



Bringing Students' Arguments to Life: Testing the Effectiveness of Local Context-based E-Modules through a Project-Based Learning Approach

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ABSTRACT

This study aims to test the effectiveness of e-modules for writing argumentative essays based on local contexts that are integrated with Project-Based Learning (PjBL). The method used was a quasi-experiment with a non-equivalent control group design. The research sample included class XI.6 as the experimental class and class XI.7 as the control class. The experimental group learned using e-modules at each stage of PjBL, while the control group obtained conventional learning. The results showed that the learning outcomes of the experimental group were significantly higher. Thus, so that e-module-based learning with local context and PjBL is declared effective for argumentative essay writing skills.

INTRODUCTION

Academic writing ability has become a key indicator of high-level literacy skills in secondary education (Lötscher et al., 2025; Prayogi et al., 2022; Sehlström et al., 2022). Argumentative essays are seen as one of the most complex writing genres because they demand skills in formulating accurate and accountable theses (Lötscher et al., 2025), constructing logically structured arguments (Prayogi et al., 2022), integrating absolute and credible supporting data or evidence (Wang & Newell, 2025), and applying the rules and conventions of academic language appropriately and carefully (Akib et al., 2025; Mallahi, 2024; Olson et al., 2023). However, various empirical studies have consistently revealed that high school students still have difficulty meeting these demands (Anito et al., 2025; Rahman et al., 2024; Zhang et al., 2025; Steiss et al., 2024). Frequently encountered obstacles include the inability to formulate arguments clearly (Taye & Mengesha, 2024), using intersentence and interparagraph cohesion (Lötscher et al., 2025; Sehlström et al., 2022), limited ability to present evidence critically, as well as the tendency to repeat information rather than develop thesis statements argumentatively (Rahman et al., 2024).

This condition is further exacerbated by the use of conventional teaching materials that are not fully responsive to students' learning needs, are less oriented to the real context (Secaresmi et al., 2024), and have not been able to encourage students' active involvement in the writing process (Al-Mubireek & Arruri, 2025). Along with the development of educational technology, e-modules are seen as able to provide a writing learning experience that is more interactive (Pelenkahu et al., 2024), flexible (Altakhaineh et al., 2024), and student-centered (Direkçi et al., 2022). However, the effectiveness of e-modules in learning to write, especially argumentative essays, is still limited to being studied in depth (Noroozi et al., 2023). In addition, many previous studies have only highlighted the use of e-modules in general without integrating them with a systematic and real-activity pedagogical approach that encourages collaboration (Kleemola et al., 2022; Yasuda, 2023) as well as critical thinking skills (Direkçi et al., 2022; Pelenkahu et al., 2024; Altakhaineh et al., 2024). Therefore, learning innovations are needed that not only utilize digital technology, but also ensure active and contextual involvement of students in the writing process.

The Project-Based Learning (PjBL) approach is able to answer these needs because it provides space for students to work on writing projects that are continuous, problem-solving-based, and close to real life (Garim et al., 2023; Zaki et al., 2024; Wang, 2022). The integration of PjBL with academic writing e-modules based on local contexts provides its own uniqueness (Nur et al., 2024; Ekawati & Jannah, 2025), because students are directed to construct arguments based on the social and cultural phenomena around them. This strategy not only increases the relevance of learning (Riwayatiningsih et al., 2025), but also fosters critical sensitivity to local issues as the foundation of scientific thinking (Andargie et al., 2025).

Although various learning innovations that utilize technology and local contexts are increasingly developed, research gaps are still evident, especially regarding the effectiveness of e-modules that integrate local contexts and Project-

Based Learning (PjBL) approaches in significantly improving argumentative essay writing skills. Previous research has generally not placed local context as the main knowledge foundation for students in constructing arguments (Garim et al., 2023; Andargie et al., 2025), and it is still rare to test the effectiveness of these e-modules through experimental designs that compare learning outcomes (Zhang et al., 2023; Pitorini et al., 2024) between the control class and the experimental class. In addition, research examining in depth how collaboration between PjBL approaches and local context-based digital materials can help students develop evidence-based arguments derived from their own social experiences is also very limited. This gap emphasizes the importance of research that systematically tests the effectiveness of academic writing e-modules of argumentative essays based on local context through the PjBL approach, so as to be able to make a stronger empirical contribution to the development of theory and practice of writing learning in the digital era.

