SOUTHEAST ASIAN LANGUAGE AND LITERATURE STUDIES (SALLS)

The Effectiveness of an Artificial Intelligence-Based Project Based Learning (PjBL) Model in Enhancing Students' Ability to Produce Digital Poetry-to-Music Adaptations, Integrated Across Subjects, For Eleventh-Grade Students

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ABSTRACT
The integration of generative artificial intelligence (AI) into poetry musicalization offers opportunities to combine literary interpretation, musical expression, and digital production. However, empirical evidence on integrating AI-generated musical accompaniment into Project-Based Learning (PjBL) for digital poetry-to-music production remains limited. This study aimed to examine the effectiveness of AI-supported PjBL using Suno AI in improving Grade XI students' digital poetry-to-music production skills through cross-curricular learning. A quantitative approach with a quasi-experimental nonequivalent control group design was employed, involving 70 students from two intact classes at SMA Negeri 1 Rengel, Indonesia. Data were collected through pretests and posttests using an analytic performance rubric and analyzed using descriptive statistics, Mann–Whitney U tests, Wilcoxon signed-rank tests, t-tests, and analysis of covariance (ANCOVA). The experimental group achieved a higher posttest mean score than the control group (82.57 versus 74.15), with a mean normalized gain of 0.38 compared with 0.10. The between-group posttest difference was statistically significant ($p < .001$), while ANCOVA indicated a strong association between instructional group and posttest performance after controlling for pretest scores (partial $\eta^2 = 0.832$). The largest between-group differences were observed in musical congruence with poetic meaning and cross-curricular integration. These findings suggest that AI-supported PjBL may facilitate the integration of literary, musical, and digital competencies in creative learning. Nevertheless, the involvement of only two intact classes at one school limits causal inference and generalizability, highlighting the need for further research across multiple educational contexts.

Keywords: artificial intelligence, digital poetry musicalization, interdisciplinary learning, project-based learning, suno A

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Introduction

Poetry-to-music adaptation at the senior high school level has traditionally emphasized expressive performance, instructional media, and guided practice. Pangalung and Purba (2023) examined mastery-learning strategies in extracurricular poetry musicalization, while Nasution et al. (2025) developed learning media to support poetry appreciation and production. Satwika et al. (2025) introduced digital modelling and expressive practice, whereas Zubair Baharuddin et al. (2025) emphasized mentoring and performance training. Although these studies contribute to poetry musicalization instruction, they primarily focus on performance development, learning resources, and guided practice rather than the systematic use of generative artificial intelligence (AI) to produce digital musical accompaniment through project-based learning.

A related gap exists in AI-supported language learning. Sumitro et al. (2025) examined the potential of generative AI to improve high school students' writing abilities, while Fitriani et al. (2023) emphasized needs analysis in developing contextual poetry-writing materials. These studies highlight the potential of technology to support creative language learning but do not specifically address the transformation of poetry into musical works. Meanwhile, research on AI-supported Project-Based Learning (PjBL) has examined digital literacy, collaboration, motivation, and learning outcomes in social studies (Ayu et al., 2026), local history (Kusmarni et al., 2025), academic writing (Mahmudah & Izzah, 2025), and language learning (Gracia & Tressyalina, 2026). Puspitasari et al. (2026) reported the potential of AI-supported PjBL to strengthen digital literacy, while Tendrita (2025) highlighted its contribution to collaboration and conceptual understanding. Sri Rahayu and Hartinah (2024) also examined PjBL in science education, and Alvionita Pratiwi and Adi Nugroho (2024) demonstrated the applicability of project-based approaches combined with differentiated instruction to creative writing. Furthermore, Walidaroyani and Pawestri (2025) examined the integration of ChatGPT into PjBL in sociology learning. Although these studies provide a foundation for integrating AI and project-based learning, their learning objectives and products differ from digital poetry musicalization, which requires students to interpret poetic meaning, translate it into musical characteristics, evaluate generated accompaniment, and produce an integrated digital work. Raya et al. (2023) also highlighted the contribution of Indonesian Language learning to communication skills and its potential for cross-curricular integration. However, the integration of Indonesian Language, Music, and Informatics through AI-supported PjBL for digital poetry musicalization remains insufficiently explored in the literature reviewed here.

