



Mapping Trends in Music Education Based on Solfeggio : A Bibliometric Study with Implications for Non-Music Vocational Students

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Abstract: This research aims to map the trends in international scientific publications related to solfeggio-based music education during the period 2016–2025 and to identify its implications for learning in non-music vocational high schools. The method used is a bibliometric study by analyzing data from the Scopus database using the keywords solfege, ear training, sight singing, sight reading, and music pedagogy. The data were analyzed using the VOSviewer tool to map trends, keyword clusters, and research focus. The results show that publications during the period 2021–2025 experienced a significant increase and formed three main clusters, namely music pedagogy and learning design, aural skills, and formal educational contexts such as conservatories. However, there is no focus on non-music vocational education contexts, indicating a research gap. These findings emphasize the need for the development of an inclusive, adaptive, and contextual solfeggio learning model, particularly for vocational high school students who do not have a formal music education background. This study provides an initial contribution in bridging the gap between formal music education studies and the need for musical learning in non-music vocational environments, as well as opening opportunities for the development of applied research in the future.

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Introduction

Music is a form of sound art that expresses thoughts and feelings through elements such as rhythm, melody, harmony, form, and expression (Jamalus, 1988 in Muttaqin & Kustap, 2008). In the context of education, music plays an important role in shaping the personality, aesthetic sensitivity, and emotional intelligence of students (Iraqi et al., 2023; Kusuma, 2025; Suhirno & Rizqi, 2024; Yang, 2023). One of the core abilities developed through music education is musicality, which is the sensitivity to the basic elements of music such as pitch, rhythm, and harmony, that can be honed without having to be proficient in playing musical instruments (Novianti et al., 2025; Sukrisna & Santoso, 2024; Yang & Ma, 2024).

To train that musicality, solfeggio has become a very important pedagogical approach and has long been applied in music education in various parts of the world. Solfeggio or solfege is a learning method that trains students' auditory, visual, and motor skills in an integrated manner, through exercises such as sight-reading, sight-singing, and ear training using solfège syllables like do, re, mi (Barić, 2024; Mimanda, 2023; Porokhovnichenko, 2024). Solfeggio practice stimulates inner hearing and musical memory, and fosters a deeper understanding of musical structure (Cha, 2024; Rummyantseva, 2024; Yang & Ma, 2024).

Furthermore, solfeggio practice involves technical aspects such as intonation, rhythm processing, dictation of melody and rhythm, as well as reading notation in various keys and



scales. In learning, these techniques form the foundation for developing musical interpretation skills, pitch recognition, and accuracy in vocalization (Rumyantseva, 2024; Steenstrup et al., 2021).

In fact, in a more modern approach, a combination of physical exercise, vocal training, mental imagery, and audio-visual technology can accelerate the mastery of musical expression and sensorimotor coordination (İlkay et al., 2025; Steenstrup et al., 2021). This is in line with Mei's (2024) research, which shows that solfeggio can help improve students' auditory abilities, concentration, and body coordination. Additionally, interactive technology-based teaching models also show potential in enhancing student engagement and learning outcomes in ear training and solfeggio exercises (İlkay et al., 2025; Zadnik, 2021).

Solfeggio also serves as an important medium in helping students understand musical concepts comprehensively, not just as technical skills, but as a means to internalize the relationship between pitch and rhythm musically. For example, the ability to perform dictation or transcribe melodies heard is a form of reinforcement for the process of active listening and analysis of musical structure (Barić, 2024).

However, in Indonesia, the reality of music art education is very different, especially in vocational high schools (SMK) that do not have an arts or music major. Since the 2013 curriculum until now, transitioning to the independent curriculum, art education is only provided in phase E, specifically in the 10th grade, and is given for only two semesters. This is very different from the junior high school or senior high school levels, where art subjects are offered at all grades (VII–IX or X–XII). As a result, non-music vocational high school students only have one opportunity in their educational level to receive formal music art education. In this situation, the very limited time becomes the main challenge.

On the other hand, the diverse backgrounds of vocational high school students, who generally have minimal musical experience and face limitations in facilities and infrastructure for music practice, often result in music education being theoretical and non-applicative, thereby hindering the optimization of students' musical development (Novianti et al., 2024; Suharto, 2012; Yang, 2023).

