

## Pedagogical Transformation in Audiovisual-Based Vocal Learning: Evidence from a Pre-Experimental Triangulation Study

Delvia Mona <sup>1\*</sup>

Yensharti <sup>2</sup>

Mia Fahmiati <sup>3</sup>

<sup>1,3</sup> Prodi Pendidikan Seni Drama, Tari dan Musik, Fakultas Bahasa dan Seni, Universitas Negeri Padang, Padang, Indonesia.

<sup>2</sup> Prodi Pendidikan Musik, Fakultas Bahasa dan Seni, Universitas Negeri Padang, Padang, Indonesia.

\*email: [delviamona@fbs.unp.ac.id](mailto:delviamona@fbs.unp.ac.id)

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### Abstract

This study examined pedagogical transformation in audiovisual-based vocal learning within digital music education, focusing on reflection, self-directed learning, learning interaction, student engagement, and vocal competence. A pre-experimental one-group pretest-posttest design with a concurrent triangulation approach was used. Thirty-two fifth-semester students completed a 12-week intervention involving vocal technique videos, self-directed practice through performance recordings, video-based reflection, and synchronous and asynchronous feedback. Data were collected using a pedagogical transformation instrument and objective vocal competence assessments by two independent evaluators. Analysis applied paired-samples t-tests, Cohen's d, and Pearson correlation. Results showed significant improvements in all pedagogical indicators and vocal competence dimensions ( $p < .001$ ). Reflection showed the largest gain ( $d = 2.13$ ), followed by self-directed learning ( $d = 1.87$ ). Changes in pedagogical indicators correlated strongly with vocal competence development ( $r = .74$ ,  $p < .001$ ). The findings highlight reflection, self-directed learning, and engagement as key dimensions in digital vocal learning.



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## INTRODUCTION

Digital transformation has changed learning practices in higher education, including in music education. Technology is no longer understood merely as a means of delivering material but as part of pedagogical changes that influence how students learn, interact, and develop competencies. Rapanta et al. (2020) explain that digital learning encourages a shift from teacher-centered approaches to more student-oriented learning activities. In line with this, Bond et al. (2021) emphasize that the effectiveness of digital learning is more determined by the quality of pedagogical design than by the presence of technology itself.

These developments are increasingly evident in music education. The use of instructional videos, performance recordings, and digital feedback has expanded access to learning resources and allows the learning process to be more flexible. (Biasutti et al., 2021) shows that digital technology enables music learning to go beyond the confines of traditional classrooms and opens up opportunities for more independent learning experiences. The acceleration of digital technology utilization in music education has become even more prominent since the COVID-19 pandemic and continues into the post-pandemic period as part of a broader pedagogical transformation.

In the context of vocal learning, the use of digital technology becomes increasingly relevant because developing vocal skills requires repeated practice, performance observation, self-evaluation, and ongoing

feedback. Laucirica et al. (2021) explain that the development of vocal ability depends on a systematic and reflective practice process. In the context of remote learning, Otčenášek et al. (2022) indicate that the quality of instructional design and technological support play a crucial role in the development of students' vocal skills.

The use of audiovisual media provides opportunities to support the process. Through instructional videos and performance recordings, students can observe vocal technique demonstrations, review material as needed, and evaluate their practice results independently. Wan et al. (2022) showed that the use of digital devices in music practice can enhance the ability to monitor and manage practice strategies independently..

This phenomenon can be explained through the perspective of digital pedagogy. Santoveña-Casal & López (2023) define digital pedagogy as an approach that places learners as active subjects who construct learning experiences through interactions with the digital environment. In this perspective, technology has pedagogical value when it can support participation, reflection, and active knowledge construction. Siddiq et al. (2023) add that learners' ability to utilize technology independently and critically is an important part of digital agency in 21st-century learning.

This perspective is closely related to the theory of self-regulated learning (SRL). Zimmerman (2002) explains that learners who have self-regulation are able to set learning goals, monitor their progress, evaluate results, and adjust learning strategies effectively. This concept remains relevant in contemporary studies and continues to be developed in research on self-regulated learning in digital environments (Elmabaredy & Gençel, 2024). In digital environments, these skills become increasingly important because learners have greater autonomy in managing their learning processes. Panadero (2022) emphasizes that self-regulation is one of the main mechanisms supporting successful learning across various educational contexts.