This research gap is relevant to the instructional context at SMA Negeri 1 Rengel. Preliminary classroom observations indicated that some students experienced difficulties creating musical accompaniment independently, tended to imitate existing arrangements, and participated with limited confidence in developing original musical concepts. These observations also suggested challenges in integrating literary interpretation with digital production. Such local conditions provide a practical rationale for investigating an alternative instructional approach, although claims about their

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extent should be supported by classroom observation records and student performance assessments.

Generative AI may help address these challenges by expanding students' opportunities to explore and evaluate musical alternatives. Suno AI enables users to generate music from textual descriptions of musical styles and characteristics. In poetry musicalization, students can use this capability to explore accompaniment that reflects a poem's theme, imagery, atmosphere, and emotional progression. However, AI-generated outputs do not automatically constitute meaningful learning or original artistic expression. Students must interpret the poem, formulate and revise prompts, compare musical alternatives, and justify their final decisions. PjBL provides a suitable pedagogical framework for organizing these activities through project planning, implementation, collaboration, product development, presentation, and reflection. Within this framework, AI functions as a supporting tool, while students retain responsibility for literary interpretation and artistic decision-making.

The present study integrates AI-supported PjBL and Suno AI through a structured sequence of activities. Students first analyze a poem's theme, imagery, emotional tone, and intended message before developing a musical concept. They then generate instrumental accompaniment using prompts that describe the desired mood, tempo, instrumentation, and musical style. Students evaluate the generated alternatives, revise prompts when necessary, and select accompaniment that supports the poem's meaning and expressive delivery. For example, a prompt for a reflective poem could read: *"Create an instrumental accompaniment for a reflective Indonesian poem about longing, memory, and hope. Use a gentle acoustic guitar and soft piano, a slow tempo, a contemplative mood, and a gradual emotional build. Keep the arrangement suitable for spoken poetry recitation. No singing, no lyrics, and no spoken words."* This prompt serves as an illustrative starting point rather than a fixed instruction for every poem. Students adapt the descriptions to the poem they analyze and the artistic effect they intend to achieve. Finally, they integrate the selected accompaniment with poetry recitation or vocal interpretation, present their digital products, and reflect on their creative decisions. The project connects Indonesian Language competencies in literary interpretation and expression, Music competencies in musical elements and sound–meaning relationships, and Informatics competencies in digital production and responsible technology use.

The novelty of this study lies in the application and empirical evaluation of AI-supported PjBL using Suno AI to develop Grade XI students' digital poetry-to-music production skills through cross-curricular learning. Unlike previous approaches centered primarily on recitation, performance, or instructional media, this model emphasizes the complete creative process, from literary interpretation and prompt development to the evaluation of AI-generated accompaniment and production of a final digital work. Its significance lies in offering a structured approach to integrating literary literacy, musical expression, and digital skills without allowing AI to replace students' creative agency. This approach is relevant to the demands of digital-era education and the opportunities for contextual, project-based learning provided by Indonesia's

Merdeka Curriculum. Nevertheless, the effectiveness of the proposed approach requires empirical evaluation rather than assumption.

Therefore, this study aims to examine the effectiveness of an AI-supported PjBL model using Suno AI in improving Grade XI students' digital poetry-to-music production skills at SMA Negeri 1 Rengel. Specifically, it investigates differences in students' performance following AI-supported PjBL and conventional instruction, with attention to poetry interpretation, musical congruence with poetic meaning and mood, vocal quality and expression, digital production quality, and cross-curricular integration. By examining these outcomes, the study seeks to contribute empirical evidence and a replicable instructional framework for integrating generative AI into poetry musicalization.