However, the national curriculum through Permendikbudristek No. 33 of 2022 has emphasized the importance of developing musicality in the music arts subject in phase E, including active involvement in music practice that is appropriate and relevant to daily life. Therefore, the solfeggio method is considered to have the potential to be integrated into music education in non-music vocational high schools, as it can train students' musicality practically, systematically, and structuredly within just two semesters of learning.

Although the solfeggio method has proven to play a strategic role in formal music education, most of its implementation and research are still concentrated in higher music education institutions such as music academies, conservatories, or art universities. With this background, it is important to evaluate the extent to which international research has addressed solfeggio-based music education, particularly in relation to non-music learners in vocational school environments. This gap highlights the importance of mapping the literature and research direction related to the application of solfeggio outside the formal music education ecosystem. The research objectives include identifying the direction and patterns of research development quantitatively and thematically, exploring research gaps, and formulating practical implications for the development of music education in non-music vocational high schools (SMK) in Indonesia. With this approach, the study is expected to serve as a foundation for more contextual and inclusive pedagogical innovations in music education in non-music vocational high schools in Indonesia.



Research Method

This research uses a literature review method with a bibliometric approach to map international scientific publication trends related to solfeggio-based music education during the period 2016–2025. This approach was chosen because it can provide a systematic quantitative synthesis, allowing for the evaluation of the knowledge map formed from publication data, the identification of influential figures, institutions, and journals in specific fields, as well as the uncovering of research gaps that have yet to be addressed (Donthu et al., 2021; Zupic & Čater, 2015). The bibliometric strategy in this research includes two main techniques as proposed by Donthu et al. (2021): (1) Performance Analysis, which is used to evaluate publication productivity based on year, journal source, author, and institutional affiliation; (2) Science Mapping, which is used to visualize the relationships between concepts and the scientific structure using keyword co-occurrence analysis.

The primary data source is the Scopus database, which was chosen due to its wide multidisciplinary coverage and high credibility in bibliometric studies (Chen et al., 2014). The search keywords include: solfege, solfeggio, ear training, sight singing, sight reading, and music pedagogy. Data is filtered based on document type (journal articles), language (English), and field of study (arts, social sciences, and psychology). The analysis was conducted for two periods: 2016–2025 (overview) and 2021–2025 (current period).

Next, the data is exported in CSV format and analyzed using VOSviewer version 1.6.20. This software was chosen for its ability to visualize bibliometric maps in the form of keyword networks, citation relationships, and thematic clustering. VOSviewer provides a graphical representation of bibliometric maps through network, overlay, and density visualization features. The diameter of the nodes indicates the frequency of occurrence or citation, while the thickness and length of the connecting lines indicate the strength and intensity of the relationships between items (van Eck & Waltman, 2010).

The research steps were carried out through the following stages: (1) Collection of bibliographic data from Scopus based on the established search string; (2) Preprocessing and filtering of data to eliminate duplicates and ensure the relevance and completeness of metadata; (3) Visualization and thematic analysis using VOSviewer with a minimum keyword occurrence parameter of two times (full counting method and association strength normalization); (4) Interpretation of thematic clusters based on visualization results to identify the main research focus, development trends, and potential scientific gaps; (5) Formulation of practical implications for the development of a contextual solfeggio learning model for non-music vocational high school students.

Results and Discussion

Trends in Solfeggio-Based Music Education Publications (2016–2025)

A bibliometric analysis of international publications from the period 2016–2025 reveals significant growth in solfeggio-based music education studies, particularly on the topics of ear training, sight singing, sight reading, and music pedagogy. Two phases of development can be identified: the early exploration phase (2016–2020), characterized by a wide distribution of topics, and the acceleration and consolidation phase (2021–2025), which shows an increase in the number of publications and thematic consistency towards the solfeggio approach in modern music education.

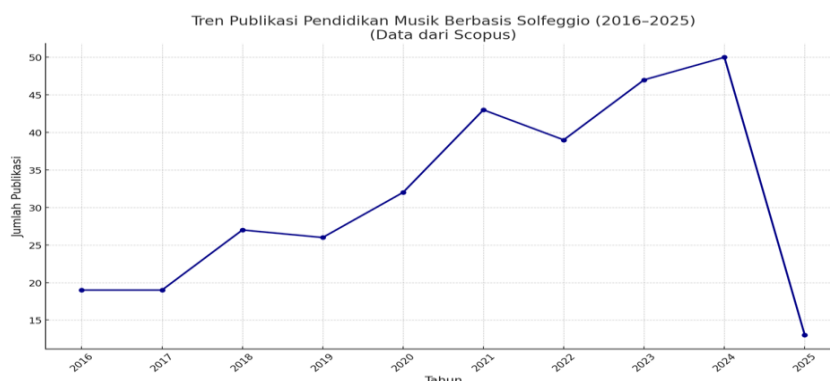


Figure 1. Chronological Distribution of Solfeggio-Based Music Education Publications in Scopus (2016–2025).