In audiovisual media-based vocal learning, digital pedagogy and self-regulated learning have the potential to complement each other. Audiovisual media provide a learning environment that supports observation, reflection, and independent practice, while self-regulation explains how learners utilize that environment to achieve their learning goals. Therefore, the use of audiovisual media not only functions as a means of delivering material but also has the potential to drive pedagogical transformation through enhancing reflection skills, independent learning, student engagement, and the quality of learning interactions.

Although various studies have reported the benefits of digital technology in music education, their focus of investigation remains diverse. Nugroho & Kusumaningrum (2021) examined online learning strategies in vocal practice, while Otčenášek et al. (2022) explored students' experiences and perceptions in remote singing instruction. These studies contribute significantly to understanding the implementation of technology-based vocal learning. However, previous research generally focused separately on learning strategies, learning experiences, or students' perceptions. Empirical evidence that integrates indicators of pedagogical transformation based on self-regulated learning with objectively assessed vocal competence within a single triangulative design remains relatively limited. Additionally, the relationship between changes in pedagogical indicators and the development of performative competence has not been extensively tested through a combination of self-report data and objective performance data. These limitations highlight the need for research capable of linking pedagogical process changes with the development of vocal competence that can be verified through independent performance assessments.

Based on these gaps, this study aims to analyze pedagogical transformation in vocal learning based on audiovisual media through changes in reflection ability, independent learning, learning interaction, student engagement, and vocal competence, which are objectively assessed by an independent evaluator. To gain a more comprehensive understanding, this study uses a concurrent triangulation approach that integrates student perception data and objective vocal performance data. This research is guided by four research questions:

**RQ1:** How does audiovisual-based vocal learning influence pedagogical transformation indicators (reflection, self-directed learning, engagement, and learning interaction)?

**RQ2:** How does audiovisual-based vocal learning influence objectively assessed vocal competence?

**RQ3:** What is the relationship between changes in pedagogical transformation indicators and vocal competence development?

**RQ4:** How does triangulation between self-report and objective performance data contribute to understanding pedagogical transformation in digital vocal learning?

This research provides theoretical, methodological, and empirical contributions. Theoretically, this study integrates the perspectives of digital pedagogy and self-regulated learning to explain the process of pedagogical transformation in vocal learning based on audiovisual media. Methodologically, this research employs a concurrent triangulation approach that connects students' perception data with objective vocal performance assessments. Empirically, this study offers evidence regarding the relationship between changes

in pedagogical transformation indicators and the development of vocal competence, which is evaluated through independent performance assessments.

The novelty of this research lies in the integration of pedagogical transformation indicators based on self-regulated learning with objective vocal competency assessments within a concurrent triangulation framework. This approach allows for the analysis of the relationship between changes in pedagogical processes and the development of vocal performance, which are assessed independently in audiovisual media-based vocal learning. Through this approach, the study shows that reflection, independent learning, and engagement are the pedagogical dimensions that experience the most significant development in audiovisual media-based vocal learning. These findings expand the understanding of the relationship between pedagogical transformation in digital learning environments and the development of performative competencies in music education.

## **RESEARCH METHOD**

### **Research Design**

This study used a pre-experimental one-group pretest-posttest design combined with a concurrent triangulation approach. This approach allows for the integration of students' perception data (self-report) and objective vocal performance data to evaluate changes in pedagogical transformation and vocal competence after the implementation of audiovisual media-based learning (Creswell & Creswell, 2023). Through this design, changes in pedagogical transformation indicators are compared between pre- and post-intervention conditions, then verified through independently assessed vocal competence data. The triangulation approach is used to enhance the credibility of the interpretation of results through the convergence of two different data sources.

### **Context and Participants**

The research was conducted over 12 weeks in the Advanced Vocal course within the Drama, Dance, and Music Education Study Program. The intervention included the use of instructional videos on vocal techniques, self-practice based on performance recordings, written reflections, as well as synchronous and asynchronous feedback. The research population consisted of 34 students enrolled in the course. Total sampling technique was used, involving all members of the population in the study. During the intervention, two students did not meet the minimum attendance requirement ( $\geq 75\%$ ) and did not complete the post-intervention measurements. Therefore, the final analysis was conducted on 32 participants who had complete pre-test and post-test data.

