

ARTICLE

## Enhancing Students' Writing Skills through Project-Based Learning with Digital Media Integration: An Experimental Study

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### ABSTRACT

This study introduces an innovative approach by integrating Project-Based Learning (PBL) with digital media to improve Indonesian university students' academic writing skills. Using a mixed-methods approach, the research involved 118 third-semester English students divided into an experimental group using the PBL model and a control group following traditional teaching methods. A quasi-experimental design was implemented, with pre-tests and post-tests assessing students' writing performance. Surveys and open-ended responses provided qualitative insights into students' perceptions of the intervention. The findings revealed a significant improvement in the writing skills of the experimental group, supported by statistical analysis that showed the significant improvement in the writing skills of the experimental group's post-test scores (mean difference of 10.305,  $p < 0.001$ ) compared to the control group (mean difference of 3.475,  $p < 0.001$ ). Students expressed positive perceptions of the PBL approach, appreciating its interactive and collaborative elements. Thus, the integration of digital media with PBL proved effective in enhancing students' writing abilities, fostering creativity, and promoting active learning. Overall, this study provides strong evidence for the benefits of integrating digital tools into project-based learning to enhance writing instruction and prepare students for the demands of the digital age.

**Keywords:** Project-Based Learning; Digital Media; Writing Skills; Innovative; ESL

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# 1. Introduction

In the era of globalization and digitalization, academic writing has become a highly demanding skill in higher education<sup>[1-4]</sup>. It is important not only for students' academic success but also for preparing them to face the challenges of an increasingly competitive job market<sup>[5, 6]</sup>. The development of digital media technology has opened new opportunities in learning methods, enabling the integration of innovative tools to enrich students' learning experiences<sup>[7-13]</sup>. However, there remains a significant gap between the conventional learning methods still widely applied in higher education and the current job market's demand for more advanced digital skills<sup>[5, 14, 15]</sup>.

Research across various universities in Indonesia has revealed that conventional teaching methods still dominate ESL writing classes<sup>[16-18]</sup>. This is characterized by a heavy reliance on textbooks and limited writing activities that are largely confined to the classroom, leading to minimal student interaction and collaboration. As a result, many students struggle to develop their writing skills fully, with their creativity and critical thinking often underdeveloped<sup>[17, 18]</sup>. The traditional teacher-centered approach, which emphasizes passive learning, has proven insufficient in helping students engage with the writing process actively. These challenges highlight the need for a more interactive and collaborative learning approach, such as Project-Based Learning (PBL), to foster creativity, enhance engagement, and ultimately improve ESL writing skills in Indonesia<sup>[19, 20]</sup>.

Project-Based Learning (PBL) with digital media offers an innovative method that integrates students' knowledge and skills through structured, outcome-oriented projects<sup>[21-23]</sup>. This approach encourages active learning, where students are not merely passive recipients of information but actively engage in the learning process through research, discussions, and reflection. The support of digital media in PBL, such as online learning platforms and collaborative tools, can enhance students' creativity and analytical abilities while enriching their learning experiences by providing access to a wide range of information and enabling remote collaboration<sup>[24-26]</sup>.

Project-Based Learning (PBL) has been widely recognized for enhancing deeper understanding, retention of knowledge, and critical thinking skills<sup>[25, 27-32]</sup>. Studies, such as those on Chinese undergraduates, highlight its ef-

fectiveness in improving writing<sup>[20, 33]</sup>. Similarly, PBL in language learning environments fosters real-world engagement and develops cognitive skills, as demonstrated in research involving Indonesian vocational students<sup>[34, 35]</sup>. The integration of digital tools within PBL plays a critical role by enabling dynamic collaboration and improving linguistic abilities, particularly through mobile-assisted models that build student confidence in communication<sup>[24, 36, 37]</sup>. Furthermore, digital platforms support the development of key 21st-century skills like digital literacy, teamwork, and self-directed learning<sup>[14, 38-40]</sup>. By encouraging ownership of learning and linking academic tasks to future career demands, PBL enhances intrinsic motivation and prepares students for the workforce<sup>[41, 42]</sup>.

Previous studies have explored project-based approaches to enhance collaboration, interdisciplinary learning, iterative learning, and authentic learning. Other research has examined the effectiveness of digital technology integration in PBL in online classes. Digital media usage in writing skills at vocational schools and the use of computer-based concept mapping in writing instruction have also been studied. However, no prior research has deeply integrated digital tools into the academic writing process in higher education. Furthermore, a more comprehensive evaluation is needed to assess the effectiveness of a learning model that combines digital media, particularly in enhancing students' academic writing skills.