1) Period of Diversification and Initial Exploration (2016–2020)

During this period, the number of international publications related to the solfeggio approach tends to be stable, ranging from 19 to 32 documents per year. Although it reflects consistent interest, the thematic focus during this period remains scattered. Most publications use general terms such as music theory, aural skills, and musicianship, without directly referring to the concept of solfeggio pedagogy. Therefore, this phase is categorized as an early exploration period, where research has not yet shown methodological or terminological consistency. However, this period serves as an important foundation for the development of a more focused research direction in the next phase. Acceleration and Consolidation Period (2021–2025)



Figure 2. Trend of Accelerated Publication of Solfeggio-Based Music Education in Scopus (2021–2025).

Starting in 2021, publications related to solfeggio-based music education have seen a significant increase, averaging more than 40 documents per year, peaking in 2024. This surge reflects the acceleration and consolidation of research direction, with an emphasis on the development of aural skills and sight-reading as the two main aspects of the solfeggio method. This trend aligns with the shift in the music education paradigm towards participatory, vocal approaches and the enhancement of applied music literacy (Wang, 2022; Yang, 2023). Wang (2022) emphasizes the importance of notation mastery and aural training in digital media-based learning. Meanwhile, Ren (2024) shows that the use of interactive technology, such as applications for sight-singing training, enhances student engagement and musical accuracy at the higher education level. This shows the consolidation of the solfeggio approach in the landscape of modern music education, which is no longer limited to conservatories or formal music education, but is also beginning to extend into inclusive and flexible learning contexts.

Thus, the period 2021–2025 can be categorized as a phase of topic consolidation, which indicates methodological and applicative recognition of the solfeggio approach in supporting effective, contextual, and inclusive music learning. This condition opens up opportunities to adopt the solfeggio approach more broadly, including in non-music vocational education such as in Vocational High Schools (SMK), where students require basic vocal and practical musical training without having to rely on complex musical instrument facilities.

Visualization and Clustering of Keywords

Visualization using VOSviewer software produces keyword clusters that depict the dominant themes in solfeggio-based music education research. This process uses the unit of analysis in the form of author keywords with the association strength normalization method and the full counting calculation technique. The minimum occurrence of keywords is set to two (2) times. Data were obtained from the Scopus database with a total of 551 documents for the period 2016–2025 and 192 documents for the period 2021–2025.

1) Keyword Cluster Analysis (2016–2025)

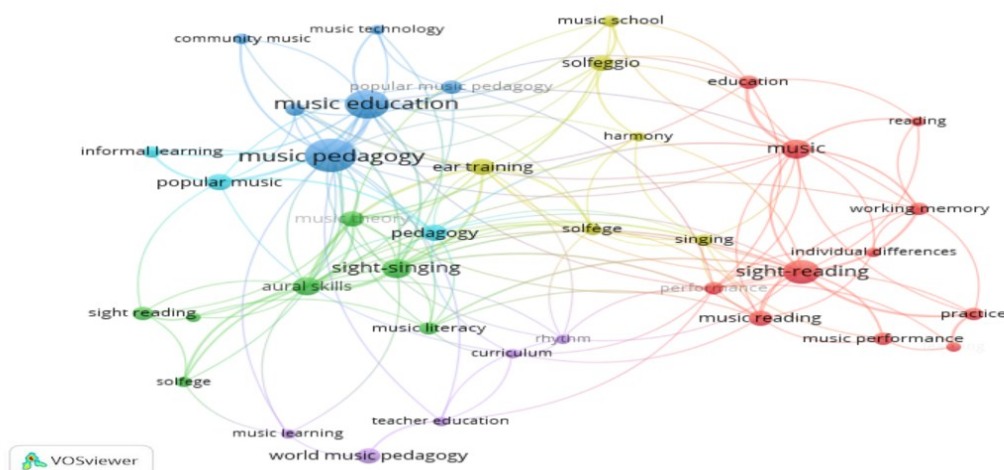


Figure 3. Co-occurrence of Author Keywords (2016–2025).

