola (Eidsheim, 2023), were released by Zero-G in 2004 as English vocalists. While the system was initially limited, it represented an innovative step in integrating human-like voices into synthesized sound. Another early Vocaloid, Miriam (voiced by singer Miriam Stockley), was also distributed by Zero-G, showcasing improved capabilities in voice synthesis (Connor, 2014).

Hatsune Miku, released on August 31, 2007, under Crypton Future Media (CFM), became the first globally recognized Vocaloid character (Isfiaty, 2020). Her name translates to "the first sound of the future," she quickly rose to fame (Kärki, 2021; Novak, 2024). Miku's debut album, Re: Package, released by Victor Entertainment on August 27, 2008, sold 20,000 copies in its first week and reached No. 5 on the Oricon chart. Miku's influence extended beyond Japan (Princen, 2024), as her second album, Re: MIKUS (released on March 25, 2009), featured remixed tracks and achieved 56,000 sales in its first week. The album was downloaded over 4 million times and earned a Gold Disc Award in Japan.

Despite Vocaloid's success in music production, particularly in the commercial and creative sectors, it still needs to be utilized in education. Though it is a powerful tool for teaching composition and digital music production, its potential in music education must be explored.

Vocaloid 6

Vocaloid 6 is the latest version of Yamaha's voice synthesis software, developed under the leadership of Kenmochi Hideki. Originally initiated at Pompeu Fabra University in Barcelona as a non-commercial research project, it transitioned into a full-fledged commercial product with Yamaha's support. Vocaloid 6 features advanced AI-based voice synthesis, enabling smoother and more natural vocal expressions. It offers a diverse voice bank with characters like Haruno Sora and Meika Hime Mikoto. It includes new features like real-time vocal editing and multi-language support, making it a powerful tool for music educators and composers.

Vocaloid 6 now offers music teachers a versatile, multi-lingual tool for teaching composition, vocal techniques, and music technology (Figure 3). The software allows users to create vocal tracks by inputting lyrics and melodies using a range of realistic voicebanks. Its intuitive interface simplifies music production, enabling students to experiment with harmonies, arrangements, and musical styles. Vocaloid 6's compatibility with various digital audio workstations (DAWs) also makes it ideal for teaching music production skills.

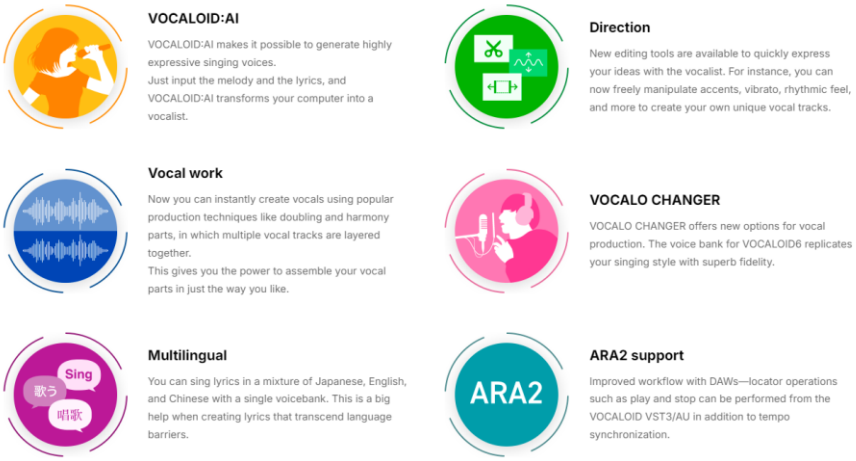

Figure 3: Vocaloid Version 6 Features
Note. VOCALOID6.1 was released on February 15, 2023.

Yamaha continues to improve the Vocaloid program. Vocaloid 6 now has enhanced capabilities that can be adapted for educational purposes, especially in teaching the basics of music reading, listening, and vocal exercises. The researchers have applied Vocaloid Versions 5/6 to teach foundational listening and singing courses, core subjects for Western music students. The researchers used Vocaloid's Mobile Editor, which is user-friendly and can be installed on various devices, such as iPads, iPhones, and laptops. This version retains the same high capabilities as the full version, with three key features:

1. Vocaloid 6 can generate synthesized voices while allowing users to set tempo, pitch, and rhythm patterns. As of 2024, Vocaloid supports an ever-expanding library of languages, including Japanese, English, Spanish, Chinese, Korean, Catalan (Princen, 2024), and Thai.