This study aims to test the effectiveness of *e-modules for* writing argumentative essays based on local contexts through the PjBL approach to the writing ability of high school students. His contributions are both theoretical and practical. In terms of scientific development, this research offers an integrated learning model that combines digital technology, local contexts, and project-based learning (a combination that is still rarely studied in academic literacy). Practically, this study provides an e-module implementation framework that can be adopted by schools to improve the quality of academic writing learning in the digital era. Thus, the results of this research are expected to enrich the treasure of knowledge and present innovative solutions for teaching writing at the secondary education level.

LITERATURE REVIEW

Academic Writing

Academic writing is a cognitive and linguistic activity that requires critical reasoning skills, systematic organization of ideas, the use of a variety of formal languages, and the use of data or empirical references that can be accounted for (Anaktototy et al., 2023; Li, 2024; Pelenkahu et al., 2024). In writing an argumentative essay, the process includes several main components, namely the formulation of a clear thesis, the preparation of logical arguments, the selection and use of relevant supporting evidence, and the drawing of conclusions that are critical and reflective (Wang & Xie, 2022; Li, 2024). Theoretical studies of academic writing affirm that these competencies can be developed through structured learning, continuous practice, the application of appropriate writing strategies, and the creation of a learning environment that encourages the exploration and elaboration of ideas in depth (Akib et al., 2025; Wang & Newell, 2025; Mallahi, 2024; Olson et al., 2023).

A number of previous studies indicate that the use of digital-based learning media has the potential to improve students' academic writing competence because it is able to provide scaffolding (Ariani et al., 2024; Meletiadou, 2022; Rahmanova et al., 2024; Mulhim & Ismaeel, 2024), examples of representative writing models (Sundari & Febrianti, 2023), and interactive exercises that support

the mastery of writing skills (Alshammary & Alhalafawy, 2023; Shahzad et al., 2024). However, some research findings also confirm that significant improvements can only be achieved if the digital media is designed contextually and is able to facilitate the active involvement of students in every stage of the writing process (Şenel, 2025; Mahapatra, 2024; Zenouzagh et al., 2023).

Local Context in Learning

Local context-based learning is based on the understanding that knowledge development is more meaningful when it is associated with a socio-cultural environment that is close to the lives of students (Pamungkas et al., 2023; Saija et al., 2022; Nurhayati 2022). Local contexts serve as cognitive and emotional stimuli that encourage student engagement through topics relevant to their life experiences. The integration of local issues in literacy learning has been shown to improve motivation, reflective ability, and argumentation quality because students interact with phenomena they recognize and are close to everyday reality (Muliadi et al., 2025; Noortyani et al., 2022).

Previous research has shown that the integration of local contexts makes a positive contribution to improving writing skills, especially in the aspects of analytical reasoning, the accuracy and relevance of arguments, and the depth of elaboration of ideas (Wale & Kassahun, 2024; McCarthy et al., 2022; Pu et al., 2022; Enright et al., 2023; Yang, 2022). Other findings reveal that the use of local contexts is also able to strengthen coherence and increase the originality of ideas put forward by students in writing argumentative essays (Prayogi et al., 2022; Wang et al., 2022).

Project-Based Learning (PjBL)

Project-Based Learning (PjBL) is a constructivism-based learning approach that places students as the main managers of the learning process through the implementation of authentic projects oriented towards solving real problems (Kurniawan et al., 2024; Loyens et al., 2023). In the PjBL stage, students are involved in a series of activities such as formulating research questions, collecting and analyzing information, analyzing data, developing solutions or arguments, and producing an authentic final product (Song et al., 2024; Rehman et al., 2023). In the context of learning to write argumentative essays, PjBL supports the development of students' critical thinking stages (Dias-Oliveira et al., 2024) (starting from identifying issues, formulating arguments, searching for and selecting supporting evidence, to preparing logical and structured conclusions).

The results of empirical research show that the application of Project-Based Learning (PjBL) is able to improve students' writing performance because it provides space for independent exploration, collaborative work, and a deeper reflection process in each learning stage (Andargie et al., 2025; Chao et al., 2025; Widiastuti et al., 2024). However, the literature also confirms that the effectiveness of PjBL is greatly influenced by the availability of adequate digital learning media and implementation guidelines that are designed in a structured manner (Lu et al., 2025; Rochmahwati et al., 2024).