This research aims to address the gap by developing and evaluating a new model of Project-Based Learning that integrates digital media to enhance students' academic writing skills. The study seeks to provide a comprehensive assessment of how digital tools can be effectively utilized within a PBL framework, offering practical insights for improving ESL writing instruction in higher education.

## 2. Materials and Methods

### 2.1. Research Design

This study employed a mixed-methods approach, integrating both quantitative and qualitative data collection and analysis to investigate the impact of incorporating digital media into project-based learning (PBL) on students' academic writing performance. The mixed-methods design was chosen to provide a comprehensive understanding of

how digital media use in PBL influences student outcomes, offering both numerical data and rich, descriptive insights. The quantitative component utilized a quasi-experimental design, while the qualitative component included open-ended questions to gather detailed reflections from students about their experiences with the learning model and its perceived impact on their learning outcomes.

## 2.2. Experimental Procedures

This study used a non-equivalent control group design which is both experiment and control groups took a similar pre-test and post-test. However, only the experimental group receives the PBL treatment while the control group taught using conventional method in writing class.

**Table 1** highlights the PBL model that is adapted from Stoller’s PBL model in writing<sup>[43]</sup>. It consists of three main stages: planning, implementation, and reporting. During the planning stage, students choose a project topic, engage in pre-communicative activities to analyze examples, ask essential questions to guide their focus, design a project plan, and create a timeline for milestones, integrating digital tools like Google Classroom. In the implementation stage, they move through prewriting activities such as outlining and mind-mapping, drafting their essays, revising based on peer feedback using evaluation rubrics, editing for language and mechanics, and publishing their final work through digital platforms like blogs or videos. Finally, in the reporting stage, students present their projects for assessment, reflect on their learning experience, and receive feedback from peers and lecture, fostering both critical evaluation and skill development.

**Table 1.** PBL model in writing class.

Main Stages	Activities
Planning	Choosing project topic Pre-communicative activities Asking essential questions Designing project plan Creating project timeline
Implementation	Prewriting (outlining, mind-mapping) Drafting Revising Editing Publishing
Reporting	Assessing the project results Reflection and Feedback

## 2.3. Sample and Data Collection

The population for this study consisted of third-semester English Language students from the Faculty of Teacher Training and Education at the University of Mataram, who are currently enrolled in an academic writing course. A total of 118 students participated in the study, selected using a cluster sampling method. Cluster sampling was chosen for its practicality, given the structured classroom settings, and to facilitate the administration of the intervention across multiple student groups. This sample size provides sufficient data to analyze the effects of integrating digital media in project-based learning on students’ creativity in academic writing.

Quantitative data in this study were collected through two primary instruments: pre-test and post-test assessments and a survey. The pre-test and post-test assessments involved students in both the experimental and control groups producing argumentative writing samples before and after the intervention. These writing samples were evaluated using an analytical rubric that assesses key components of writing such as introduction, thesis statement, development of main points, organization, mechanics, and conclusion. This allows for a measurable comparison of student improvement in argumentative writing and creativity as a result of the PBL model integrated with digital media. The survey, administered at the end of the intervention, asked students to rate various aspects of the learning process, such as classroom atmosphere, writing activities, teaching methods, and learning materials, using a Likert scale.

Qualitative data were collected through open-ended questions embedded within the survey. These questions invited students to elaborate on their perceptions and experiences with the PBL model, offering deeper insights into how the intervention impacted their creativity and learning process. Students were asked to explain the reasoning behind their survey responses and share their thoughts on the effectiveness of the teaching method.

## 2.4. Analyzing of Data

The quantitative data were analyzed using SPSS to determine the effectiveness of the Project-Based Learning (PBL) model integrated with digital media on students’ creativity and argumentative writing skills. A paired t-test was

used to compare the pre-test and post-test scores within each group, identifying significant improvements after the intervention. Additionally, an independent t-test compared the post-test scores between the experimental and control groups to evaluate the PBL model’s impact on students compared to traditional instruction. Statistical significance would be determined with a p-value of less than 0.05, and effect sizes would be calculated to understand the magnitude of the improvements.

The data also were collected using close and open-ended survey responses. These data offer deeper understanding into how the PBL model impacted students’ writing processes and engagement, complementing the quantitative findings and providing a well-rounded view of the intervention’s effects.

### 3. Results

This section focuses on the outcomes derived from the analysis of quantitative and qualitative data. The results are presented in tabular format, followed by explanations

and analyses. The exhibited data consists of two types: the student learning outcomes and the student perceptions.