The attrition rate of 5.9% (2 out of 34 participants) is considered low and does not alter the overall characteristics of the research cohort. The two participants who dropped out came from age groups and academic backgrounds similar to the other participants, indicating no substantial attrition bias. Therefore, the analysis was conducted using data from participants who completed the entire series of measurements (complete-case analysis). The final sample consisted of 20 females (62.5%) and 12 males (37.5%) aged 20–22 years. All participants had completed basic vocal courses and had basic experience in vocal performance practice.

### **Learning Intervention**

The intervention is designed based on the principles of digital pedagogy and self-regulated learning. Students learn vocal techniques through instructional videos that include demonstrations of breathing techniques, intonation, articulation, resonance, and musical interpretation. In addition to studying the video materials, students regularly practice independently, record their vocal performances using digital devices, conduct video-based reflections on their recordings, and receive both synchronous and asynchronous feedback from instructors. These activities are structured to support monitoring, self-evaluation, and the continuous development of learning strategies.

### **Research Instrument**

Data were obtained from pedagogical transformation instruments and objective vocal competence assessments. The pedagogical transformation instrument uses a five-point Likert scale developed based on the concepts of self-regulated learning, digital pedagogy, and student engagement. The four dimensions measured include reflection ability, independent learning, learning interaction, and student involvement. The operationalization of the research variables is presented in Table 1.

**Table 1.** Operationalization of Research Variables

Variable	Dimension	Main Indicator
Pedagogical Transformation	Reflection Ability	Self-evaluation, identifying strengths and weaknesses, and improvement planning
Pedagogical Transformation	Independent Learning	Goal setting, practice management, progress monitoring, and learning strategies
Pedagogical Transformation	Learning Interaction	Utilization of feedback, communication with lecturers, and responses to guidance
Pedagogical Transformation	Student Engagement	Active participation, perseverance in practice, and attention to the material
Vocal Competence	Technical Control	Intonation, breathing, voice stability
Vocal Competence	Tonal Quality	Resonance, sound color, tonal consistency
Vocal Competence	Articulation and Diction	Clarity of pronunciation and diction
Vocal Competence	Musical Expression	Musical interpretation, dynamics, and emotional expression

The content validity was established through expert judgment involving three experts in music education, pedagogy, and learning evaluation. Internal reliability was tested using Cronbach's Alpha and showed good to excellent consistency ( $\alpha = 0.83-0.89$ ) (Field, 2017). The reliability summary of the instrument is presented in Table 2.

**Table 2.** Reliability of the Pedagogical Transformation Instrument

Construction	Number of Items	Cronbach's Alpha
Reflection	10	0.88
Self-Directed Learning	12	0.89
Learning Interaction	10	0.83
Student Engagement	12	0.87

Vocal competence is assessed using a rubric adapted from the ABRSM Singing Assessment Criteria (Moura et al., 2024). The evaluation includes technical control, tonal quality, articulation, and diction, as well as musical expression, with a total score range of 4–20.

### Vocal Assessment Procedure and Inter-Rater Reliability

Vocal performance assessment was conducted by two independent evaluators with experience in vocal pedagogy and music performance evaluation. To minimize assessment bias, all vocal recordings were anonymized before the evaluation process. Participants' identities were removed, and each recording was assigned a random code so that evaluators did not know the students' identities. Additionally, pre-test and post-test recordings were arranged in a random order and given codes that did not indicate the data collection time. Thus, evaluators were unaware whether the recordings being assessed were from the pre-test or post-test phase (single-blind assessment), which helps to minimize potential expectancy bias. Inter-rater reliability was analyzed using the Intraclass Correlation Coefficient with a two-way random effects model with absolute agreement. An ICC value of 0.84 indicates a good level of agreement among raters (Liljequist et al., 2019).