Integration of E-Module, Local Context and PjBL

The integration of the three main components (e-module, local context, and PjBL) is seen as able to provide a more comprehensive academic literacy learning experience. E-modules play a role in providing a systematic learning structure and flexible learning access (Amril & Thahar, 2022); the local context guarantees the relevance of the material through its relevance to the socio-cultural reality of the student (Al-Abdullatif & Gameil, 2024); while PjBL optimizes the inquiry process and argumentation development through authentic project activities (Indrawati et al., 2022). Conceptually, the synergy of the three is believed to provide a significant improvement in the quality of student writing.

Findings from a number of previous studies show that learning interventions that combine digital technology with a project-based approach result in higher quality improvements in writing than conventional learning (Afifah & Sukasih, 2025; Erni, 2023; Rika et al., 2024). However, studies that specifically integrate PjBL with local context-based e-modules are still relatively limited, so further research is needed to fill this gap.

H1: There is a difference in the ability to write argumentative essays using local context-based e-modules through the PjBL approach

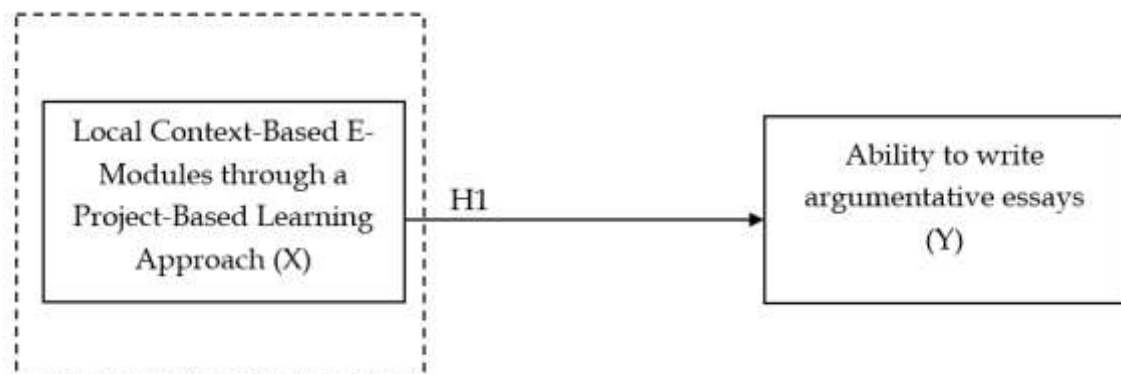


Figure 1. Conceptual Framework of Local Context-Based PjBL E-Module for Argumentative Essay Writing.

METHODOLOGY

This study uses a quasi-experiment design of the non-equivalent control group type (Stratton, 2019; Hastjarjo, 2019; Cham et al., 2024) to test the effectiveness of e-modules for writing argumentative essays based on local context through the Project-Based Learning (PjBL) approach at the high school level. This design was chosen because the study used natural grades without a randomization process, so comparisons were made between two groups with different treatments. The experimental group obtained learning by utilizing local context-based e-modules that were integrated in the PjBL stage, while the control group followed conventional learning through lecture and assignment methods without the use of e-modules or project-based activities. To measure the working hypothesis, both groups were given a pre-test at the beginning of learning and a post-test at the end of the treatment as a basis for comparing learning outcomes.

Table 1. Research Design

Class	Pretest	Treatment	Posttest
E	O ₁	X	O ₂
K	O ₃	-	O ₄

Description:

E = Experimental Class

K = Control Class

X = Experimental Class Treatment

O₁ = Pretest Kelas Eksperimen

O₂ = Posttest Experimental Class

O₃ = Control Class Pretest

O₄ = Control Class Posttest

The study population included two classes, namely class XI.6 which was designated as the experimental class and class XI.7 as the control class, with a total of 36 students each in the school where the research was conducted. The sample was determined through purposive sampling techniques by considering the equality of academic characteristics, learning readiness, and curriculum so that the comparison between the experimental group and the control group took place objectively and proportionally. The research instrument is in the form of an argumentative essay writing test which is assessed using standard rubrics including the formulation of an argumentative thesis, the coherence of the argument flow, the relevance of supporting evidence, and the accuracy of academic language style.

The data was analyzed inferentially by starting with a normality test to ensure the fulfillment of the basic assumptions of parametric statistics. The improvement in writing ability in each group was analyzed using the paired samples t-test, while the difference in learning effectiveness between the experimental and control groups was tested through independent samples t-test. In addition, the N-Gain calculation is used to determine the level of effectiveness of the intervention based on the increase in scores from pre-test to post-test. The effectiveness of treatment was determined through a statistical significance value with a criterion of $p < 0.05$.