#### 3.1. The Student Learning Outcomes

**Table 2** shows that the experimental group (N = 59) improved from a pre-test mean score of 62.71 to a post-test mean of 73.02, indicating a significant gain after the PBL intervention. The control group (N = 59) had a smaller increase, from a pre-test mean of 64.27 to a post-test mean of 67.75. The larger improvement in the experimental group suggests the effectiveness of integrating digital media with PBL in enhancing students’ writing skills.

**Table 3** shows the normality test results using both the Kolmogorov-Smirnov and Shapiro-Wilk tests that all the data sets (pre-test and post-test scores for both the experimental and control groups) are normally distributed. The significance values for all tests are above the 0.05 threshold (ranging from 0.200 to 0.268), indicating no significant deviation from normality. This suggests that the data is suitable for parametric statistical analysis.

**Table 2.** Descriptive statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-test Experiment	59	45	83	62.71	9.101
Post-test Experiment	59	53	94	73.02	9.306
Pre-test Control	59	38	89	64.27	9.459
Post-test Control	59	41	92	67.75	9.611
Valid N (listwise)	59				

Std. Deviation refers to Standard Deviation.

**Table 3.** Tests of normality.

Class	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test Experiment (PBL)	0.047	59	0.200*	0.989	59	0.888
Post-test Experiment (PBL)	0.073	59	0.200*	0.982	59	0.518
Pre-test Control (Conventional)	0.085	59	0.200*	0.985	59	0.664
Post-test Control (Conventional)	0.102	59	0.198	0.975	59	0.268

\*. This is a lower bound of the true significance.

<sup>a</sup>. Lilliefors Significance Correction.

**Table 4** shows the paired t-test results that indicate a statistically significant improvement in both the experimental and control groups. For the experimental group, the mean difference between pre-test and post-test scores is  $-10.305$ ,

with a t-value of  $-39.365$  ( $p < 0.001$ ), showing a substantial increase after the PBL intervention. In contrast, the control group shows a smaller mean difference of  $-3.475$ , with a t-value of  $-10.916$  ( $p < 0.001$ ). These findings suggest that

**Table 4.** Paired samples test.

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
					Lower	Upper				
Pair 1	Pre-test Experiment– Post-test Experiment	-10.305	2.011	0.262	-10.829	-9.781	-39.365	58	<0.001	<0.001
Pair 2	Pre-test Control– Post-test Control	-3.475	2.445	0.318	-4.112	-2.837	-10.916	58	<0.001	<0.001

Std. Deviation refers to Standard Deviation; Std. Error Mean refers to Standard Error of the Mean.

while both groups improved, the experimental group had a significantly greater gain, highlighting the effectiveness of the PBL model integrated with digital media in enhancing writing skills.

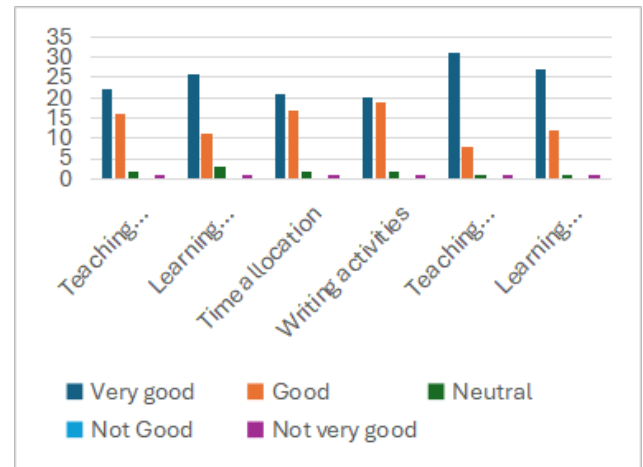
**Table 5** shows the results of Levene’s test that indicate that the assumption of homogeneity of variance is met for all measures of central tendency (mean, median, and trimmed mean) in the dataset. The significance values for all tests are above the 0.05 threshold (ranging from 0.589 to 0.612), suggesting there is no significant difference in variances between the experimental and control groups. This confirms that the variances are equal, allowing for the use of parametric tests for further analysis.

**Table 6** shows the independent t-test results that indicate a statistically significant difference between the experimental and control groups’ learning outcomes. Levene’s test indicates equal variances ( $F = 0.259$ ,  $p = 0.612$ ), allowing us to assume equal variances for the t-test analysis. The t-test reveals a mean difference of 5.271, with a t-value of 3.027 ( $p = 0.002$  for one-sided,  $p = 0.003$  for two-sided). The 95% confidence interval of the difference ranges from 1.822 to 8.721, confirming that the Project-Based Learning (PBL) approach had a significantly greater positive effect on students’ writing performance compared to the conventional method.

