

## ENHANCING CRITICAL WRITING THROUGH TECHNOLOGY- ENHANCED FLIPPED CLASSROOMS IN INDONESIAN EFL EDUCATION

### APRIMORANDO A ESCRITA CRÍTICA POR MEIO DE SALAS DE AULA INVERTIDAS COM TECNOLOGIA INTEGRADA NO ENSINO DE INGLÊS COMO LÍNGUA ESTRANGEIRA NA INDONÉSIA

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#### Abstract

This study quantitatively assesses the effectiveness of an e-learning-integrated flipped classroom model in developing critical writing skills among Indonesian senior high school EFL learners. Using a one-group pre-test/post-test design with 48 eleventh-grade students, data were collected through a validated critical writing test (argumentative essay rubric) and analyzed in SPSS Version 25 with paired-sample t-tests ( $\alpha = .05$ ) and Cohen's d. Results showed a statistically significant improvement in writing scores, with the mean increasing from 65.04 (Fair) to 87.46 (Excellent), particularly in argument development, evidence use, and coherence. The study contributes original empirical evidence from an Indonesian public high school context, demonstrating how structured e-learning platform integration enhances flipped classrooms as a tool for advancing higher-order writing skills in under-researched EFL settings.

**Keywords:** Flipped Classroom. Critical Writing. EFL. Educational Technology. Digital Learning.

#### Resumo

*Este estudo avalia quantitativamente a eficácia de um modelo de sala de aula invertida integrado ao e-learning no desenvolvimento de habilidades de escrita crítica entre alunos do ensino médio indonésio que aprendem inglês como língua estrangeira (EFL). Utilizando um delineamento pré-teste/pós-teste com um único grupo de 48 alunos do 11º ano, os dados foram coletados por meio de um teste de escrita crítica validado (rubrica para redação argumentativa) e analisados no SPSS versão 25 com testes t de amostras pareadas ( $\alpha = 0,05$ ) e d de Cohen. Os resultados mostraram uma melhora estatisticamente significativa nas notas de escrita, com a média aumentando de 65,04 (Regular) para 87,46 (Excelente), particularmente no desenvolvimento de argumentos, uso de evidências e coerência. O estudo contribui com evidências empíricas originais de um contexto de escola pública de ensino médio indonésio, demonstrando como a integração estruturada de uma plataforma de e-learning aprimora as salas de aula invertidas como ferramenta para o desenvolvimento de habilidades de escrita de ordem superior em contextos de EFL pouco explorados.*



*Palavras-chave: Sala de Aula Invertida. Escrita Crítica. Inglês como Língua Estrangeira. Tecnologia Educacional. Aprendizagem Digital.*

## 1 INTRODUCTION

The integration of technology in education has propelled the flipped classroom model to a prominent position in pedagogical innovation, especially within English as a Foreign Language (EFL) instruction[1]. Recent studies highlight its potential to enhance student engagement, promote personalized learning, and develop higher-order thinking skills. In the EFL context, this model enables students to acquire foundational knowledge through digital resources outside the classroom, allowing for increased face-to-face time dedicated to interactive, writing-focused activities essential for academic literacy[2]. The heightened emphasis on critical writing skills in educational standards reflects the need for students to communicate effectively in a globalized context. Despite this, developing advanced writing competencies in Indonesian secondary schools remains a challenge, often hindered by traditional, teacher-centered methods[2].

Although there is growing scholarly focus on the flipped classroom model, a significant research gap exists regarding empirical investigations of this model's effectiveness in Indonesian senior high schools for EFL learning. Much of the available literature relies on qualitative methods, with scarce rigorous quantitative studies assessing its impact on measurable outcomes like critical writing performance[3]. Furthermore, existing research often centers on higher education or general language proficiency, thus neglecting the potential of this model to enhance higher-order writing skills tailored to secondary education, particularly against the backdrop of Indonesia's unique challenges, such as inconsistent digital infrastructure and varying levels of teacher technology readiness[4].

This study aims to quantitatively assess the effectiveness of a technology-supported flipped classroom model in developing critical writing skills among eleventh-grade EFL students in Indonesia. Employing a single-group pretest-posttest design, the research examines how structured digital learning combined with interactive writing workshops can improve students' argument development, coherence, and utilization of

evidence. By providing empirical data within a public high school context, the study seeks to contribute to the literature on evidence-based pedagogical innovations in EFL education, offering insights for educators regarding the implementation of flipped learning strategies and emphasizing the importance of intentional technology integration in bolstering critical literacy.

