

Integrating Deep Pedagogical Learning into Project-Based Learning to Enhance Students' Musical Intelligence

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Abstract

Deep learning in this study refers to a pedagogical orientation toward conceptual understanding, reflective inquiry, meaningful connection, and transfer, rather than artificial-intelligence-based deep learning. This study examined whether embedding this orientation within Project-Based Learning (PjBL) could strengthen students' musical intelligence through a choir project at SMA Negeri 1 Brebes. This research used a sequential explanatory mixed-methods approach, which included a quasi-experimental pretest-posttest. There were 25 students in the experimental group and 25 students in the control group for comparison purposes, followed by interviews, observation, and documentation. The average score for the experimental group on the posttest was much higher ($M = 91.52$) compared to the control group ($M = 82.08$), indicating a significant statistical difference between the two groups ($p < .001$). Qualitative evidence explained these gains through four interconnected changes: more accurate vocal performance, stronger understanding of song structure, greater interpretive sensitivity to harmony and expression, and more purposeful collaboration. The findings indicate that PjBL becomes pedagogically deeper when project completion is accompanied by structured analysis, feedback, reflection, and interpretation. The study recommends process-based assessment in music projects so that artistic products are evaluated together with the depth of students' musical reasoning and reflective engagement.

Keywords

Deep Pedagogical Learning; Musical Intelligence; Music Education; Project-Based Learning; Choir

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1. INTRODUCTION

Education today needs teachers to use teaching methods that not highlight mastery of the subject but also build deep understanding and meaningful learning experiences. Music has roles in learning. Music helps grow emotional and cognitive skills that are essential, to students' daily lives (Azzahra & Jaya, 2025; Sundaravally, 2026; Zou et al., 2024). In this study, musical intelligence is viewed as a developable educational talent, demonstrated through students' ability to understand, organize, explain, and apply musical concepts, rather than as an innate or hereditary ability possessed only by certain individuals (Davis et al., 2011). This challenge is particularly evident in secondary-level music education. Arts education is not merely about learning theory; it also requires students to listen, create, and share meaning through music. Observations at Brebes State High School No. 1 show that many



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students enrolled in the music program lack basic musical understanding and skills acquired in previous educational stages. This results in a lack of foundational knowledge in notation, rhythm, vocal technique, harmonic awareness, and an understanding of ensemble playing. These conditions create problems in the learning process, particularly in choir classes (Abi et al., 2026; Pendergast & Robinson, 2020; G. Zhang et al., 2024). The development of musical habits is aided by repeated practice, but continuous practice alone is not always enough for students to fully understand the functions of pitch, harmony, dynamics, phrasing, or vocal balance. If students merely imitate these examples until the musical piece is finished, the result may be a musical piece, but their true understanding of music will remain superficial. This lack of genuine understanding does not occur by chance. For a long time, music education in Indonesia has been based on a teacher-centered method that emphasizes memorizing notation and repeating vocal exercises, rather than fostering musical intelligence from the outset through a flexible and creative approach; thus, this method offers few opportunities for interpretive or reflective engagement. (Bruin & Merrick, 2024; P. Li & Wang, 2023; Wang et al., 2025).

This difference matters because the word deep learning is now being used in two different ways. In computer science it commonly refers to multilayer neural-network techniques. In this article, however, deep learning denotes a pedagogical orientation toward sustained conceptual engagement, connection among ideas, introspection, consciousness of one's own thought processes, and real-life application of knowledge (L. Chen, 2025; Kovač et al., 2025; Winje & Løndal, 2020). This study does not refer to that computational sense. Following (Kovač et al., 2025), The term “deep learning” here refers to a pedagogical approach that involves applying knowledge to everyday life, enhancing critical thinking skills, and understanding key concepts. It is not merely about memorizing information or replicating without understanding (Lindblom-Ylänne et al., 2019; McDaniel et al., 2025a). The latest findings from QALAMUNA also positions pedagogical deep learning as centered on conceptual understanding, reflection, critical thinking, and meaningful learning, and meaningful learning over computational modeling (Kamila et al., 2026). Systematically integrate deep learning into instructional components to foster higher-order thinking. These studies support a broader pedagogical alignment between the two approaches but do not address the specific demands of music education at the secondary school level, where conceptual understanding must be aligned with auditory perception, physically practiced techniques, interpretation, and ensemble interaction. This distinction is conceptually important because music education that stops at the accurate reproduction of pitch and rhythm remains at a superficial level musical intelligence. This research addresses this disciplinary gap through the context of choral music (Khnnous & Mesbahi, 2024; M. Liu, 2021; Merchán Sánchez-Jara et al., 2024).