The results of the bibliometric analysis produced five main clusters that represent thematic trends in publications related to solfeggio-based music education.

Red Cluster (Cognition and Music Performance), keywords such as sight-reading, working memory, and music performance indicate a focus on the cognitive aspects of reading music. Schmidt et al. (2023) assert that sight-reading involves simultaneous activation of auditory perception, visual recognition, and motor and cognitive coordination. They highlight the importance of the contingency between notation and solfège syllables in forming automatic responses when reading music. The implication is that the design of solfeggio learning for non-music students needs to consider cognitive capacity, with an approach based on systematic contingency training.

Blue Cluster (Music Education and Technology), the keywords in this cluster include music pedagogy, popular music, and music technology, which indicate an orientation towards contextual and technology-based learning. Yang (2023) shows that the integration of online platforms such as Rain Classroom can enhance collaboration and enable independent access to solfeggio materials. In a vocational education environment, where students have diverse musical backgrounds and motivation can sometimes be low, this approach is relevant for



paving new ways to adapt solfeggio methods through music that is closer to the students' daily lives.

Yellow Cluster (Ear Training and Solfeggio), keywords such as solfeggio, ear training, and harmony mark the focus on auditory training in formal music institutions. Porokhovnichenko (2024) emphasizes that intonation and ear training through vocal and interval techniques are essential foundations in the development of musical abilities. This training becomes very important, especially for non-music vocational high school students, as it provides a pathway to musical learning that does not rely on instruments.

Green Cluster (Music Theory and Literacy), with keywords such as aural skills, sight-singing, and music theory, this cluster represents the main foundation of the solfeggio approach. Barić (2024) states that mastery of music theory and notation is a prerequisite for developing expressive sight-singing skills, especially in the study of harmony and polyphony. For vocational high school students, the integration of basic theory and vocal exercises needs to be designed in a structured manner.

Purple Cluster (Global Music Curriculum and Education), keywords such as world music pedagogy and curriculum point to the importance of a multicultural approach in music education. Rummyantseva (2024) shows that solfeggio can be developed through the exploration of historical genres such as medieval organum, which combines historical context, aesthetics, and pedagogy. This is relevant to the context of non-music vocational schools in Indonesia, which have cultural diversity and open opportunities for integrating local values into solfeggio-based vocal learning.

2) Keyword Cluster Analysis (2021–2025)

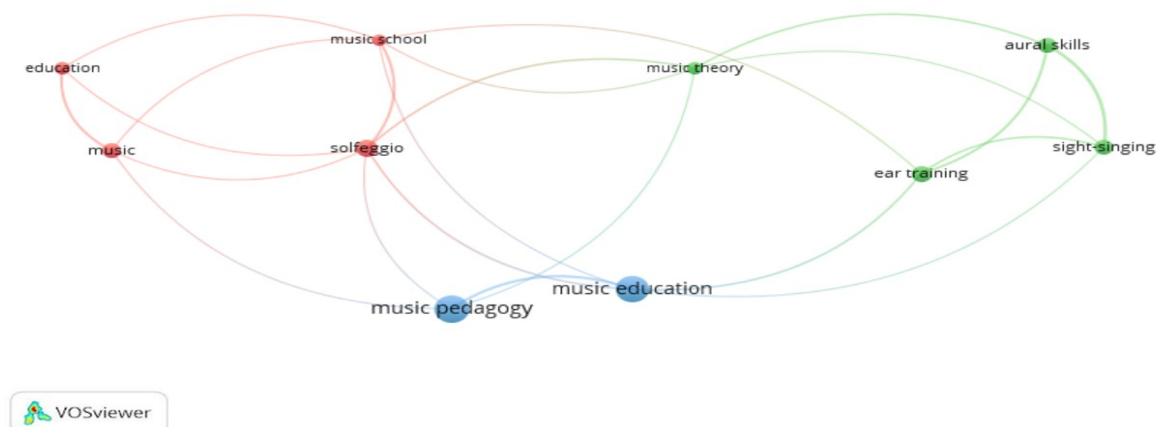


Figure 4. Co-occurrence of Author Keyword (2021-2025).