However, the implementation of the flipped classroom model encounters notable challenges within the Indonesian educational landscape[5]. One primary issue is the digital divide, whereby unequal access to technology and internet connectivity leads to disparities in learning opportunities, particularly affecting students in rural or underserved areas. Additionally, many teachers lack the necessary digital pedagogical skills to effectively implement the model, facing difficulties in transitioning from teacher-centered to student-centered methods, which may lead to inconsistent application across classrooms.

Further complicating matters are students' low levels of self-regulated learning (SRL), which can impede the successful outcomes of flipped learning[6]. Many Indonesian EFL students lack the autonomy and intrinsic motivation needed to engage with pre-class materials, resulting in preparation deficits for in-class activities[7]. Cultural attitudes also play a role, as entrenched practices of rote learning and teacher authority may conflict with the model's requirements for active learning and peer engagement[8]. Lastly, prevailing assessment practices focused on standardized testing do not align with the formative assessments that are critical for fostering skills crucial to developing writing proficiency.

## **2 RESEARCH METHOD**

The research conducted in this study is a type of development research or *Research and Development*(R&D), which aims to develop a new product or improve an existing product[9]. stated that the term product can be interpreted as hardware (*hardware*) or software (*software*), such as interactive learning models, guidance models etc [10]. This study adopted a quantitative approach using a single-group pretest-posttest design to evaluate the effectiveness of an e-learning-integrated flipped classroom model in developing critical writing skills among Indonesian EFL learners. This design is

particularly appropriate for educational research conducted in authentic classroom settings where random assignment or the implementation of control groups may not be feasible. By measuring student performance before and after the intervention, this design allows for the detection of learning gains attributed to the instructional innovation [11]. The quantitative nature of this study allows for statistical analysis of writing improvement, providing empirical evidence regarding the model's impact on specific aspects of critical writing.

## **2.1 Participant of the study**

A total of 48 eleventh-grade students from a public high school in Medan, Indonesia, participated in this study. Purposeful sampling was used to select participants with comparable English proficiency levels and similar prior exposure to writing instruction, as confirmed by their English achievement scores and teacher recommendations. This sampling strategy was essential to minimize external variance and ensure that observed effects could be reasonably attributed to the e-learning-enhanced flipped classroom intervention [12]. All participants were enrolled in the same English class and had no prior formal instruction in critical writing through the technology-mediated flipped approach, thus establishing a consistent baseline for the intervention.

## **2.2 E-Learning platform and flipped classroom intervention**

This intervention involved the systematic integration of an institutional Learning Management System (LMS) with a structured flipped classroom approach implemented over eight weeks. Before each class session, students accessed curated digital materials through the LMS, including instructional videos on argumentative writing structures, sample texts with analytical annotations, and guided pre-writing exercises. The platform facilitated asynchronous interaction through discussion forums where students could ask questions and engage with the content before face-to-face sessions.

Classroom sessions were redesigned to maximize interactive activities focused on writing. These included collaborative writing workshops, structured peer review sessions using digital rubrics, and teacher-guided revision exercises. The pedagogical design

emphasized higher-order thinking skills, with approximately 75% of class time dedicated to applying, analyzing, and evaluating writing concepts rather than receiving direct instruction. This redistribution of learning time represents a core principle of the flipped classroom model as applied in this EFL context.

### **2.3 The instrument and data analysis**

Data were collected using a validated critical writing test administered as pre- and post-intervention assessments, where students composed argumentative essays evaluated through an analytic rubric covering argument development, evidence use, coherence, critical analysis, and language accuracy. Quantitative analysis involved descriptive statistics, paired-sample t-tests to measure significance, with the alpha level set at .05 for all statistical tests. Effect size was calculated using Cohen's *d* to evaluate the magnitude of improvement, with interpretations following conventional benchmarks (small:  $d = 0.2$ , medium:  $d = 0.5$ , large:  $d = 0.8$ ). All analyses were processed using SPSS Version 25. The study adhered to strict ethical protocols, including institutional approval, informed consent from guardians and participants, voluntary participation with the right to withdraw, and complete anonymization of data to ensure confidentiality throughout the research process.