The second gap discussed in this study is theoretical, not practical, and this is something that should be considered when reading the study. Project-Based Learning (PjBL) is often considered to foster deep engagement by its very definition, which raises a logical question: what does the explicit application of the Deep Learning perspective to PjBL add that PjBL itself is not already claimed to provide? The answer proposed here is that PjBL establishes a structure for activities (a project with a final product), but does not, by itself, guarantee the cognitive depth of engagement in those activities; a student could complete a choir project through imitation and repetition without ever analysing the harmonic structure or internalising the meaning of the lyrics. In this study, Deep Learning is not just a new name for PjBL. It is seen as a way of thinking about the specific stages of planning, implementation and evaluation in PjBL (Handayani et al., 2023; Mikly et al., 2021). This ensures that the project aims to deepen understanding of the concept. Instead of merely carrying out the work in a certain way. This distinction constitutes the theoretical gap addressed by this study (Omelianenko & Artyukhova, 2024; Subiyantoro, 2023).

Project-Based Learning (PjBL) offers a compatible but not identical pedagogical structure. PjBL organizes learning around authentic problems or products, sustained inquiry, student responsibility, collaboration, revision, and public presentation (Almulla, 2020; Bagus Susetyo & Edi Nugroho, 2023;

Pucihar, 2025). Its strength in music education lies in providing students with tangible artistic goals: a choral performance requires planning, role assignment, rehearsal, musical decision-making, coordination, and evaluation. However, the existence of a project does not automatically guarantee deep learning. Students may complete a project by dividing tasks, following instructions, and rehearsing repeatedly without examining the conceptual relationships embedded in the work. The theoretical gap discussed in this study lies precisely at this point (Cuervo-Calvo & Cabedo-Mas, 2024; da Fonsêca Barros & Penna, 2023; Rauduvaitė & Sun, 2023).

The proposed integration assigns distinct functions to both constructs. PjBL provides a framework for authentic activities, while deep pedagogical learning imparts cognitive and reflective qualities to students' engagement within that framework (Farshad & Fortin, 2026; Guo et al., 2020a). In the choir project, students are not required to sing accurately. They are also guided to analyze structure, identify harmonic relationships, justify expressive choices, identify problems in their performance, respond to feedback, and reflect on how each vocal part contributes to the overall sound. In my view, the uniqueness of this study does not lie in the claim that PjBL and deep learning are interchangeable. Rather, its uniqueness lies in the fact that explicit, reflective, and meaning-oriented mechanisms can deepen a project that, without them, might otherwise remain outcome-centered. Although distinct from one another, both PjBL and deep learning have their respective roles. This project benefits from both approaches (Dean et al., 2023; Prajoko et al., 2023; S. A. Sari et al., 2025).

According to a recent study published in QALAMUNA, (Vina Arie Paramita et al., 2026) researched how deep learning is used in project-based learning and stressed the need for linking project tasks to student development, while (Ramadani et al., 2026) systematically integrated deep learning into learning components to strengthen higher-order thinking. These studies support a broader pedagogical alignment between the two approaches but do not address the specific demands of music education at the secondary school level, where conceptual understanding must be coordinated with auditory perception, internalized techniques, interpretation, and ensemble interaction. This study addresses this disciplinary gap through the context of choral music.

Therefore, this study examines whether the integration of deep pedagogical learning into PjBL enhances students' musical intelligence and, more importantly, how the learning process accounts for the observed quantitative differences. This study has two objectives: (1) to examine differences in musical intelligence outcomes between students who received the integrated intervention and those in the comparison group; and (2) to explain these statistical patterns through qualitative evidence regarding vocal technique accuracy, structural understanding, interpretive and emotional sensitivity to harmony, and collaborative skills.

2. METHODS

This explanatory study employs a mixed-methods design and sequential analysis. Using quantitative research methods, this explanatory study was conducted first to identify patterns of change and differences occurring both at the individual level and across groups; afterwards, the qualitative part looked at how the students experienced the intervention and why certain aspects of musical intelligence seemed to have improved. In the quantitative study, a comparison of pre- and post-instruction test scores was conducted using a quasi-experimental approach because the participants were drawn from existing extracurricular activity groups rather than from randomly selected classes. The qualitative part made use of interviews, field observations and documentation of the projects. Integration took place at the stage of interpretation by linking the statistical results with the evidence from the students' and teachers' accounts as well as from the observed rehearsal practices.

This study employs a sequential explanatory design using a mixed-methods approach. The study begins with the collection and analysis of quantitative data. Subsequently, qualitative data are collected

and analyzed to explain the outcomes obtained from the quantitative results (Amila NKK Gamage, 2025; Sharma et al., 2023; Toyon, 2021). This design was chosen because a numerical measure of improvement alone cannot reveal the reflective processes that Deep Learning is theorized to activate; the qualitative phase was therefore designed specifically to trace those processes.