2. Vocaloid can compose and create polyphonic melodies with up to 16 parts, all of which can be played simultaneously.

3. The Vocaloid sound bank has been expanded from previous versions, offering over 2,000 media libraries in Version 6 using a variety of synthesized voices, including robotic, female, and male voices, each with unique characteristics. These voices allow for a more realistic and flexible composition of melodies.

Given these capabilities, the researcher utilized Vocaloid's older Version 5 and the newest Version 6 to develop an innovative basic vocal practice system to address the identified challenges and fulfill the research objectives (Figure 4).

Figure 4: Vocaloid 6 Program
Source: https://www.vocaloid.com/en/vocaloid6/

INNOVATIVE INSTRUCTIONAL DESIGN METHODS

Today, various instructional design models (IDMs) are developed to be used in multiple learning environments, enabling the application of various educational learning theories across different sectors (Ipek & Ziatdinov, 2017; Spatioti et al., 2022). In developing innovative methods for essential vocal practice for a foundational singing class, the researchers followed Seels and Glasgow's IDM (Figure 5).

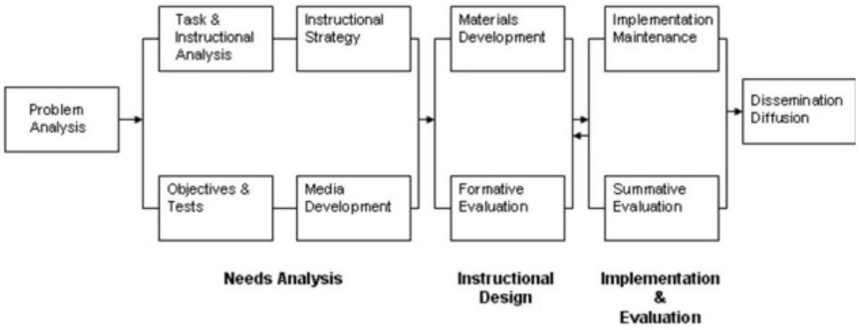

Figure 5: Seels and Glasgow's IDM

Additionally, the teaching methods were influenced by Zoltán Kodály's approach to music education and singing (Asztalos, 2023; Hiney, 2012; Szanto, 2021). The critical steps in this development process were as follows:

1. **Problem Analysis**: This step involves needs assessment techniques to identify and specify whether the issue lies within teaching practices or activities.

2. **Instructional and Activity Analysis:** This includes analyzing and making decisions about the learners' prior knowledge, required pre-existing skills, and teaching materials.

3. **Setting Objectives and Designing Tests:** The lessons' objectives and criteria are clearly outlined, and tests are developed accordingly.

4. **Selecting Teaching Techniques and Methods:** Techniques and methods are selected for instruction, which could include procedural conditions or steps.

5. **Choosing and Developing Teaching Materials or Activities:** Emphasis is placed on selecting materials and methods to help students succeed.

6. **Development of Teaching Tools and Planning:** This involves developing materials, equipment, and lesson plans while ensuring the teaching process and activities are practical.

7. **Progress Evaluation:** This is achieved through ongoing assessments during the teaching process, collecting data on achieving objectives to allow refinement and possible re-evaluation.

8. **Implementation and Adjustment**: The teaching model is implemented in real situations, and adjustments are made as necessary.

9. **Evaluation and Conclusion:** Data is collected and analyzed to ascertaain if the expected outcomes were achieved.

10. **Dissemination and Application of the Model:** After proving effective, the model is ready for broader application in educational settings.

Instructional Methods Development

The researchers began developing the essential vocal practice methods using the Vocaloid program. The process started by installing Vocaloid on a personal device, with the iPad chosen as the primary tool for creating the vocal practice innovation. Although there were some initial issues with purchasing the software

from Thailand, software purchasing from international buyers is now more accessible through a Yamaha web interface showing local currencies and local billing/shipping information.

Before installation, it is essential to note that Vocaloid operates using a digital voice library containing samples from real singers. These samples are processed and fine-tuned to create realistic singing voices. Vocaloid provides tools for adjusting pitch, rhythm, length, vibrato, and volume to produce lifelike singing based on the user's settings. However, to ensure optimal performance, music creators should verify that their devices meet the program's basic requirements. The researchers followed specific steps to create exercises and record melodies to develop the essential vocal practice innovation. These steps are detailed and divided into critical stages as follows:

1. **General Setup** - To begin creating a project, click the "+" symbol in the upper left corner and name the project. Once the general setup is complete and you confirm the project creation, the program will guide you to a window where you can configure the musical details.