Methods

This study employed a quantitative approach with a quasi-experimental design to examine the effect of an instructional intervention on students' digital poetry-to-music production skills (Creswell & Creswell, 2018). Specifically, a Nonequivalent Control Group Design was used, involving pretests and posttests for both the experimental and control groups. Since individual students could not be randomly assigned to different instructional conditions within the school setting, two intact classes were selected as the research groups (Cook & Campbell, 1979; Sugiyono, 2019). Class XI-E, consisting of 35 students, was randomly selected as the experimental class and received project-based learning supported by artificial intelligence (AI-supported PjBL), while Class XI-C, consisting of 35 students, served as the control class and received conventional instruction. Both groups completed a pretest before the intervention and a posttest afterward to measure changes in their digital poetry-to-music production skills.

The independent variable was the instructional model, comprising AI-supported PjBL in the experimental class and conventional instruction in the control class. The dependent variable was students' ability to produce digital adaptations of poetry into music through an integrated, cross-subject learning process. To reduce the influence of extraneous variables, both classes were taught by the same teacher and received the same learning materials, instructional duration, number of meetings, and access to digital devices. The two classes were also considered comparable in terms of class size and general academic characteristics. These measures were intended to improve the comparability of the groups and reduce potential confounding arising from differences in teaching personnel and instructional conditions.

Nevertheless, because the intervention was implemented in intact classes, class-level differences and other unmeasured contextual factors could still have influenced the outcomes. Although Class XI-E was randomly selected as the experimental class, this procedure should not be interpreted as individual-level random assignment or as evidence that the two groups were fully equivalent at baseline. Pretest scores were therefore used to examine initial differences in the outcome measure. A nonsignificant baseline difference, if observed, would indicate only that the analysis did not detect a statistically significant difference in pretest scores; it would not establish equivalence between the groups or eliminate potential confounding. Furthermore, because only one class represented each instructional condition, the effects of the instructional model could not be completely separated from class-specific effects. Accordingly, the findings should be interpreted cautiously as evidence of differences in student performance associated with the instructional intervention rather than definitive proof of causality.

The study population comprised students in Classes XI-E and XI-C at SMA Negeri 1 Rengel, with 35 students in each class. All 70 students participated in the study, forming the research sample. Purposive sampling was used to identify the two classes based on their similar class sizes and general academic characteristics. Class XI-E was then randomly selected as the experimental class, while Class XI-C served as the control class. Thus, class selection was purposive, whereas the selection of the experimental class from the two identified classes was random. This procedure should be distinguished from random assignment of individual students to experimental and control conditions. The research design is presented in the following table.

Table 1. Research Design: Nonequivalent Control Group Design

Group	Pretest	Intervention	Posttest
Experimental (XI-E, *n*=35)	O_1	X_1	O_2
Control XI-C, *n*=35	O_3	X_2	O_4

Source: Author (2026)

Notes:
O_1 = pretest measurement in the experimental group.
O_2 = posttest measurement in the experimental group.
O_3 = pretest measurement in the control group.
O_4 = posttest measurement in the control group.
X_1 = AI-supported Project-Based Learning (PjBL).
X_2 = conventional instruction (lectures, demonstrations, practice, and assignments without an AI-supported project).

The design was used to identify students' initial abilities in both groups, measure changes following the intervention, and analyze differences in improvement in digital poetry-to-music production between students receiving AI-supported PjBL and those receiving conventional instruction.

Research Setting and Period

The study was conducted at SMA Negeri 1 Rengel with Grade XI students studying poetry musicalization in Indonesian Language, integrated with Music and Informatics. The population consisted of Grade XI students at SMA Negeri 1 Rengel. Purposive sampling was used to select two classes with relatively equivalent academic characteristics based on their previous semester average scores. Class XI-E was designated as the experimental group and XI-C as the control group. The research was conducted in three stages: preparation, implementation, and completion. During preparation, the researcher developed teaching modules, student worksheets, assessment rubrics, and research instruments. Experts in language and literature, music, and instructional technology validated the instruments, which were then piloted. The researcher also coordinated with Indonesian Language, Arts, and Informatics teachers.

The implementation stage began with pretests for both classes. The experimental class then received six sessions of PjBL based on the George Lucas Educational Foundation (2005) syntax: starting with an essential question, designing the project, creating a schedule, monitoring the project, assessing the outcome, and evaluating the experience. Students used AI to support poem interpretation, concept development and musical arrangement, and digital-product editing. AI use was guided by ethical principles, with students remaining the primary creators of their work.