### Data Analysis

Data analysis was conducted using IBM SPSS Statistics 26. Normality assumptions were checked using the Shapiro-Wilk test, and all variables met the normality criteria ( $p > 0.05$ ). Differences between pre-test and post-test scores were analyzed using a paired-samples t-test at a significance level of 0.05. The magnitude of change was calculated using Cohen's  $d$  and interpreted based on the criteria proposed by Lakens (2013). Furthermore, gain scores were used in Pearson correlation analysis to evaluate the relationship between changes in pedagogical transformation indicators and vocal competency development. The interpretation of the correlation strength refers to Cohen (2013), namely  $r = 0.10$  (small),  $r = 0.30$  (medium), and  $r \geq 0.50$  (large).

### Triangulasi Data

The concurrent triangulation approach is carried out through comparing the direction of changes, the consistency of effect sizes, and the relationship between changes in pedagogical indicators and vocal competence. Convergence is considered achieved when both data sources show a significant increase in the same direction, a large effect size, and a significant positive relationship between variables (Archibald, 2015).

## Research Ethics

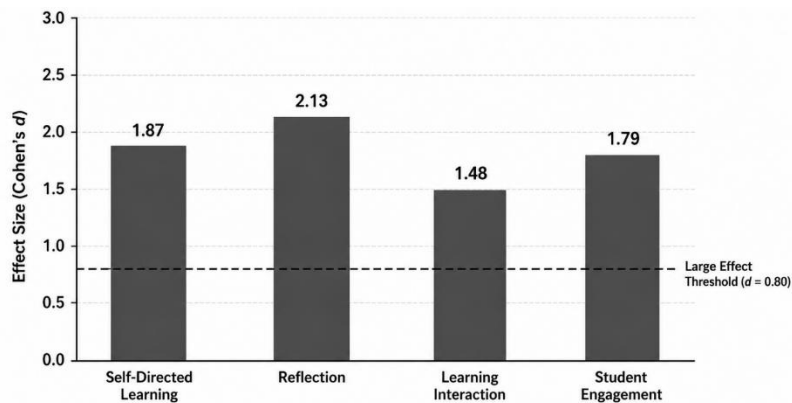
The research was conducted in accordance with the principles of educational research ethics. All participants gave informed consent to participate, participated voluntarily, and their identities' confidentiality was guaranteed through the use of anonymous codes during data collection, analysis, and reporting.

## RESULTS AND DISCUSSION

### Changes in Pedagogical Transformation Indicators

The analysis results indicate that all pedagogical transformation indicators experienced a significant increase after the implementation of audiovisual media-based vocal learning ( $p < .001$ ). Reflection ability showed the greatest improvement, from  $M = 2.74$  ( $SD = 0.58$ ) to  $M = 3.88$  ( $SD = 0.49$ ), with a 41.6% increase and a very large effect size ( $d = 2.13$ ). Learning independence increased from  $M = 2.87$  ( $SD = 0.61$ ) to  $M = 3.94$  ( $SD = 0.54$ ), with a 37.3% increase ( $d = 1.87$ ). Student engagement rose from  $M = 2.83$  ( $SD = 0.60$ ) to  $M = 3.86$  ( $SD = 0.51$ ), with a 36.4% increase ( $d = 1.79$ ), while learning interaction increased from  $M = 2.91$  ( $SD = 0.63$ ) to  $M = 3.79$  ( $SD = 0.52$ ), with a 30.2% increase ( $d = 1.48$ ).

All indicators show effect sizes in the large to very large category. The effect size in the pedagogical transformation domain ranges from  $d = 1.48$  to  $d = 2.13$ . Reflection ability exhibits the highest effect size, while the learning interaction shows the lowest effect size. Figure 1 presents the distribution of effect sizes for each pedagogical transformation indicator.