The study took place at SMA Negeri 1 Brebes and included students in their XI and XII grades who took part in the school's music extracurricular activities. The group that received the intervention consisted of 25 students who took an active role in the choir project and were given the integrated PjBL-deep pedagogical learning intervention. The control group was made up of 25 students from the same extracurricular group who did not receive the full project intervention. Music teachers and other relevant members of the school provided contextual information by means of interviews and observations. Since the assignment of students to groups followed the usual structure of the extracurricular activity, the design is regarded as quasi-experimental and causal conclusions are therefore kept within certain limits.

Musical intelligence was defined using performance and comprehension criteria aligned with the learning objectives: vocal-technical accuracy, an understanding of musical structure, interpretive sensitivity to harmony and expression, and the ability to work collaboratively. A pretest and a posttest were given before and after the intervention. The Shapiro-Wilk test assesses the normality of the sample, which validates the statistical assumptions. The t-test is used to compare final scores across groups and identify significant differences in performance. Normalized gain (N-Gain) is calculated to measure performance improvement, thereby providing insights into the effectiveness of the intervention. We set the significance level of $\alpha = .05$. After reviewing the data, we processed it, grouped it into categories, analyzed the themes, and combined it all with the results from the quantitative data.

Intervention Design: Syntactic Matrix of PjBL Stages and Deep Learning Principles

The intervention was organized as a six-stage learning sequence to enable observation of the distinction between ordinary choir rehearsal and the integrated treatment in practice. The students in the experimental group didn't just get more practice time. They were asked to demonstrate their musical reasoning at each stage of PjBL. They were asked to map the song form and harmonic function, identify what they did not yet understand, justify choices regarding pitch, dynamics, articulation, and balance, use feedback to identify technical issues, and consider how their performance had changed. These prompts operationalized deep pedagogical learning within the project rather than treating reflection as an activity added after the performance (Irfan et al., 2023; W. Li et al., 2025; Lobczowski et al., 2021). A description of the procedure is provided in Table 1. A similar emphasis on structured reflection and authentic assessment has been reported in project-based ensemble learning, where reflection becomes part of musicianship development rather than a separate written exercise (Troglauer & Morrison, 2024). The control group continued the school's regular choir practice without these explicit analytical and reflective prompts, providing the comparison used in the subsequent analysis.

Table 1. Integration of PjBL and Deep Pedagogical Learning in the Choir Intervention

Stage	PjBL activity	Deep-learning mechanism	Primary evidence / indicator
1. Authentic challenge	Define the choir performance target and performance criteria	Activate prior knowledge; identify what is not yet understood	Initial diagnostic notes; musical problem identification
2. Project planning	Assign vocal sections and map rehearsal tasks	Analyze song form, melodic contour, harmonic function, lyrics, and expressive intention	Structural-understanding worksheet

Stage	PjBL activity	Deep-learning mechanism	Primary evidence / indicator
3. Investigation	Sectional exploration and guided rehearsal	Ask why a pitch, dynamic, articulation, or balance decision is musically appropriate	Reasoned musical explanations; interpretive sensitivity
4. Diagnostic rehearsal	Repeated sectional and full-ensemble practice	Use feedback to identify pitch-matching, breathing, diction, blend, and timing problems; revise strategies	Vocal-technical accuracy; observation notes
5. Performance preparation	Integrate sections, schedule rehearsals, simulate public performance	Connect individual responsibility with collective sound; peer feedback and self-monitoring	Collaborative capacity; rehearsal documentation
6. Reflection and evaluation	Evaluate process and final performance	Reflect on what changed, why it changed, and how understanding can transfer to later repertoire	Student/teacher interview evidence; reflective evaluation

Source: Research design, 2025

This subsequent study, which focuses more on qualitative aspects, is designed to provide explanatory evidence regarding these four indicators, rather than merely serving as a descriptive appendix. Interview prompts, therefore, asked students to describe changes in listening, structural and harmonic understanding, responses to technical problems, interpretation of the song, and coordination with other singers. Observation notes were organized around the same dimensions. Because the qualitative evidence was used to explain the score patterns rather than to serve as a stand-alone descriptive supplement, this link between phases was crucial. Reflective narratives in music education research can highlight facets of musical learning and agency that are not captured by performance scores alone (Pogonowski et al., n.d.).