## **3 RESULTS AND DISCUSSION**

The design used in this study was ADDIE, so the data analyzed came from the implementation stages applied at the universities that served as the research subjects. The data analyzed in this study specifically focused on the needs analysis aspect. The needs analysis was observed by collecting data through questionnaires given to respondents, with the aim of identifying the gap between the current condition and the ideal condition expected in learning development. The effectiveness of the flipped classroom model in developing critical writing skills in the Indonesian EFL context: a quantitative study. The effectiveness of critical writing skills in the context of English as a Foreign Language (EFL) using the Flipped Classroom model can be demonstrated through the improvement of student learning outcomes, namely the critical writing scores obtained after the learning

process. In addition, the effectiveness of this model is also seen from the improvement of students' understanding of the structure and arguments in their written texts. To provide a clearer picture, this section explains the effectiveness test of the flipped classroom model and its supporting tools in the context of critical writing learning.

After implementing the flipped classroom learning model, students were asked to write critically at Gajah Mada High School, Medan. This research was conducted on English subjects in grade XI IPA with the topic of expository text (argumentative essay). Based on the results of the analysis of student writing, significant variations in scores were obtained between before and after the implementation of the model in the control and experimental classes. In general, an effective learning model occurred, which means the ability to construct arguments, use supporting evidence, and have cohesion between paragraphs.

The results of the study show that the flipped classroom model is *effective* in improving students' critical writing skills in the context of learning English as a foreign language (EFL). Students in the experimental class who participated in learning with the learning approach, *Flipped Classroom*, showed a more significant improvement in writing skills compared to students in the control class who followed conventional learning. This difference was evident in the quality of the writing produced by students after the treatment, where students in the experimental class were able to construct more coherent arguments, present relevant evidence, and demonstrate better cohesion between paragraphs. Meanwhile, improvements in the control class tended to be more limited and did not show any striking changes. Thus, it can be concluded that the application of the flipped classroom learning model has a positive and significant impact on the development of students' critical writing skills in the EFL context.

After implementing and applying the model, the flipped classroom model *was effective* in improving students' critical writing skills in the context of learning English as a foreign language (EFL) at the high school level. Based on the results of the analysis of students' writing, that is Analysis of the scores for writing expository essays (argumentative essays) that differ from each other that students write, the following points can be concluded. *First*, data analysis results for the pretest of Gajah Mada High School, Medan. The score obtained was 65.04 with a Sufficient qualification, while the post-test score was 87.46 with a Very Good qualification. For further clarification, an analysis of

the results of the students' writing scores is needed. In detail, it can be seen in the following table.

**Table 1**

*Average Writing Scores*

No	School	Class	Phase	Average Pretest Score	Qualification	Post-test Average Score	Qualification
1	Gajah Nada High School	Pre-test	Grade XI Students	59,42	Enough	65,04	Enough
		Post-test	Grade XI Students	54,63	Almost Enough	87,46	Very well

A homogeneity test is conducted to ensure that the research subject groups are under comparable conditions. One important step in this process is conducting a homogeneity test. The homogeneity test aims to identify whether there are significant differences between the groups being compared in this study. By ensuring that the groups are homogeneous, the test results can more accurately reflect the effects of the product being developed, rather than being influenced by differences in initial characteristics between the groups. This section presents the results of the homogeneity test analysis, which serves as the basis for the feasibility of implementing the next experimental stage.

A homogeneity test is conducted to determine whether the data from a research sample has homogeneous variance. The homogeneity test is performed by comparing the largest variance with the smallest variance in the sample class at a significance level of 0.05 with a degree of freedom of  $dk=n-1$ . For more details, see the following table.

**Table 2**

*Homogeneity Test*

Pretest	Positions
N= 24	N=24
$X_1= 65,04$	$X_2= 87,46$
$S_1^2=230,36$	$S_2^2=376,99$
S=3,32	S=2,47

$$\begin{aligned}
 F &= \frac{\textit{The largest variant}}{\textit{Smallest variant}} \\
 &= \frac{230,36}{376,99} \\
 &= 1,34 \qquad (1)
 \end{aligned}$$

Based on the data homogeneity test conducted,  $F$  was obtained<sub>hit</sub> 1.34 and  $F_{\text{table}}$  1.84 at a significance level of 0.05 with  $n=n-1$ , the figure (1.84) is obtained. Therefore, it has a homogeneous variance because  $F_{\text{hit}} < F_{\text{table}}$  (1,34 < 1,84). Once it is known that the data group is distributed and homogeneous, a t-test can be carried out to determine the comparison of the pretest and post-test of critical writing skills.