RESEARCH RESULTS

Normality Test Results

Table 2. Normality Test Results

Value Type	Class	Kolmogorov-Smirnov Sig.	Shapiro-Wilk Sig.	Information
Pretest	Experiment	0,200	0,275	Normal
Pretest	Control	0,200	0,293	Normal
Post-test	Experiment	0,200	0,321	Normal

Post-test	Control	0,200	0,361	Normal
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The results of the normality test showed that the pretest values in both groups, both experimental and control, were normally distributed because the significance values in the Kolmogorov-Smirnov and Shapiro-Wilk tests were above 0.05. The same condition was also seen in the posttest score, where both the experimental and control groups obtained a significance value of > 0.05 , so that all posttest data were declared to be normally distributed. These findings confirm that the distribution of data in each group before and after treatment was in the normal category, so the study met the assumption of normality and could be continued by using paired sample t-Test analysis to test the effectiveness of the e-module of academic writing argumentative essays based on local context through the Project-Based Learning approach in high school.

Homogeneity Test Results

Table 3. Test Results Homogeneity

Value Type	Levene Statistic	Itself.	Information
Pretest (Experiment-Control)	0,527	0,469	Homogeneous
Post test (Experiment-Control)	1,037	0,312	Homogeneous

Based on the results of the variance homogeneity test using Levene's Test, a significance value of 0.469 was obtained in the pretest data and 0.312 in the posttest data, both greater than 0.05 so that the variance between the experimental and control groups was declared homogeneous. Thus, the requirements to proceed to the efficacy test stage are met because both groups have equal variance. This condition ensures that the increase in statistically analyzed learning outcomes is really influenced by the application of local context-based e-modules through the Project-Based Learning approach, not by differences in initial characteristics between groups.

Independent Sample t-Test Results

Tabel 4. Independent Sample t-Test

Value Type	Levene Sig.	Variant Results	t	df	Sig. (2-tailed)	Mean Difference	Information
Pretest	0,964	Equal variances assumed	0,025	70	0,980	0,028	No significant difference
Post-test	0,679	Equal variances assumed	9,928	70	0,000	12,694	Very significant differences

The results of the Independent Samples t-Test on the pretest value showed that the significance value of Levene was 0.964 (> 0.05), so the calculation used the assumption of equal variances assumed. A significance value (2-tailed) of 0.980 (> 0.05) confirms that there was no significant difference in initial ability (pretest) between the experimental class and the control class. Thus, both groups were in an equal initial condition before being given learning treatment.

In contrast to the pretest results, the posttest test showed a Levene value of 0.679 (> 0.05) which means that the variants of the two classes are homogeneous so that the analysis still uses equal variances assumed. A significance value (2-tailed) of 0.000 (< 0.05) indicates a very significant difference between the posttest scores of the experimental class and the control class. The mean difference of 12,694 points indicates the difference in learning outcomes in the experimental class compared to the control class after treatment.

These results strengthen the conclusion that the application of e-modules to write argumentative essays based on local contexts through the Project-Based Learning approach has a significant impact on the learning outcomes of writing argumentative essays. A very significant difference in posttest scores proves that e-modules based on local context through the PjBL approach are more effective than conventional teaching materials.

DISCUSSION

The results of the study show that the use of e-modules to write argumentative essays based on local contexts through the Project-Based Learning (PjBL) approach has proven to be effective, in line with the results of previous research (Garim et al., 2023; Stuart et al., 2025; Nur et al., 2024; Ekawati & Jannah, 2025; Zaki et al., 2024; Na et al., 2024). These findings can be seen from the significant difference in the quality of argumentative essay writing in experimental class students compared to control classes, which use conventional teaching materials. These differences can be seen in the aspects of thesis argument, clarity of paragraph structure, cohesion and coherence, relevance of supporting evidence, and the accuracy of academic language style. These findings show that the integration of local context-based e-modules not only provides digital materials, but also facilitates cognitive and affective engagement (Afifah & Sukasih, 2025; Erni, 2023; Rika et al., 2024) students more optimally in the academic writing process (Ariani et al., 2024; Meletiadou, 2022; Rahmanova et al., 2024; Mulhim & Ismaeel, 2024).