The control class received the same materials and learning objectives through lectures, demonstrations, practice, and assignments without an AI-supported project.

After the intervention, both classes completed a posttest. The final stage involved data collection, processing and analysis, hypothesis testing, and report preparation.

Data Collection Techniques and Instruments

To support assessment objectivity, additional data were collected using classroom implementation observation sheets and student-response questionnaires. The data were analyzed using descriptive and inferential statistics. Descriptive analysis summarized the mean, standard deviation, and minimum and maximum pretest and posttest scores. Before hypothesis testing, assumptions were examined using the Shapiro–Wilk normality test (Shapiro & Wilk, 1965) and Levene's test of variance homogeneity (Levene, 1960). If assumptions were met, between-group differences could be examined using an independent-samples t-test. Given the nonequivalent-group design, however, Analysis of Covariance (ANCOVA), with pretest scores as a covariate, was considered more appropriate (Field, 2018). If normality assumptions were not met, the Mann–Whitney U test was used for between-group comparisons (Mann & Whitney, 1947). Within-group pretest–posttest changes were analyzed using a paired-samples t-test or Wilcoxon signed-rank test (Wilcoxon, 1945), depending on whether parametric assumptions were met. Students' digital poetry-to-music production skills were assessed through performance tests at pretest and posttest. Students created digital adaptations of a designated poem, and each work was evaluated using a five-aspect analytic rubric: poem interpretation and understanding, music congruence with the poem's meaning and mood, vocal quality and expression, digital production quality, and cross-curricular integration. Each work was assessed by two raters to improve objectivity.

The intervention's effect was determined using Cohen's d based on Cohen's (1988) criteria. When ANCOVA was used, effect size was expressed as partial eta squared. Improvement from pretest to posttest was calculated using N-Gain (Hake, 1998): high when $g > 0.70$, moderate when $0.30 \leq g \leq 0.70$, and low when $g < 0.30$. All statistical analyses used a significance level of 0.05 and could be conducted using SPSS or JASP.

Discussion

1. Data Description

Data were collected from 35 control-class students (XI-C) and 35 experimental-class students (XI-E) who completed pretests and posttests on digital poetry musicalization (scale 0–100). Descriptive statistics are summarized in Table 1.

Table 2. Descriptive Statistics for Digital Poetry Musicalization Scores

Group	Stage	n	Mean	SD	Min	Max
Control	Pretest	35	71.42	1.53	70.6	74.2
Control	Posttest	35	74.15	2.21	70.6	77.0
Experimental	Pretest	35	71.94	1.76	70.6	74.2
Experimental	Posttest	35	82.57	1.66	80.0	84.0

Source: Author (2026)

The two groups had nearly equivalent initial abilities (the difference between pretest means was only 0.52 points). After the intervention, the experimental group's mean posttest score (82.57) exceeded that of the control group (74.15), a difference of 8.42 points.

Table 3. Mean Posttest Scores by Indicator

Indicator	Control	Experimental
Poem interpretation and understanding	82.37	86.03
Music congruence with poem meaning and mood	68.00	79.77
Vocal quality and expression	72.83	82.49
Digital production quality	75.43	82.57
Cross-curricular integration	72.14	82.00

Source: Author (2026)

The largest between-group differences occurred in music congruence with the poem's meaning (11.77 points) and cross-curricular integration (9.86 points). The smallest difference was in poem interpretation and understanding (3.66 points), an indicator on which both groups had relatively high scores from the pretest stage (80.00).

2. Preliminary Assumption Tests

Normality test (Shapiro–Wilk). All data distributions deviated significantly from normality (Table 3); therefore, nonparametric statistics were used for the primary hypothesis tests, with parametric statistics as a comparison.