3. FINDINGS AND DISCUSSIONS

Synthesis of Quantitative and Qualitative Findings by Musical Intelligence Indicator

The findings are presented by connecting the statistical pattern with evidence from rehearsals, interviews, and project documentation. The analysis follows four dimensions defined before the intervention: vocal-technical accuracy, understanding of musical structure, interpretive and emotional sensitivity to harmony, and collaborative capacity. This organization avoids treating the quantitative and qualitative strands as parallel reports. Instead, each numerical result is read alongside evidence of what students actually did during rehearsal and how they described the change in their musical thinking. Such an approach is especially relevant to ensemble learning, where musical achievement emerges through both individual understanding and interaction with other performers. Project-based music education has similarly been discussed as a setting in which learner responsibility, authentic musical activity, and reflection can be connected rather than assessed in isolation. Research documentation, performance test results, interview transcripts, and field observation notes support this comprehensive strategy. As a result, this method provides evidence that students' musical intelligence has improved as a result of the intervention.

Before discussing these indicators, the overall data profile is described here to serve as a common

reference for further research. Based on the results of the Shapiro-Wilk test, the p-values for the pretest and posttest scores of both groups were all greater than 0.05 (Table 2). This indicates that the data come from a population that can be analyzed using parametric tests, thereby confirming the appropriateness of this approach.

Table 2. Shapiro-Wilk Normality Test

Class	Statistic	df	Sig.
Pretest Experimental	.960	25	.421
Posttest Experimental	.931	25	.089
Pretest Control	.964	25	.499
Posttest Control	.932	25	.096

Source: Research Data, 2025

All Shapiro-Wilk significance values exceeded .05, indicating that the score distributions did not significantly depart from normality. Parametric comparison was therefore retained for the posttest analysis.

The experimental group scored an average of 91.52 in the post-test while the control group scored 82.08. The statistical value reported as 0.000 should be read as $p < 0.001$, not as a probability of zero (see Table 3). These findings show a significant difference between the experimental group and the control group after the intervention. Although this study used entire student cohorts rather than randomly selected groups, the observed differences are viewed from the perspective of the intervention's impact, not as absolute causal conclusions. The mixed-methods design enriches our understanding of the learning process while highlighting transformative changes in that process that may have contributed to these differences (Ilma et al., 2023; Marks et al., 2023). Four specific indicators clarify the results, demonstrating the experimental group's excellent performance. Table 4 shows that the experimental group achieved an impressive N-Gain score of 78.17, firmly placing it in the "effective" category. Meanwhile, the control group, with a score of 61.42, showed "moderately effective" results. This developmental journey is reflected in the remarkable progress from the pre-test to the post-test in both groups, as clearly depicted in Figure 1.

Table 3. Independent T-Test

Class	N	Mean	Sig.
Posttest Eksperimen	25	91.52	.000
Posttest Kontrol	25	82.08	.000