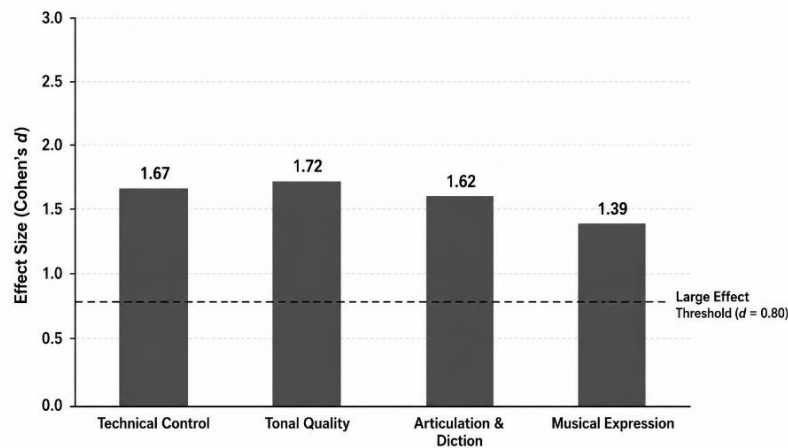


**Figure 1.** Effect sizes for pedagogical transformation indicators following audiovisual-based vocal learning. All indicators demonstrated large to very large effects and exceeded the conventional threshold for a large effect ( $d = 0.80$ ).

### Changes in Vocal Competence Based on Objective Assessment

The results of the vocal performance assessment by two independent evaluators showed a very encouraging improvement across all aspects of vocal competence ( $p < .001$ ). The tonal quality received special attention with the largest effect size ( $d = 1.72$ ), followed by technical control including intonation and breathing ( $d = 1.67$ ), as well as articulation and diction ( $d = 1.62$ ). Musical expression also showed positive development ( $d = 1.39$ ).

Inter-rater reliability analysis shows a high level of agreement ( $ICC = .84$ ). The effect size in the vocal competence domain ranges from  $d = 1.39$  to  $d = 1.72$ , all of which fall into the large effect category. Tonal quality exhibits the highest effect size, while musical expression shows the lowest effect size. Figure 2 presents the distribution of effect sizes across each dimension of vocal competence.



**Figure 2.** Effect sizes for objective vocal competence dimensions assessed by independent evaluators. All dimensions demonstrated large effects and exceeded the conventional threshold for a large effect ( $d = 0.80$ ).

### Convergence Analysis between Pedagogical Transformation and Vocal Competency Development

Convergence analysis shows that student perception data and objective vocal performance data exhibit a consistent development pattern after the implementation of audiovisual media-based vocal learning. Both data sources indicate a significant increase in all observed indicators ( $p < .001$ ).

In the domain of pedagogical transformation, the effect size ranges from  $d = 1.48$  to  $d = 2.13$ , with reflection ability showing the highest effect size and learning interaction showing the lowest. In the vocal competence domain, the effect size ranges from  $d = 1.39$  to  $d = 1.72$ , with tonal quality showing the highest effect size and musical expression showing the lowest.

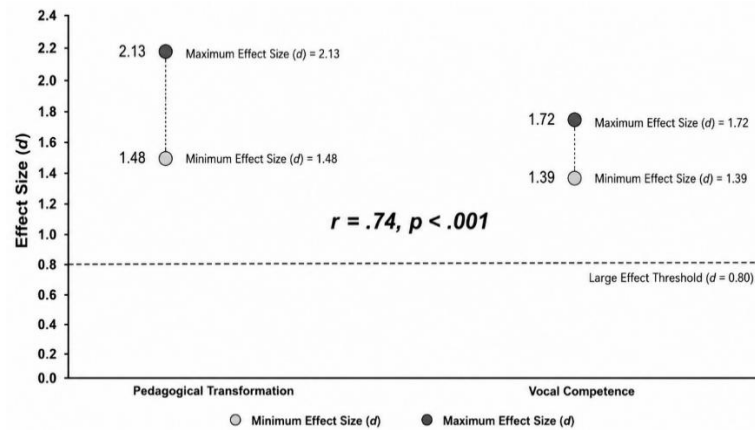
Although the effect size in self-report data tends to be higher than in objective performance data, both data sources show similar development patterns. All indicators in both domains demonstrate effect sizes in the large to very large categories, indicating consistent directions of change after the intervention.

The results of the Pearson correlation analysis indicate a strong positive relationship between changes in pedagogical transformation indicators and the development of vocal competence ( $r = .74, p < .001$ ). This finding suggests that improvements in pedagogical transformation occur alongside increases in objectively assessed vocal competence.