E-modules through the PjBL approach allow students to experience the writing process as a critical thinking and problem-solving activity (Song et al., 2024; Rehman et al., 2023), are not just task completions. Learning to write argumentative essays requires the ability to analyze issues, identify viewpoints, look for data validity, and formulate claims logically. The PjBL model supports this process through the stages of investigation, collaboration, resource exploration, drafting, revision, and presentation of project results. This activity gives students the opportunity to study independently, discuss, and test arguments repeatedly before producing the final text. This is in line with the view

that effective writing develops through experiential learning and continuous reflection (Andargie et al., 2025; Chao et al., 2025; Widiastuti et al., 2024).

The contribution of local context in the e-module is also an influential factor. The local materials and issues raised in the e-module have been proven to increase students' personal and emotional closeness to the topic of writing (Pamungkas et al., 2023; Saija et al., 2022). This emotional closeness encourages an intrinsic motivation to explore information, develop points of view, and craft more authentic and persuasive arguments. These findings confirm the theoretical argument that learning based on students' experiences and social sphere strengthens students' involvement, confidence, and critical thinking in writing (Wale & Kassahun, 2024; McCarthy et al., 2022; Pu et al., 2022; Enright et al., 2023; Yang, 2022). Thus, the local context is not only a thematic element, but a strategic pedagogical instrument in improving academic literacy.

The difference in results between the experimental and control classes also showed that writing learning was not enough to be delivered only through teacher explanations and short exercises, as was predominantly the case with conventional learning. Learning to write requires space for exploration, project experience, and constructive feedback. The PjBL approach through e-modules provides a learning environment rich in interactivity, flexibility, and independent engagement. Students can access the material at any time, work on projects in stages, utilize multimedia resources, and obtain systematic direction regarding writing steps. This allows for a higher improvement of writing skills compared to conventional learning that focuses on lectures and assignments without process assistance.

The results of this study also strengthen previous findings (Amril & Thahar, 2022; Al-Abdullatif & Gameil, 2024; Afifah & Sukasih, 2025; Erni, 2023; Rika et al., 2024) that the integration of learning technology and the PjBL approach can show differences in writing competence because it is oriented towards authentic activities and real problem-solving. This research provides an important update by showing that there are significant learning outcomes when technology-based learning is contextualized into culture, social environment, and local reality. Thus, the results of this study provide a theoretical contribution that the effectiveness of e-modules does not only depend on learning media, but also on the alignment between the PjBL approach and the cultural context.

Overall, the findings of this study confirm that e-modules writing argumentative essays based on local contexts through the Project-Based Learning approach are feasible as an alternative to writing learning in high school. This approach not only shows differences in learning outcomes, but also builds reflective mindsets, critical thinking skills, and student learning independence. Thus, learning designs like this can be recommended to be applied more widely to academic literacy learning and 21st century skill development.

CONCLUSIONS AND RECOMMENDATIONS

This study shows that the application of e-modules to write argumentative essays based on local contexts through the Project-Based Learning (PjBL) approach has proven to be effective in having a positive impact on the achievement of students' writing skills. This can be seen in the aspects of thesis argument

formulation, paragraph coherence, relevance of supporting data, and the use of academic language. Active involvement in writing projects and the proximity of the theme to the student's local environment have been proven to encourage motivation, critical thinking, and the quality of writing results more optimally than conventional learning.

Based on the results of the study, Indonesian teachers are recommended to integrate local context-based e-modules with the PjBL model as a writing learning strategy to strengthen students' writing skills and active engagement. The school is expected to provide facility support and training for the implementation of innovative digital learning. Developers of teaching materials are advised to develop e-modules that combine local content, project activities, and formative feedback. Further research can test the application of local context-based e-modules to other types of academic literacy skills to broaden understanding of the effectiveness of this approach.

FURTHER STUDY

This research has several limitations that need to be considered. The implementation of learning using e-modules based on local contexts through Project-Based Learning is carried out in a relatively short time so that the development of students' writing skills cannot be observed in the long term. In addition, the research only focused on argumentative essay writing skills and was conducted in one school, so the findings could not be generalized to various forms of academic literacy and different educational environments.

Based on these limitations, further research is recommended to expand the scope of material on other types of academic writing and involve schools with more diverse student backgrounds. Further research is also recommended to examine the long-term impact of e-module use, including its impact on the development of critical thinking, learning independence, and student learning experience in the context of digital learning.

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