Source: Research Data, 2025

Table 4. N-Gain Score

Class	Mean	Category
Eksperimen	78.17	Effective
Kontrol	61.42	Quite Effective

Source: Research Data, 2025

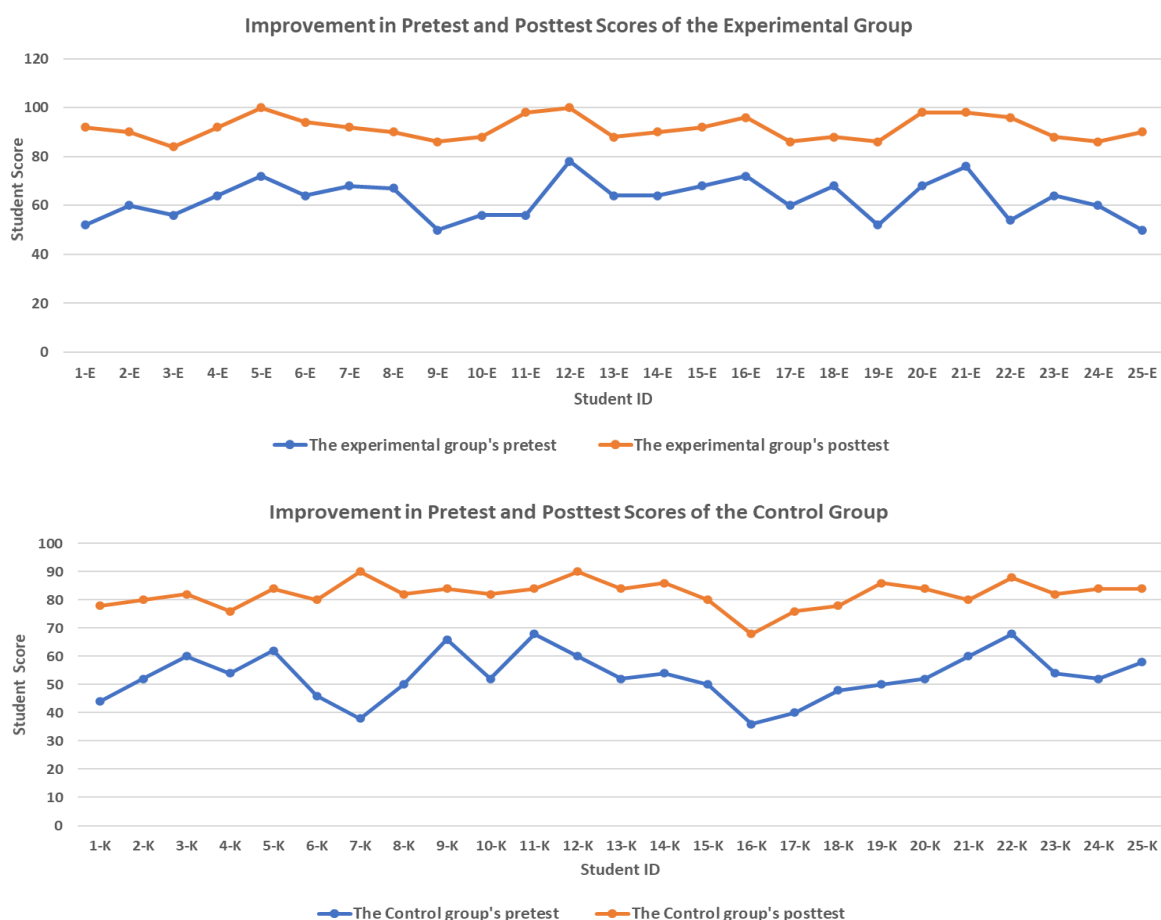


Figure 1. Pretest (blue) and Posttest (orange) score trend of the experimental and control group, n = 25 (Source: Research Data, 2025)

The N-Gain model supports the findings of the post-test comparison. The experimental group showed an average increase of 78.17%, while the control group reached only 61.42%. The value of the mixed-methods design lies in its explanation of what changed in the learning process that may have caused this difference. Four indicators provide this explanation. The following is an explanation of each indicator.

Vocal technical accuracy provides the first explanation for the posttest difference. Individual vocalists and vocal groups experienced issues with pitch matching, breathing, diction, blend, and timing throughout the diagnostic-rehearsal stage (Table 1, Stage 4). The observation notes reveal that the correction was followed by a second try and a brief explanation of why the change was required. This differs from simply extending rehearsal duration: students were expected to recognize the technical problem and use feedback to revise the next performance. The observed pattern, therefore, supports a more cautious interpretation of the score difference: reflective diagnosis was one plausible mechanism underlying the experimental group's stronger technical progress.

Indicator 2 concerns understanding of song structure. The experimental group's N-Gain of 78.17 was accompanied by evidence from the structural-analysis worksheets completed during project planning (Table 1, Stage 2). A student explained how his viewpoint evolved during the task, transitioning from mere imitation to comprehending the reasons behind the arrangement of specific notes and harmonies (Student, 2025). The genuine worth of this narrative is found not in the words alone, but in the change in the student's concentration: the task transformed from simply replicating the vocal line to considering how melody, harmony, and structure unite. This concept is in harmony with project-oriented music education techniques that integrate aspects of choice and reflection within the

project, instead of post-performance (Dillon, 2023; Troglauer & Morrison, 2024).

Indicator 3 refers to interpretive and emotional sensitivity to vocal harmony. The evaluators requested this demonstration because it clearly illustrates why the N-Gain scores of the experimental group were higher than those of the control group. Rather than simply imitating the choir conductor's performance, we conducted thorough field observations during the research and rehearsal phases to gather in-depth and useful insights (Table 1, Phases 1–2; documented in Figures 2 and 3) revealed that students were guided to reflectively analyze how individual vocal frequencies blended into chord tones and how that blending supported the song's expressive intent. Because the students were constantly asked, "Why is the dynamic like this here?" rather than simply "Sing it like this," they appear to have developed a keener aural sensitivity to harmonic balance as well as a stronger emotional response to the music's expressive intent. This aligns with the supervising teacher's description of the group's affective changes: "The students have gained confidence, especially as they prepare for the choir competition. Their performances became more captivating because they not only memorized the songs they sang but also understood them (Teacher, 2025). When compared to quantitative differences, this suggests that the higher N-Gain in the experimental group was due to introspective and meaning-oriented engagement with musical sounds and structure, rather than longer practice time."