Overall, the analysis results indicate the achievement of convergence between self-report data and objective performance data in describing the changes that occur during the implementation of audiovisual media-based vocal learning. This convergence is demonstrated by the similarity in the direction of change, a large effect size in both domains, and a strong positive relationship between changes in pedagogical transformation indicators and vocal competence development. A summary of the convergence analysis results is presented in Table 3, while Figure 3 provides a visualization of the relationship between the two research domains.

**Table 3.** Summary of Convergence Analysis

Aspect	Finding
Pedagogical transformation effect size range	$d = 1.48-2.13$
Vocal competence effect size range	$d = 1.39-1.72$
Direction of change	Both data sources showed significant improvement across all indicators ( $p < .001$ )
Inter-domain relationship	$r = .74, p < .001$
Convergence status	Achieved



**Figure 3.** Convergence between pedagogical transformation and vocal competence based on effect-size ranges and inter-domain correlation ( $r = .74, p < .001$ ). All observed effect sizes exceeded the conventional threshold for a large effect ( $d = 0.80$ ).

### Reflective Ability as a Dominant Dimension of Pedagogical Transformation

The research results indicate that the ability to reflect shows the greatest improvement compared to other pedagogical transformation indicators ( $d = 2.13$ ). This finding suggests that audiovisual media not only serve as a means of delivering material but also as a learning environment that allows students to re-observe, self-evaluate, and continuously monitor their performance development.

The improvement is related to the characteristics of the intervention that place reflection as an integral part of the learning process. Students learn the material through videos, record their vocal performances, review the recordings, and compose reflections on aspects that need improvement. This cycle provides greater opportunities for self-evaluation compared to activities that rely more on social interaction.

This finding aligns with McPherson et al. (2022), who explain that self-monitoring and evaluation help students identify the gap between musical goals and actual performance. In vocal learning, recording performances allows students to evaluate intonation, articulation, breath control, and musical expression more objectively. These results are also supported by Sandberg-Jurström & Lindgren (2022), who emphasize the importance of reflection spaces in music learning, as well as Barclift & MacLeod (2023), who demonstrate the effectiveness of video-based reflection.

In addition to showing the largest effect size, the increase in reflection occurs in line with the development of vocal competence, which is assessed objectively. The strong positive relationship between changes in pedagogical indicators and vocal competence ( $r = 0.74; p < 0.001$ ) indicates that reflection has the potential to become a pedagogical dimension related to the development of performative competence.

This finding expands on previous literature that generally considers reflection as a factor influencing learning experience or academic success. The research results indicate that reflection is also related to improved vocal performance, which can be verified through objective assessment. Therefore, reflection not only functions as an evaluative activity but also as a metacognitive process that helps students continuously adjust their practice strategies.

From a theoretical perspective, the research findings reinforce the connection between digital pedagogy and self-regulated learning. Audiovisual media provide an environment that supports monitoring and reflection, while self-regulation explains how students utilize that environment to improve the quality of their performance (Panadero, 2022). Therefore, audiovisual recording-based reflection can be viewed as one of the important dimensions in the pedagogical transformation of digital vocal learning.

### Independence in Learning and Self-Regulation Enhancement in Vocal Learning

Independence in learning also experienced a very strong increase ( $d = 1.87$ ). This finding indicates that the flexibility of audiovisual media allows students to develop greater control over their own learning process. Students can access materials independently, replay instructional videos, adjust their learning pace, and determine the frequency of practice according to their needs. These characteristics create conditions that support the development of self-regulation because students have greater responsibility for the learning process they undertake.

This finding is in line with Jansen et al. (2019) showed that the ability to set goals, monitor progress, and manage learning strategies contributes to learning success. Similar results were also found by Broadbent & Fuller-Tyszkiewicz (2018), which considers self-regulation as an important factor in online and blended

learning. Additionally, Wong et al. (2019) as well as Elmabaredy and Gencil (2024) emphasize that self-regulation is one of the most consistent predictors of success in learning within digital environments.

In the context of vocal learning, the flexibility of audiovisual media allows students to practice repeatedly and continuously evaluate their technical skill development. Research findings indicate that increased independence in learning correlates with improvements in technical aspects of vocals, especially intonation and breath control. This pattern suggests that the results of the study show that increased learning independence occurs in tandem with the development of vocal performance.