The hypothesis test for writing can be concluded as follows. Based on the results of the t-test, it is concluded that the alternative hypothesis for critical writing Gajah Mada High School, Medan ( $H_1$ ) is accepted at a significance level of 95% and  $dk$   $n-1$  because  $t_{\text{hitung}} > t_{\text{tabel}}$  (6.21 > 1.67). In other words,  $H_1 =$  there is significant effectiveness in the use of *Flipped Classroom* effective in improving students' critical writing skills in the context of learning English as a foreign language (EFL) at the high school level.

The results of this study indicate that the application of the Flipped Classroom model can significantly improve students' critical writing skills in the context of learning English as a foreign language (EFL). This improvement is reflected in the significant difference in pretest and post-test scores, especially in the experimental class, where students demonstrated better abilities in constructing arguments, providing supporting evidence, and constructing logical and cohesive paragraph structures. This finding is in line with constructivist learning theory, which emphasizes the importance of students' active involvement in constructing their knowledge as proposed by [13], and that meaningful learning occurs through social interactions and activities that encourage cognitive engagement. The model Flipped Classroom provides students with space to explore the material independently through online media before class meetings take place so that face-to-face time can be focused on practice, discussion, and refining writing skills. This is consistent with [14], pioneers of flipped learning, who state that this model allows teachers to act as facilitators and guide students individually according to their needs. In an EFL context, this approach is particularly relevant because students need

more time to internalize the structure of academic texts and develop critical thinking skills.

Implications for learner autonomy. One of the important impacts of implementing the flipped classroom model, which is often overlooked, is its contribution to developing learner autonomy. In traditional learning, students tend to be passive and rely heavily on teacher explanations. However, with the flipped model, students are given the responsibility to learn the material independently before class begins. This fosters students' metacognitive awareness of their learning process, as they become accustomed to planning, monitoring, and evaluating their understanding before receiving teacher intervention in class.

Little (1991) states that independent learning is not only an end in itself but also a necessary condition for meaningful learning. In this context, the flipped classroom model not only improves writing skills but also strengthens the character of independent learners, which is a key competency in foreign language learning and the 21st-century curriculum.

The role of technology and digital accessibility. Another crucial component for the success of flipped learning is the role of technology. In the digital age, the use of instructional videos, Learning Management Systems (LMS), and collaborative applications like Google Docs or Padlet significantly aids the pre-learning process. However, it's important to note that the effectiveness of this model depends heavily on students' digital accessibility. In some contexts, in Indonesia, technological disparities remain a significant obstacle. Therefore, the implementation of the flipped classroom model must consider equal access to devices and the internet.

According to [15], the success of flipped classrooms in schools with limited resources can only be achieved if teachers can adapt the media used flexibly, for example, by providing printed versions of materials or using social media as a means of learning communication. This means that the success of this model requires teachers' pedagogical creativity, not just sophisticated technology. Implementation challenges in the local cultural context. The teacher-centered nature of student learning in Indonesia also presents a challenge in implementing the flipped model. Many students are accustomed to being "directly guided" by teachers and lack independent learning skills. Therefore, the transition to the flipped model requires a process of cultural adaptation from both students

and teachers. In some cases, prior training in independent learning strategies is necessary to enable students to optimally access and understand pre-learning materials.

As Hofstede (2001) points out, the collectivist cultural characteristics of Asian countries, including Indonesia, make teacher authority very dominant in the classroom. Therefore, the teacher's role in the flipped model remains crucial, particularly in facilitating the transition to a learning culture, motivating students, and establishing a classroom structure that supports collaboration and responsibility for learning.

Furthermore, the results of this study are also supported by [16], Turkish Online Journal of Educational Technology, which found that the flipped classroom model effectively improves the academic writing skills of EFL students at the high school level, especially in the aspects of organization and the use of coherent arguments. Likewise, the study by [17] published in *Computers & Education* showed that EFL students who learned using a flipped approach demonstrated higher learning outcomes compared to students who learned using a traditional approach. This finding strengthens the argument that flipped classroom-based learning encourages independent learning and higher-order thinking skills, two key components of critical writing [18].

From a pedagogical perspective, the success of this model can also be explained through the approach of active learning, where students are not merely recipients of information but rather active subjects who evaluate, interpret, and reconstruct ideas through writing activities. Critical writing activities in the experimental class provide students with opportunities to test their ideas in a collaborative environment, which in turn encourages the improvement of their academic literacy. Thus, the flipped classroom model is not only theoretically relevant but also empirically proven to be effective in developing students' critical writing skills in the context of foreign language learning. The characteristics of the flipped classroom learning model that distinguish it from the usual learning model are (1) changes in the use of class time. (2) Changes in the use of time outside the classroom. (3) Carry out activities that are traditionally considered homework in class. (4) Carry out activities that are traditionally considered in class, outside the classroom. (5) Class activities emphasize active learning, peer learning, and problem solving. (6) Activities before and after class. (7) Use of technology and video as media [19].