Indicator 4 pertains to the ability to collaborate. Records of the exercises indicate that students are arranging themselves by vocal part, refining their abilities and balance, and discussing practice assignments with their peers and instructors (Figures 2 and 3). In this context, collaboration is not seen as a general social result; instead, it is strongly associated with musical interdependence. Soprano, alto, tenor, or bass vocals can only be properly assessed when viewed alongside the other voices. Thus, the design of this initiative necessitates that students link personal readiness with the group sound. This viewpoint corresponds with findings on communal musical cognition, highlighting conversation and introspection as key elements of group musical thought (Pogonowski et al., n.d.). It aligns with school-centric PjBL studies that recognize active involvement and collaborative practice as essential to music education (Nan, 2025; Nugroho & Dewi, 2021; L. Zhang & Ma, 2023).



Figure 2. Students organizing vocal formation prior to rehearsal (Source: Research Data, 2025)

Based on these four indicators, the experimental group's stronger posttest and N-Gain results are best understood as a pattern associated with the way the project was enacted, not as evidence that PjBL alone automatically produces deeper learning. The intervention inserted analytical questions, diagnostic feedback, peer coordination, and reflection into successive stages of the choir project. Taken collectively across the four indicators, the higher performance of the experimental group should not be interpreted merely as a generalized treatment effect. Rather, the observed advantage can be traced to

students' sustained reflective engagement with harmonic structures and lyrical-expressive meanings throughout the successive stages of Project-Based Learning (PjBL) (DongJin & Mohamad Ashari, 2024; Samsudin & Liliawati, 2022; Uyen et al., 2023), This process-oriented engagement provides a plausible pedagogical mechanism through which the deep learning approach facilitates deeper musical understanding, interpretive sensitivity, and the development of musical intelligence (M. M. Li & Tu, 2024). Students were therefore required to relate technical accuracy to structure, harmony, expression, and the contribution of their own voice part to the ensemble. This interpretation also clarifies the study's theoretical contribution: deep pedagogical learning functions here as a specification of the cognitive and reflective work expected inside PjBL. A recent QALAMUNA study shows that the concept of deep learning can be integrated into project-based activities through questions, reflection, and scaffolding. In line with the findings of other studies, this study focuses on early childhood education, placing greater emphasis on what makes it unique rather than addressing music education for older students (Vina Arie Paramita et al., 2026) . In conclusion, these new findings expand the discussion into the realm of learning. In the learning process, intellectual understanding must be balanced with listening skills, vocal techniques integrated with the body, interpretation, and group performance.

Enhancing Students' Cognitive Understanding

Using learning inside project-based learning can boost students' musical intelligence at SMA N 1 Brebes. In the arts and music classes, student learning using project-based learning strategies has been shown to enhance student abilities. Students' abilities develop in a balanced way across musical skills, social skills, and thinking skills.(Cuervo-Calvo & Cabedo-Mas, 2024b; Kibici, 2022). In project-based music education, students develop their own interests and engagement in learning. They are encouraged to analyze and overcome music-related challenges through these creative activities, thereby turning obstacles into opportunities for growth. Studies demonstrate that project-based learning helps students think deeply and creatively and develops their speaking and cooperation skills. Students can participate in project-based learning by collaborating to acquire knowledge and taking control of the learning process. Students develop their thinking skills through active participation in project-based learning and the development of innovative ideas. Students can learn effectively through project-based learning and are better prepared to tackle practical problems. Through project-based learning, students can engage in independent learning and creative thinking(Guo et al., 2020b; Rehman et al., 2023) .

Vocal precision in technique

Classroom observations show that corrective feedback is provided during practice, rather than after students have completed an entire musical passage. The teacher splits the performance into sections. The teacher splits the performance into sections. The teacher urges students to focus on note articulation, breathing technique, note onset voice blending, and steady tempo. When problems appear, students must look at the root causes. Students have to make sure their answers are correct and modify them as needed. This approach of teaching helps pupils connect theory to real life. It has nothing to do with copying music or sticking to instructions. Students should consider the causes of their actions. They have to find places for improvement, evaluate their own performances, react to criticism, and examine musical components. Digital tools and online music resources can help to improve this process by providing students sample materials, practice exercises, and exploration opportunities. Using internet music tools and resources in classes helps one to determine their value in teaching. Since technology helps students to listen intently, understand ideas, monitor their development, and consider how their technical skills relate to their expressive results, it is quite important in education. Students are not merely directed to imitate notation or follow procedures. They must evaluate musical challenges, critically assess their own performances, respond to feedback, and identify steps for self-improvement. By integrating deep learning into music projects, they will discover various ways to create and produce music. In addition to fostering creativity, this approach also encourages the development of each individual's musical identity. Deep learning can analyze various musical elements, such as melody, rhythm, and harmony, which can then serve as material to develop students' music

composition skills. Although research on deep learning in music education continues to evolve, this approach offers potential benefits for enhancing students' knowledge of music theory and their practical skills (J. Li & Yan, 2025; Omirali et al., 2025; Subiyantoro, 2023) .