The interpretation is supported by Osborne et al. (2020) which indicates that strengthening self-regulated learning in musicians is related to improved quality of practice and learning strategies. Additionally, triangulation results show a strong positive relationship between changes in pedagogical indicators and the development of vocal competence ( $r = 0.74$ ;  $p < 0.001$ ). These findings suggest that the development of vocal competence is not only influenced by the intensity of practice or the use of technology but also by students' ability to regulate and evaluate their own learning process.

From a theoretical perspective, these findings reinforce the view that technology does not directly lead to improved performative competence. Instead, technology provides flexible learning opportunities, while self-regulation can be seen as a pedagogical process related to utilizing digital learning opportunities to support the development of vocal skills. Therefore, independent learning is one of the important components in the pedagogical transformation of audiovisual media-based vocal education.

### Student Engagement and Learning Interaction in a Digital Environment

The research results show that student engagement increased more significantly ( $d = 1.79$ ) compared to learning interaction ( $d = 1.48$ ). This difference indicates that audiovisual media is more effective in supporting individual learning activities than activities that heavily rely on direct social interaction.

The pattern is likely related to the characteristics of the intervention that allow students to access materials flexibly, perform repeated practice, record their performance, and reflect on their practice results. Conversely, learning interactions require two-way communication, immediate feedback, and more complex social coordination.

This finding aligns with Redmond et al. (2018), who explain that involvement in online learning develops through students' active participation in various learning activities. Similar results were reported by Martin et al. (2020), which shows that flexible digital learning design can increase student engagement. Additionally, Reeve & Shin (2019) It emphasizes that a supportive learning environment that fosters student autonomy can enhance active engagement in the learning process.

Conversely, the relatively lower increase in learning interactions indicates that the social aspect of vocal learning still faces challenges in the digital environment. Bond et al. (2021) explain that the effectiveness of digital interaction is highly influenced by the quality of communication and instructional design. In the context of vocal learning, aspects such as direct demonstration, musical communication, and spontaneous feedback are still easier to develop through face-to-face learning. This finding is supported by Otčenašek et al. (2022), which shows that the quality of musical experience in remote singing learning can be affected by audiovisual transmission limitations.

Research findings indicate that pedagogical transformation in digital vocal learning is differential. The dimensions related to reflection, self-regulation, and individual participation develop more strongly compared to dimensions that heavily depend on social interaction. This suggests that the effectiveness of learning technology is not universal but is influenced by the compatibility between the characteristics of the technology and the competencies being developed.

Thus, audiovisual media seem to be more effective in supporting activities oriented toward reflection, individual engagement, and self-directed learning management compared to the development of more intensive social interactions. These findings reinforce the view that pedagogical transformation in digital vocal learning occurs selectively and contextually.

### Critical Interpretation of Large Effect Sizes

All indicators of pedagogical transformation and vocal competence show effect sizes ranging from large to very large ( $d = 1.39$ – $2.13$ ). These findings indicate that the implementation of audiovisual media-based vocal learning is associated with substantial changes in both pedagogical and performative aspects.

The magnitude of the effect size may be influenced by the characteristics of the intervention that integrates various learning activities simultaneously, including instructional videos, repeated practice,

reflection based on recordings, and both synchronous and asynchronous feedback. The combination of these activities creates a learning environment that encourages active student engagement throughout the learning process. These findings are in line with Rapanta et al. (2020) which emphasizes the importance of pedagogical design in determining the effectiveness of digital learning.

Nevertheless, the large effect size should be interpreted with caution. Lakens (2013) emphasizes that the effect size indicates the magnitude of change, but does not automatically prove a causal relationship. In this study, the use of a one-group pretest-posttest design remains vulnerable to internal validity threats such as maturation, additional learning experiences, and repeated measurement effects (Shadish et al., 2002).

The strength of this research lies in the use of a concurrent triangulation approach that integrates students' perception data and objective performance assessments. The strong positive relationship between changes in pedagogical indicators and vocal competence ( $r = 0.74$ ;  $p < 0.001$ ) indicates convergence across data sources. These findings reinforce the interpretation that the changes observed are not only reflected in students' subjective perceptions but are also related to observable developments in performative competence.