Visualization of publication data from 2021–2025 shows three main clusters reflecting the consolidation of research directions in solfeggio-based music education, with an emphasis on formal pedagogy, basic music theory, and aural skills.

Red Cluster (Solfeggio in the Context of Institutional Education), this cluster contains keywords such as solfeggio, music, education, and music school, reflecting a focus on the integration of solfeggio into the formal education system. Barić (2024) explains that the solfeggio curriculum in Croatia has a linear structure that emphasizes mastery of theory and vocal techniques based on fixed solmization. Rummyantseva (2024) adds that works such as organum are used to train aesthetic expression and understanding of music history through a vocal approach. The implication for the context of non-music vocational schools is the need



for a systematic yet flexible curriculum structure, so that it can bridge students with non-musical backgrounds.

Blue Cluster (Music Pedagogy), although consisting of limited keywords such as music pedagogy and music education, this cluster emphasizes that pedagogy remains the foundation for the development of solfeggio methods. Yang & Ma (2024) emphasize the importance of project-based learning and technology that remain grounded in pedagogical principles. Meanwhile, Steenstrup et al. (2021) developed the IMAGINE–SING–PLAY approach, which emphasizes musical expression through narration and vocal movement. These findings highlight the importance of adaptive and contextual teaching methods, especially for vocational learners who require simple and practical instructional language.

Green Cluster (Aural Skills and Music Theory), keywords such as ear training, sight-singing, and music theory reinforce the position of this cluster as the core of solfeggio learning. Lu (2022) states that auditory skills are the main indicator of success in reading and imitating music, especially in technology-based assessment systems. Porokhovnichenko (2024) emphasizes the importance of intonation practice and interval recognition from the beginning of learning. For vocational school students who do not have a musical background, an aural-based solfeggio approach can serve as a bridge to intuitively introduce musical concepts. Structured ear training and sight-singing practice can help enhance students' musical sensitivity, while also strengthening their vocal perception and motor coordination skills.

Comparison of Keyword Clusters

Bibliometric analysis using VOSviewer shows a shift in the focus of solfeggio-based music education research between two periods: 2016–2025 and 2021–2025. Over the ten-year span, the research map formed five broad thematic clusters, covering cognitive aspects, technology-based informal learning, to cross-cultural approaches. In contrast, the last five years showed a concentration of research on three core clusters: music pedagogy, aural skills, and institutional education.

This shift reflects a tendency towards a more formal and systematic approach. The disappearance of keywords such as world music pedagogy, popular music, and community music from the latest visualization indicates a decline in interest in global and non-traditional music learning contexts. Nevertheless, the presence of the keywords ear training and aural skills in both periods emphasizes that core solfeggio skills remain the main foundation in music education, including in vocational contexts.

Table 1. Comparison of Keyword Clusters.

Aspect	2016–2025	2021–2025
Number of Clusters	5	3
Main Focus	Cognitive, pedagogical, global, performative	Pedagogy, aural skills, institution
Cognitive & Performance Cluster	<i>Sight-reading, working memory, practice</i>	Not appearing
Pedagogical Cluster	<i>Music pedagogy, teacher education</i>	<i>Music pedagogy, music education</i>
Aural Skills	<i>Sight-singing, aural skills, ear training</i>	Keep appearing
Global/Popular Context	<i>Popular music, world music pedagogy</i>	Not appearing
Institutional Focus	<i>A little (music school)</i>	<i>Stronger (music school, education)</i>



Aspect	2016–2025	2021–2025
Visual Structure	Complex, dense, multidimensional	Concise, focused, simple

Nevertheless, no keywords directly related to vocational education, non-music students, non-major music, or technical education were found. The absence of these keywords, both in the 2016–2025 and 2021–2025 periods, indicates that research in the field of solfeggio-based music education is still centered on the context of formal music institutions such as conservatories and higher education, rather than in non-music environments like vocational schools.

Identification of Research Gaps

The results of the keyword clustering explicitly reveal a research gap in the application of solfeggio in the context of non-music vocational education. Not a single keyword points to the population of students from non-music backgrounds, even though practically, musical education is greatly needed to develop aesthetic competence, creativity, and art appreciation skills for vocational high school students.