### 3.2. The Students’ Perception

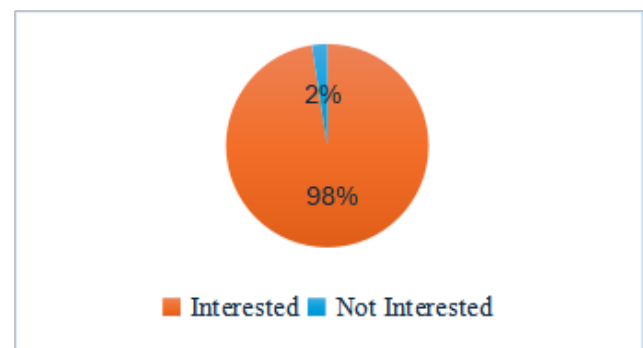
**Figure 1** presents student perceptions of various aspects of the Project-Based Learning (PBL) model, including teaching procedure, learning atmosphere, time allocation, writing activities, teaching methods, and learning materials. Overall, the majority of students rated the aspects as “Very Good” or “Good,” with teaching methods and learning atmosphere receiving the highest ratings in the “Very Good” category. A few students provided neutral or negative feedback, particularly in the categories of time allocation and learning materials. The results indicate that students gener-

ally had a positive perception of the PBL approach, finding it effective and engaging across multiple dimensions of the learning experience.



**Figure 1.** The student perception of various aspects of PBL.

**Figure 2** shows a strong positive interest in future participation, with 40 respondents indicating they are interested compared to only 1 respondent who is not interested. This suggests a high level of enthusiasm or satisfaction among participants, indicating that the majority are likely to engage in future activities or events. The overwhelming majority in favor of participation highlights a successful or appealing aspect of the current initiative, with only minimal disinterest observed.



**Figure 2.** The student interest in the future participation.

**Table 5.** Tests of homogeneity of variances.

		Levene Statistic	df1	df2	Sig.
Learning Outcome	Based on Mean	0.259	1	116	0.612
	Based on Median	0.294	1	116	0.589
	Based on Median and with adjusted df	0.294	1	110.171	0.589
	Based on trimmed mean	0.281	1	116	0.597

**Table 6.** Independent samples test.

		Levene's Test for Equality of Variances		t-Test for Equality of Means							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Learning Outcome	Equal variances assumed	0.259	0.612	3.027	116	0.002	0.003	5.271	1.742	1.822	8.721
	Equal variances not assumed			3.027	115.880	0.002	0.003	5.271	1.742	1.822	8.721

Std. Deviation refers to Standard Deviation; Std. Error Difference refers to Standard Error of the Difference.

In open-ended responses, **Student 1, Student 2, and Student 3** provided insights into their positive perceptions, citing enjoyment of the new, interactive teaching style, the refreshing learning environment, and the practical application of writing skills as key benefits. Some students highlighted the value of learning essay-writing in a structured yet flexible format, which helped them improve both creatively and academically. Others appreciated the unique teaching approach, noting that it made learning more enjoyable and accessible, fostering an interest in pursuing further development in writing.

**Student 1.** *Every time the lecturer teaches or delivers a lesson, we can understand it better because of the effective way the material is presented. The lecturer also helps us when we have difficulty understanding the material, even if it has already been explained.*

**Student 2.** *The lecturer is very responsive; I appreciate the explanations, examples, and guidance on how to improve my writing. I felt no pressure while completing my tasks, the learning environment was very comfortable, and the materials provided were well-structured. I can see my progress and now have a clearer understanding of what I need to do to improve my writing in the future.*

**Students 3.** *In my opinion, this is the kind of teaching approach that should be adopted by lecturers, by applying a student-centered approach. This way, the class can be more family-friendly, enjoyable, and less intimidating for students.*

Overall, these findings underscore the favorable impact of the PBL model with digital media on students' learning experiences, suggesting that it not only improves academic skills but also promotes a positive and motivating educational environment. The consistently positive feedback indicates that students were engaged, found the activities meaningful, and felt encouraged to continue using similar learning models in the future.

## 4. Discussion

The findings of this study demonstrate the significant impact of integrating Project-Based Learning (PBL) with digital media tools on enhancing students' academic writing skills in higher education, specifically within the context of Indonesian universities. The quantitative results, supported by pre-test and post-test comparisons, clearly indicate that the experimental group, which received the PBL intervention, showed a markedly greater improvement in writing performance compared to the control group. This aligns with the research objective of evaluating the effectiveness of a PBL model integrated with digital media, addressing the gap identified in the literature regarding the need for innovative, student-centered teaching approaches in ESL writing classrooms<sup>[19, 20, 44-47]</sup>.