Therefore, although the research results show substantial changes, further studies with comparison groups, quasi-experimental designs, or longitudinal analysis are still needed to strengthen inferences about the relationship between pedagogical transformation and the development of vocal competence in media-based audiovisual learning.

### **Pedagogical Implications, Limitations, and Contributions of the Research**

Research findings indicate that reflection, independent learning, and student engagement develop more strongly than learning interactions. This pattern suggests that audiovisual media are more effective in supporting self-regulated learning activities compared to activities that heavily rely on direct social interaction. The findings support the view Graham (2018) that the effectiveness of technology depends on the compatibility between the characteristics of the technology and the pedagogical goals to be achieved. This is also in line with Boelens et al. (2017) which emphasizes the importance of balancing independent learning activities and collaborative ones in blended learning design.

In the context of vocal education, research results indicate that audiovisual media should be positioned as a complement, not a replacement for face-to-face learning. A blended or hybrid learning approach appears more appropriate because it allows the use of technology to support reflection, independent practice, and self-regulation, while face-to-face learning is focused on developing musical expression, artistic communication, and direct performative feedback.

This research has several limitations, mainly the use of a one-group pretest-posttest design, a relatively small sample size, and the research context originating from a single institution. Additionally, some pedagogical transformation indicators still rely on self-report data, which may be influenced by perception bias. Nevertheless, this study provides theoretical, methodological, and empirical contributions. Theoretically, this research expands the study of digital pedagogy and self-regulated learning by demonstrating that the pedagogical transformation in digital vocal learning occurs in a differential manner. Methodologically, this study integrates self-report data and objective vocal performance assessments through a concurrent triangulation approach, allowing for cross-validation of the changes that occur. Empirically, the study shows that changes in pedagogical transformation indicators are positively related to the development of vocal competence, which is assessed independently.

The main innovation of this research lies in the integration of a pedagogical transformation indicator based on independent learning with objective vocal competency assessment through a simultaneous triangulation approach. The findings also show that reflection, self-regulation, and learning engagement are pedagogical dimensions that demonstrate the most significant development during the intervention and have the potential to contribute to the development of vocal competence. These results indicate that the influence of technology on performative competence is closely related to the pedagogical processes that support ongoing monitoring, self-evaluation, and independent practice.

### **CONCLUSION**

Research results indicate that vocal learning based on audiovisual media is significantly related to improvements in pedagogical transformation and students' vocal competencies. Reflection ability and independent learning show the most substantial development, followed by student engagement and learning interaction. These findings suggest that pedagogical transformation in a digital environment occurs

differentially, with dimensions related to reflection, independent learning, and engagement developing more strongly compared to dimensions that heavily rely on social interaction.

Triangulation analysis shows a strong positive relationship between changes in pedagogical indicators and the development of vocal competence ( $r = 0.74$ ;  $p < 0.001$ ). This finding indicates that the development of performative competence is not only related to the use of technology but also to the processes of reflection, independent learning, and engagement facilitated by the digital learning environment. Therefore, the effectiveness of audiovisual media in vocal learning appears to be connected to the pedagogical dimensions that support monitoring, self-evaluation, and independent practice continuously.

Theoretically, this research enriches the study of digital pedagogy and self-regulated learning by demonstrating that the development of vocal skills is related to pedagogical transformations that occur selectively and contextually within digital learning environments. Practically, the findings support the use of audiovisual media to enhance reflection, independent learning, and self-practice, while the development of musical expression, artistic communication, and performative feedback still require direct involvement from instructors through blended or hybrid learning approaches.

This study has limitations in the use of a one-group pretest-posttest design, a relatively small sample size, and the research context originating from a single institution. Therefore, future research is recommended to use experimental or quasi-experimental designs with more diverse samples and longer observation periods to test the consistency of findings across various music education contexts.

These findings support the view that pedagogical transformation is an important dimension in digital music learning and should be considered alongside technological factors when evaluating the effectiveness of learning. Methodologically, this study shows that integrating pedagogical transformation indicators based on self-regulated learning with objective vocal competence assessments within a concurrent triangulation framework can provide a more comprehensive understanding of the relationship between the learning process and vocal performance development.

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