The absence of terminology such as vocational students, technical high school, non-music learners, or inclusive music education serves as an indicator that this area has not received adequate attention in international scientific publications. This indicates that the context of vocational high schools or vocational education as subjects or objects in the development of solfeggio models has not yet entered the global map of music research. Therefore, research that develops vocal-based solfeggio learning for non-music students has the potential to make a new contribution to contemporary music literature and pedagogy.

Recommendations for research directions and the development of an inclusive solfeggio learning model for non-music major vocational high school students.

This research focuses on two strategic aspects: first, providing a new direction in solfeggio-based music education studies; second, promoting the development of inclusive learning models for non-music students in vocational school environments. Bibliometric results show that for nearly a decade, solfeggio research has tended to focus on higher music education institutions, with the main subjects being students or individuals with a musical background. The absence of keywords such as vocational education and non-music students indicates a significant research gap.

To address this gap, it is necessary to develop a solfeggio learning model that is relevant to the conditions of non-music vocational high school students—namely, students without initial musical abilities and limited access to instruments. The recommended learning model should be:

- 1) Based on vocal and body as the main instruments, to build basic musical skills practically and efficiently (Steenstrup et al., 2021).
- 2) Adaptive and responsive to students' abilities, emphasizing a reflective and participatory approach in auditory training (İlkay et al., 2025).
- 3) Simple and low-cost, utilizing online platforms and self-study methods (Yang, 2023).
- 4) Interactive and collaborative, through methods such as flipped classroom and peer feedback that have been proven to enhance musical expression (Yang & Ma, 2024).
- 5) Contextual with the vocational world, by linking solfeggio material to music practices relevant to the profiles of vocational high school students (Barić, 2024).
- 6) Structured and gradual, like the interval-based vocal approach used in the teaching of organum (Rumyantseva, 2024).



The further implications of this research include opportunities to explore strategic research themes, such as: (1) Experiments implementing the vocal solfeggio model in non-music vocational high school grade X classes to test its impact on improving basic musicality, (2) Qualitative studies to identify the needs of vocational high school students in solfeggio learning that are more relevant to their vocational context, (3) Development and validation of practice-based vocal solfeggio modules that can be used by general teachers in vocational high schools, and (4) Longitudinal studies on the impact of solfeggio learning on the development of students' audio-visual skills over a certain period.

With a focus on this goal, this research not only contributes to mapping bibliometric trends but also encourages the connection between mapping results and the development of real innovations in more inclusive music education practices. This aligns with the vision of expanding access to music learning, enhancing musical literacy, and bridging the gap between formal music education and the needs of vocational education that is both applicable and transformative.

Conclusion

This research aims to map the direction and trends of scientific publications related to solfeggio-based music education and to identify opportunities for developing pedagogical approaches relevant to non-music major students in Vocational High Schools (SMK). The results of the bibliometric analysis of international publications from the period 2016–2025 indicate that solfeggio research has seen an increase in quantity and consolidation of thematic directions, particularly on issues of pedagogy, aural skills, and integration within formal music education institutions. However, no explicit representation was found regarding the context of vocational education, non-music students, or solfeggio practices outside the academic art environment. These findings indicate a significant research gap, while also opening up space for the development of new approaches that are inclusive and contextual.

Operationally, this finding recommends the development of a solfeggio learning model that can be implemented for non-music vocational high school students, with the following characteristics: using vocals and body as the main instruments, structured gradually, not relying on expensive musical instruments, adopting interactive and reflective learning methods, and aligned with the vocational work environment. This model is designed to enhance students' basic musical abilities such as intonation, rhythm, and sight-singing, even for beginners without formal music experience. Thus, this research not only contributes to the mapping of academic literature but also generates strategic directions and implementable solutions for the development of music education in the vocational sector. Further research is recommended in the form of learning model experiments, the development of modules based on vocal practice, and long-term evaluations of the impact of solfeggio learning on the musicality of vocational school students.

Recommendation

Education policymakers need to encourage the integration of vocal-based solfeggio learning into the non-music vocational high school arts and culture curriculum, with support for teacher training and simple learning resources. Teachers in the field are advised to develop contextual, gradual, and cost-effective solfeggio learning strategies—based on vocal and reflective practices—without reliance on musical instruments. Future researchers can examine the effectiveness of the vocal solfeggio learning model in enhancing the basic



musicality of vocational high school students, as well as develop modules and evaluation instruments that are appropriate for the vocational context.

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