2. **Setting Musical Details** - The first musical detail to set is the tempo. To do this, click the "Master track" and hold down the tempo value. A "Properties" window will appear. Select "Properties," and a new window will allow you to input the desired tempo. Once this step is completed, you can set the number of bars (measures) according to your preference and the project's tempo speed. The researchers chose a 70 beats per minute (BPM) tempo, a moderate speed suitable for vocal practice.

3. **Selecting Synthesized Voices** - Click on the word "Vocaloid" to open a menu where you can select different synthesized voices. You can then configure the voice settings in the "Part Singer" section, aligning the voice with your desired musical part.

Users can choose synthesized voices from the "Singer Library," which may need to be purchased separately (Figure 6), or they can use the default voices with the program. In the researcher's case, they purchased two or three different synthesized voices, both male and female, to ensure a variety of voices. These voices created vocal practice exercises for both male and female students.

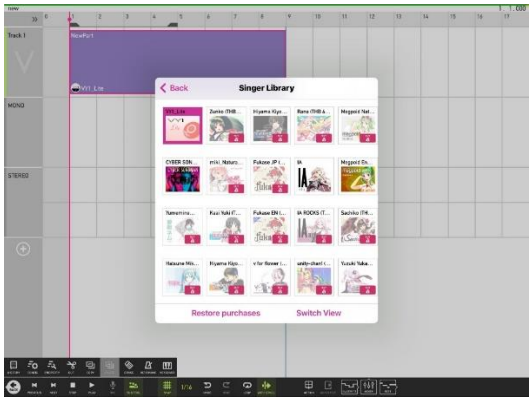

Figure 6: Singer Libraries

4. Recording Notes and Creating the Project- Begin by clicking "Edit," which will display a piano roll on the left side and the musical bars on top, according to the number of bars you have set. Each bar will be divided according to the tempo you selected earlier. You can input notes according to the desired tempo, melody, and note values. Notes can be entered directly using the keyboard. For instance, you can input notes like C, D, E, F, G, A, B, including sharp (#) and flat (♭) notes. You can also select different note values, such as **1/1** for whole notes, **1/2** for half notes, and **1/4** for quarter notes. This allows you to compose and build the vocal exercise according to the specific musical structure you want.

After completing the note input process, users can proceed by adding lyrics. This is done by selecting the "Lyric" option and typing the desired lyrics for the system to sing. The system only accepts lyrics that consist of vowels and specific consonants in Japanese. For developing the vocal practice innovation based on

Kodaly's method, the lyrics are limited to the solfège syllables: Do, Re, Mi, Fa, So, La, Ti, Do. These syllables are employed to maintain consistency with the Kodaly approach to singing and music education.

INSTRUCTIONAL METHODS DEVELOPMENT STEPS

Instructional Methods Effectiveness Evaluation

Instructional methods

Effectiveness assessment was undertaken by submitting the training plan to three experts in music and education. The evaluation focused on critical areas, including the design, the accuracy and relevance of the content, and its problem-solving capabilities. The teaching method was rated highly, with a mean = 4.82, indicating a very high level of effectiveness.

Based on the experts' feedback, the researchers made improvements before implementing the instructional method with actual students. These improvements included ensuring the clarity of the program's lyrics and enhancing the uploaded videos' quality, making them easier to read and understand. After making these adjustments, the instructional method was ready for the next testing phase in an actual classroom setting (Santrock, 2018).

Implementation of the Classroom Instructional Method

After assessing the effectiveness of the instructional method and making necessary adjustments based on expert recommendations, the researchers implemented a primary vocal training method with the target group to achieve the established objectives. This process also included collecting data on learning outcomes before and after implementing the instructional method. The recorded scores from the assessments conducted before and after using the primary vocal training method showed significant differences in the scores. The data was collected from 80 students enrolled in the music college at Thailand's Payap University, focusing on skills in listening and reading musical notes. The assessment scores were evaluated for consistency by experts.