Table 4. Shapiro–Wilk Normality Test Results

Data	*W*	*p*	Interpretation
Control pretest	0.521	<0.001	Non-normal
Control posttest	0.885	0.002	Non-normal
Experimental pretest	0.613	<0.001	Non-normal
Experimental posttest	0.749	<0.001	Non-normal

Source: Author (2026)

Variance homogeneity test (Levene). The group variances were homogeneous for both pretest ($F = 1.693$; $p = 0.198$) and posttest ($F = 3.183$; $p = 0.079$). Although the posttest p-value approached the significance threshold, the variances were considered homogeneous at the 0.05 level. Baseline equivalence test. The independent-samples t-test showed no significant between-group difference at pretest ($t = -1.301$; $p = 0.198$), confirmed by the Mann–Whitney *U* test ($U = 700$; $p = 0.198$). The groups therefore began with equivalent baseline abilities.

3. Hypothesis Testing

Between-group posttest comparison. The Mann–Whitney *U* test showed a significant difference between the experimental and control posttest scores ($U = 1225.0$; $p < 0.001$). All experimental posttest scores (80.0–84.0) were above the control scores (70.6–77.0), indicating complete separation between the distributions (rank-biserial correlation = 1.00). An independent-samples t-test produced a consistent result ($t = -18.001$; $df = 68$; $p < 0.001$).

Within-group improvement. The Wilcoxon signed-rank test showed significant improvement in both the control group ($W = 20.0$; $p < 0.001$) and the experimental group ($W = 0.0$; $p < 0.001$). Paired-samples t-tests yielded the same conclusion (control:

t = 8.310; experimental: *t* = 27.475; both *p* < 0.001), with a substantially greater improvement in the experimental class.

Thus, H_0 was rejected and H_1—that the AI-based PjBL class would demonstrate stronger digital poetry-to-music production skills than the conventional class—was accepted.

4. Effect Size and Improvement (N-Gain)

Table 5. Effect Size and N-Gain

Measure	Control	Experimental
Cohen's d (within-group, pre–post)	1.41	4.64
Cohen's d (posttest, experimental vs. control)	-	4.30
Mean N-Gain	0.10	0.38
N-Gain category	Low	Moderate

Source: Author (2026)

The between-group posttest Cohen's d of 4.30 was very large and exceeded Cohen's (1988) guidelines. The experimental class's mean N-Gain (0.38) was moderate and substantially higher than the control class's N-Gain (0.10), which remained low (Hake, 1998).

5. Analysis of Covariance (ANCOVA)

Table 6. ANCOVA Summary

Predictor	Coefficient	*SE*	*t*	*p*
Intercept	47.406	9.798	4.839	<0.001
Group (Experimental)	8.225	0.452	18.181	<0.001
Pretest (covariate)	0.375	0.137	2.732	0.008

Source: Author (2026)

The model explained 84.4% of the posttest variance (R^2 = 0.844). The effect of instructional group on posttest scores, after controlling for pretest, was very large (partial eta squared = 0.832). In this dataset, pretest was also a significant covariate (p = 0.008), indicating that initial ability contributed to posttest variation, although instructional group remained the dominant factor.

The findings suggest that AI-based Project-Based Learning (PjBL) was associated with better digital poetry-to-music production skills among Grade XI students than conventional instruction. This pattern was consistent across the t-test, nonparametric tests, and ANCOVA, providing converging statistical evidence of a posttest difference between the groups. However, consistency across statistical tests does not eliminate potential bias arising from the research design.

Baseline comparability and intervention effect. The baseline comparison yielded a non-significant difference between groups (*p* = .198). However, this result does not establish statistical equivalence or confirm that the groups had identical initial abilities. The observed posttest mean difference of 8.42 points indicates better performance in the intervention group, but this difference should be interpreted cautiously because the study used a nonequivalent control group design. ANCOVA further indicated that instructional group was strongly associated with posttest scores (partial η^2 = .832), while pretest scores also made a statistically significant contribution (*p* = .008). This finding suggests that initial performance remained relevant to students' posttest

outcomes, supporting the use of ANCOVA to adjust for measured baseline differences (Cook & Campbell, 1979; Field, 2018).