Additionally, using technology-based tools like augmented reality or virtual musical instruments helps to create a more interesting and successful classroom. This approach aims at encouraging pupils to explore more freely, as music's art is centered on imagination. Integrating musical instruments and digital technology also gives more people access to learning materials that were previously restricted (Naseer et al., 2024; Sularso et al., 2024; Zhao & Gaikwad, 2024). From the standpoint of efficiency, the research findings point to the fact that applying the PBL approach in music education helps to develop pupils' musical ability. Deep learning technology can inspire kids to get better learning results than conventional teaching approaches. This method helps pupils to not only learn to "do" music but also acquire a greater knowledge of the ideas behind music and how it may be expressed personally and groupwise (Andayani et al., 2022; Yimei, 2019; Zheng et al., 2024) . This procedure offers a good educational justification for the experimental group's higher average post-test results: technical development is backed by self-diagnosis and self-monitoring rather than only more repetition. This feedback-oriented approach fits with advanced music instruction's cooperative creative teaching, which uses repeated feedback and group musical problem solving to support artistic development (Creech et al., 2022) .

Structural understanding of the song

During the planning stage, students were asked to create a compositional structure diagram and determine where each vocal part would be placed. As one student observed, this practice marked a shift from passive imitation toward a genuine understanding of the reasoning behind the placement of certain notes and how harmonization works. This conceptual shift highlights the importance of integrating the principles of deep learning into the teaching process, which is essential for fostering critical insight and enhancing the effectiveness of instruction. We engage in deep learning when we stop treating musical elements as isolated instructions and begin to explore how these elements are interconnected: why a particular melodic line is placed in that position, how a modulation transitions to the next section, and how the introduction of a specific section contributes to the work as a whole (Kapania et al., 2025). Furthermore, this understanding shifts from theory to active practice when it directly influences artistic decisions, such as adjusting dynamics in contrasting melodies or synchronizing breathing during structural transitions. (Ramadani et al., 2026) also argue that learning principles must be systematically integrated into every aspect of teaching to foster this kind of critical understanding (McDaniel et al., 2025b; Smarandache et al., 2022) .

Although research findings indicate that students participating in choral competitions demonstrate greater development in musical intelligence, differences in experience and motivation preclude drawing definitive causal conclusions. However, this choral project creates a task framework in which students actively negotiate arrangements, resolve interpretive differences, and share responsibility for the performance. Collaborating with others helps create strong emotional bonds and a shared purpose, which makes the learning experience more memorable; achieving shared goals through shared experiences further enriches the learning experience.

Interpretive and emotional sensitivity to vocal harmony

Discussions during practice sessions focus not only on technical accuracy but also on expressive goals, emphasizing aesthetic engagement and emotional expression. Through this approach, teachers recognize how important these aspects are for students when they sing. These guided questions encourage students to engage personally with the music and take the initiative in shaping their own interpretations, thereby shifting the role of authority from an external model to their own critical listening skills. Teachers ask guided questions to encourage students to feel more connected to the music and interpret it independently. This shift allows students to gain greater control over their learning and

improve their listening skills. This shift is linked to a deeper understanding of the repertoire, rather than merely technical memorization (Piličiauskaitė & Gabnytė Bizevičienė, 2025). When considered in light of quantitative differences between groups, a purely technical interpretation of the findings becomes untenable; traditional practice typically improves accuracy without altering how students articulate their singing. The perspective at the core of a student-centered practice environment is the redistribution of authority. Instead of imitating external practice models, the primary focus is on students' own interpretation of the text, critical listening, and responsibility for their artistic decisions. This shift reflects a broader perspective on participation in choir, where children's self-reported experiences of group singing prioritize emotional expression and aesthetic engagement over mere technical proficiency (Hendry et al., 2022; Krüger Bridge, 2026).

Impacts of Deep Learning on Music Learning Outcomes

Pedagogical Integration in Learning

In an ensemble such as a choir, coordination is not merely a task; it is a fundamental musical skill. With this in mind, teachers will feel more confident in fulfilling their roles as they develop these skills and understand how they influence the learning process. Singers must harmonize the soprano, alto, tenor, and bass parts with the rhythm of the rehearsal, listen to the interactions between the parts, and adjust their volume and timing to improve the overall sound quality. Project-based learning provides a purpose for this coordination by creating real-world situations where every decision affects the group. Project-based learning alone does not reveal the depth of musical thinking that occurs when students engage in focused analysis and reflect on their actions. Enriching the learning experience by examining strategies, providing constructive feedback, asking questions about meaning, reflecting on their work, and explaining their reasoning clarifies how the project leads to a deeper understanding of music.