Table 1 illustrates students' mean test scores and standard deviations before and after participating in the instructional method. Initially, the student's average score was 7.78, with a standard deviation of 0.43, indicating relatively consistent performance among the group. Following the instructional method's implementation, the average score rose to 8.16, with a slightly higher standard deviation of 0.60. This increase in average score suggests an overall improvement in student learning outcomes, supporting the instructional method's effectiveness in enhancing their listening skills and reading musical notes.

Table 1: Comparison of Test Scores Before and After Using the Instructional Method

Number of students	Before course start		After course completion	
N	$\bar{x}$	S.D.	$\bar{x}$	S.D.
80	7.78	0.43	8.16	0.60

Education Methods Dissemination

This innovative method for essential singing practice using the Vocaloid program was disseminated according to the principles of dissemination of technology and innovation via the YouTube Channel at the "reikochanth" channel, the researchers' distribution area (Figure 7). The method was to upload all the developed videos into the system permanently. After that, the researchers sent all the video links to teachers of Western music listening, reading, and writing skills to institutions with websites with 40,000 or more visitors.

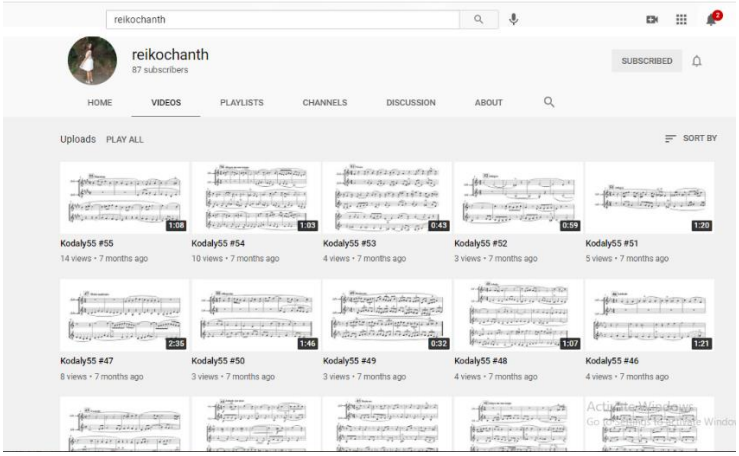

Figure 7: Distribution channels

CONCLUSION

The objective of this research was to develop an instructional method for basic vocal training using the Vocaloid program and to assess the effectiveness of the developed instructional method. The researcher implemented the development of the instructional method according to established principles and concepts and subsequently tested and disseminated it for total utilization. After the sample group applied the instructional method, the results revealed that the average scores from post-implementation assessments were higher than those from the pre-implementation assessment.

This suggests that using the Vocaloid program for basic vocal training could be a practical self-learning tool, fitting well with modern music education. It highlights the value of self-directed learning, encouraging students to explore knowledge and develop practical skills on their own. If widely adopted, this method could help learners practice singing independently, without the earlier limitations. As of 2024, Vocaloid supports a growing range of languages, including Japanese, English, Spanish, Chinese, Korean, Catalan (Princen, 2024), and Thai. It also has the potential to boost students' motivation to improve outside of regular classroom learning.

RECOMMENDATIONS

Vocaloid is an effective tool for music production, particularly for creating teaching materials and compositional works. It enables users to produce realistic vocal performances without human singers, musicians, or producers. For this research, the researcher has two recommendations for future studies and the development of instructional methods to improve and enhance the effective use of the Vocaloid program.

First, the Vocaloid program can be accessed and utilized on computers. Through practical experience, the researcher found that while using the Vocaloid program on an iPad offers greater convenience and flexibility, presenting high-quality sound is more effectively achieved on a computer. This allows users to separate the left and right speaker outputs, enabling them to adjust and learn vocal exercises or songs in a manner that mimics real-life situations. In contrast, using an iPad or smartphone does not allow this separation.

Second, the latest version of the Vocaloid program, Vocaloid 6, has been developed and updated to enhance the quality of synthetic voices while improving functionality for easier creation of musical works. Therefore, the researcher recommends using the program's latest version to achieve optimal results. Future developments are anticipated to continue to enhance and improve the program further.

Declarations

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Declaration of conflicting interests

The authors declare no potential conflicts of interest concerning this article's research, authorship, or publication.

Informed Consent Statement

Informed consent was obtained from all individual participants included in the study.

Disclosure Statement

The authors declare that they have no conflicts of interest.

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