Nevertheless, adjustment for pretest scores cannot rule out other plausible confounding factors, such as differences in classroom composition, prior experience with digital tools, teacher–student interactions, or students' familiarity with music production. Moreover, because the study involved only two intact classes at a single school, class-level differences may be inseparable from the instructional condition. The findings should therefore be interpreted as evidence of an association between the instructional approach and students' posttest performance rather than definitive proof of a causal effect. Further research involving more classes across multiple schools, preferably with random assignment where feasible, is needed to strengthen causal inference and assess the generalizability of the findings.

Effectiveness across indicators. The most notable gains in the experimental class occurred in music congruence with poem meaning (from 62.97 to 79.77) and cross-curricular integration (from 71.86 to 82.00). By contrast, poem interpretation and understanding improved relatively little in both groups because baseline scores were already high (80.00), leaving less room for improvement. This pattern suggests that AI support within PjBL is particularly beneficial during creative synthesis across domains translating a poem's meaning into musical choices, arrangements, and digital production rather than textual comprehension, which depends more heavily on students' literary-reading competencies.

Improvement in the control group. The control class also showed statistically significant improvement (N-Gain = 0.10, low category), as expected from conventional instruction that provides content exposure and practice. However, the marked difference in N-Gain between groups (0.10 versus 0.38) indicates that an AI-integrated project structure adds substantial value beyond conventional face-to-face instruction alone.

Very large effect. Cohen's d of 4.30 and a rank-biserial correlation of 1.00 indicate a very strong practical effect, with no overlap between the posttest score ranges (control 70.6–77.0; experimental 80.0–84.0). The small within-group score variation (SD approximately 1.5–2.2) also contributes to the large reported effect size. Therefore, interpretation should consider the assessment rubric and the fact that the study was conducted at a single school.

Violation of the normality assumption. All pretest and posttest data were nonnormally distributed (Shapiro–Wilk, $p < 0.05$). Thus, using nonparametric tests (Mann–Whitney U and Wilcoxon signed-rank) as the primary analyses was appropriate (Mann & Whitney, 1947; Wilcoxon, 1945), and their results were consistent with the t-tests used for comparison.

Pedagogical implications. These findings support a shift in assessment from the final product alone toward assessment of an integrated, cross-curricular project process, consistent with Dewey's pragmatist view of learning through experience ("learning by doing"). In digital poetry musicalization PjBL, AI serves as scaffolding that helps students explore arrangement and digital-production options without replacing their literary interpretation or artistic creativity.

Limitations. This study was limited to two classes at one school; therefore, its findings should be tested in broader populations. The relatively narrow score ranges within each group also warrant attention because they contribute to the large reported effect size.

Conclusion

This study found that AI-based Project-Based Learning (PjBL) was associated with better digital poetry-to-music production skills among Grade XI students than conventional instruction. The experimental group achieved a higher posttest mean (82.57) than the control group (74.15), with a larger normalized gain (0.38 versus 0.10). ANCOVA also indicated a strong association between instructional group and posttest performance after adjusting for pretest scores (partial $\eta^2 = 0.832$). The greatest improvements were observed in musical congruence with poem meaning and cross-curricular integration, suggesting that AI-supported PjBL may help students combine literary interpretation, musical expression, and digital production in an integrated creative project.

The study contributes to interdisciplinary language learning by illustrating how AI tools can support students' creative production while retaining the importance of literary interpretation and artistic decision-making. However, because the quasi-experimental study involved only two intact classes at one school, the findings do not establish a definitive causal effect and may not generalize to other educational contexts. Further research involving more classes across multiple schools is needed to examine the robustness and transferability of these findings.

Declarations

Author Contribution

Conceptualization: S.P. and T.I.; Methodology: S.P. and T.I.; Software: S.P.; Validation: S.P. and T.I.; Formal analysis: S.P.; Investigation: S.P.; Data curation: S.P.; Writing – original draft: S.P.; Writing – review and editing: T.I.; Visualization: S.P.; Supervision: T.I.; Funding acquisition: Not applicable.

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Competing Interest

The authors have no competing interests, whether financial or non-financial, that are relevant to this work.

Generative AI and AI-assisted Technologies in the Manuscript Preparation Process

During the preparation of this manuscript, the authors used Chatgpt to improve the language clarity, readability, and overall organization of the text. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the published article.

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