Without a performance, deep learning can feel too abstract. Overall, the project provides context, and the deep learning methodology generates high-quality questions and answers that can help students recognize how their choices shape the overall sound.

Evidence for mechanisms and bounds design considerations, and the teacher's role.

The findings indicate that enhanced performance stems from an artistic setting and structured teaching techniques that direct musical cognition. Greater engagement in the tested group indicates a blend of significant project objectives and analytical thought processes; however, the absence of random group assignments may suggest other factors could influence the outcomes, such as varying initial motivation levels, time dedicated to practice, and previous student participation, making it crucial to exercise caution when asserting that deep learning techniques are the sole reason. Therefore, the main conclusion is that the increase in figures aligns with the evidence of events, implying that students utilized the intended analytical and reasoning approaches. To expand on these concepts, further studies should use matched groups, report effect sizes with confidence intervals, and examine their applicability to instrument playing, music composition, and standard music education. This finding reinforces research indicating that profound teaching techniques, when applied alongside creative tasks, enhance students' critical thinking and music analysis skills (J. C. W. Chen, 2024; Costes-Onishi & Kwek, 2023; S. Zhang, 2023). Key elements and concepts involve: Diagnostic Teaching: Identifying learning gaps without disciplining students is crucial for connecting feedback to a more profound musical comprehension. The Teacher's Supportive Role: Simply delivering instruction is insufficient; the manner in which the educator assists is crucial in deep learning environments, where research indicates that reflecting on their actions has a greater impact on learning than merely completing an assignment (Y. Liu et al., 2022; Qian, 2025; Sølvi & Glenna, 2022). Sequential Vocal Training: By advancing step-by-step from warm-ups to songs according to each student's needs, this method demonstrates how personalized instruction, supplemented by teacher support and regular assessments, enhances students' abilities. Psychological Readiness: Although proficiency in music and performance is vital, fostering students' confidence and preparedness for learning is essential to their development.

as musicians.

Implications for implementation, challenges, and next steps.

Essentially, these findings suggest a design approach: taking into account the context of real-world performance (such as starting a choir) will yield a predictable level of complexity. By taking this context into account, educators can better appreciate the importance of students' work, which in turn can enhance their motivation to learn. At the same time, deep learning methods help students ask relevant questions to understand and navigate these complexities. The research design, which did not involve a comparison group or control variables, requires caution in interpreting causal relationships. The authors propose conducting experiments, providing additional information on effect sizes and confidence levels, and verifying whether similar methods are effective in other areas of music.

This study emphasizes the importance of teacher preparation and classroom interactions, stating that successful teaching strategies and a commitment to student engagement are crucial for achieving positive outcomes (Y. Liu et al., 2024; Sularso et al., 2023; Thorgersen et al., 2015). By reflecting on their thoughts and experiences, teachers can improve their skills and recognize the positive impact they have on students. The authors suggest conducting experiments and collecting more data on effect sizes to test the effectiveness of these methods across various fields of music education. Ultimately, this study highlights that effective teaching methods and authentic connections with students are essential for creating a productive educational environment. The authors propose conducting experiments, providing additional information on effect sizes and confidence levels, and verifying whether similar methods are effective in other areas of music. Furthermore, this study discusses its implications for teacher training and the classroom environment, emphasizing that teachers' instructional techniques and their efforts to attend to students are key factors in achieving success.

The researchers suggest that to support the conclusions of this study, further experiments and additional data on effect sizes and confidence levels are needed, as well as testing the effectiveness of similar methods across various fields of music education.

4. CONCLUSION

Integrating deep pedagogical learning with project-based learning was found to improve musical intelligence in the choir program at SMA Negeri 1 Brebes. The experimental group achieved a higher posttest average (91.52 vs. 82.08; $p < .001$) and exhibited a greater N-Gain (78.17% vs. 61.42%). Qualitative data illuminates this pattern through four interconnected mechanisms: the improvement of vocal skills, the understanding of song structure, the reflective exploration of harmonic and emotional elements, and the purposeful collaboration in music. The main implication is not that finishing a project guarantees profound learning, but rather that a genuine music project can serve as a means for enhanced comprehension when students are consistently tasked with analyzing, justifying, revising, listening, and reflecting. Nevertheless, since the groups were non-random and varied in the intensity of their project involvement, additional studies with randomized controls and larger sample sizes are required to confirm these results and investigate broader musical contexts. In arts and culture education, assessment must take into account both the ultimate goals and the students' learning process, including musical reasoning, self-reflection, responses to feedback, and group-based reasoning. Curriculum developers and educators can adapt this syntax to other music initiatives while maintaining the distinction between pedagogical and AI-driven deep learning.

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