The significant increase in the experimental group's post-test scores (mean difference of 10.305,  $p < 0.001$ ) compared to the control group (mean difference of 3.475,  $p < 0.001$ ) suggests that the PBL model was highly effective in

fostering students' creativity, critical thinking, and overall writing skills<sup>[25, 27, 29, 30, 48, 49]</sup>. This is consistent with previous studies highlighting the benefits of PBL in improving language learning outcomes by providing authentic, real-world tasks that enhance student engagement and active learning<sup>[50-54]</sup>. The integration of digital media further amplified these benefits, as it allowed for dynamic collaboration, access to a wide range of resources, and the development of essential 21st-century skills like digital literacy<sup>[25, 55, 56]</sup>. These findings suggest that the digital integration within the PBL framework not only enhanced students' writing abilities but also provided a more engaging and supportive learning environment, as evidenced by the overwhelmingly positive student feedback in the survey and open-ended responses.

The qualitative data corroborate the quantitative results, offering deeper insights into how the PBL model impacted students' learning experiences. The students highlighted the interactive and collaborative nature of the PBL activities, which made the learning process more enjoyable and less intimidating. This aligns with constructivist learning theories, which emphasize the importance of active participation and learner autonomy in building knowledge and skills<sup>[57, 58]</sup>. The positive perceptions reported by the students regarding teaching methods, learning atmosphere, and writing activities suggest that the PBL model effectively addressed the limitations of conventional, teacher-centered approaches in ESL writing classes, fostering a more student-centered and engaging learning environment.

Despite these positive outcomes, some of them expressed concerns about time allocation and the adequacy of learning materials, indicating areas for potential improvement in the implementation of PBL. Future research could explore strategies for optimizing time management within PBL projects and enhancing the quality and accessibility of digital learning resources to better support students' needs. Additionally, while the current study focused on argumentative writing skills, future studies could examine the effectiveness of the PBL model in other genres of writing, such as narrative or expository texts, to gain a broader understanding of its impact on different aspects of academic writing.

In terms of practical implications, the findings of this study suggest that integrating digital media within a PBL framework can be a highly effective approach to improving writing instruction in ESL contexts. Educators are encour-

aged to adopt similar models that emphasize project-based, collaborative tasks supported by digital tools, as this approach not only enhances writing skills but also helps students develop essential competencies for the modern workforce, such as teamwork, problem-solving, and digital literacy<sup>[24-26]</sup>. Given the positive student perceptions and significant improvements observed in this study, it is clear that PBL, combined with digital media, holds great promise for transforming ESL writing instruction and fostering a more engaging, skill-focused educational experience.

This study contributes to the existing body of literature by providing empirical evidence on the effectiveness of a PBL model integrated with digital media in improving students' academic writing skills in higher education. The significant gains observed in the experimental group underscore the value of incorporating innovative, student-centered teaching methods that leverage digital technologies. However, further research is needed to refine and adapt the model to different educational contexts and to explore its long-term impact on student writing performance and skill development.

## 5. Conclusions

This study demonstrated that integrating digital media with Project-Based Learning (PBL) significantly enhances students' academic writing skills in ESL contexts. The experimental group showed notable improvements in writing performance, supported by positive student feedback, indicating that the PBL model effectively fosters creativity, engagement, and collaboration. These findings highlight the potential of digital PBL as an innovative approach that addresses the limitations of traditional teaching methods, aligning better with modern educational needs.

While the results are promising, challenges related to time management, material adequacy, and the relatively small sample size suggest areas for further refinement. Future research could address these limitations by optimizing the implementation of the model, involving larger and more diverse participant groups, and exploring its effectiveness across different writing tasks and educational settings. Overall, this study provides valuable insights into the potential of integrating digital tools into project-based learning to enhance writing instruction and prepare students for the de-

mands of the digital age.

## Author Contributions

Conceptualization, I. and M.F.B.; methodology, M.; software, I.; validation, I. and M.F.B.; formal analysis, M.; investigation, H.I.; resources, I.; data curation, M.F.B.; writing—original draft preparation, I.; writing—review and editing, M. and M.F.B.; visualization, H.I.; supervision, I.; project administration, M.F.B.; funding acquisition, I.

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Not applicable.

## Informed Consent Statement

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## Data Availability Statement

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## Conflicts of Interest

The authors declare no conflict of interest.

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