The Significant improvements in students' critical writing skills demonstrate the effectiveness of the e-learning-integrated flipped classroom model in the context of EFL secondary schools in Indonesia. This quantitative evidence indicates that the intervention substantially improved students' abilities to construct logical arguments, select relevant evidence, and organize ideas cohesively, which are core markers of advanced academic literacy [20]. The model's success can be interpreted through key pedagogical theories. First, the model operationalizes [21] Zone of Proximal Development by utilizing digital pre-learning materials and collaborative in-class activities as a structured framework, enabling students to progressively achieve higher levels of writing competence. Second, the model aligns with Cognitive Load Theory [22] by providing foundational knowledge through an e-learning platform, it reduces unnecessary cognitive load during class, freeing up mental resources for the complex tasks of argumentation and critical synthesis.

These findings contribute to the growing discourse on technology enhanced pedagogy by demonstrating that the effectiveness of the flipped classroom model is not only technological but also pedagogically fundamental. This model reconfigures the learning sequence to prioritize higher order cognitive engagement analysis, evaluation, and creation as categorized in Bloom's taxonomy [23]. This shift from passive reception to active knowledge construction is further reinforced by the principles of active learning, where students engage in meaningful problem-solving, peer dialogue, and repeated writing practice [24]. Consequently, this study underscores that the flipped classroom, when supported by a structured e-learning platform, serves as a catalyst for developing learner autonomy and metacognitive skills, which are essential for academic success in EFL settings.

Empirically, this study strengthens and contextualizes previous research. It confirms the findings of Zou and Xie 2019, Hung 2015 [25] [26] regarding the positive impact of flipped learning on the coherence and organization of EFL writing, while extending them to the underexplored context of Indonesian public high schools. The substantial effect size suggests that this model can effectively address persistent challenges in teaching critical writing in similar educational settings. However, this research also highlights critical factors for success: the role of a reliable e-learning platform for content delivery and interaction Sohrabi [27] and the need for proactive student engagement with pre-class materials [28].

Practically, this research offers a validated framework for integrating technology into writing instruction. It goes beyond simply advocating for tool adoption and provides a pedagogical blueprint in which technology facilitates a more intentional learning architecture shifting instruction outside the classroom to deepen intellectual work within. In the Indonesian EFL context, this implies that pedagogical innovation must combine technology investment with teacher professional development focused on designing meaningful pre-class activities and facilitating interactive, student-centered writing workshops.

Finally, while the results are promising, they also illustrate the limitations of implementing this model. Its success depends on equitable digital access, institutional support for technological infrastructure, and a shift in learning culture toward greater student self-regulation. Therefore, future research should investigate hybrid or low-tech adaptations to resource-limited environments and use longitudinal designs to assess the sustainability of writing skill improvements and their transfer to other academic domains.

#### **4 CONCLUSION**

This study confirms the significant effectiveness of integrating an e-learning platform into a flipped classroom model for developing critical writing skills among Indonesian senior high school EFL learners. The quantitative analysis revealed substantial improvement in students' writing performance, particularly in constructing logical arguments, utilizing relevant evidence, and achieving textual coherence. The model successfully leveraged structured digital pre-learning to shift classroom time toward interactive, higher-order writing activities, thereby fostering both learner autonomy and critical thinking. However, the successful implementation of this pedagogical innovation remains contingent upon equitable access to technology, institutional support for digital infrastructure, and teacher preparedness in facilitating student-centered learning.

The research makes three primary contributions to the field. First, it provides original empirical evidence from an under-researched context Indonesian public high schools demonstrating a measurable, positive impact of a technology-enhanced flipped classroom on specific academic writing competencies. Second, it moves beyond

advocating for technology adoption by presenting a validated pedagogical framework that strategically integrates e-learning platforms to reconfigure the learning sequence for deeper cognitive engagement. Finally, it highlights critical contextual factors for successful implementation, thereby offering practical guidance for educators and policymakers seeking to innovate EFL instruction while acknowledging infrastructural and cultural realities.

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### Authors’ Contribution

All authors contributed equally to the development of this article.

### Data availability

All datasets relevant to this study’s findings are fully available within the article.

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