



Flipped Classroom and Digital Technology in EFL Reading: A Deep Learning Approach

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ABSTRACT

This study investigated the implementation of a flipped classroom integrated with digital technology and a deep learning approach to improve EFL students' reading comprehension at Universitas PGRI Ronggolawe Tuban. The study employed a pre-experimental quantitative design using a one-group pretest-posttest model. Eighteen fourth-semester students from the English Language Education Study Program, Faculty of Teacher Training and Education, participated in the study during the odd semester of the 2026/2027 academic year. The participants were selected through total sampling because only one class was involved. The instruments consisted of a reading comprehension test, pre-test, post-test, treatment materials, instructional videos, digital reading texts, YouTube-based learning activities, documentation of students' scores, and a questionnaire. The data were analyzed using SPSS through descriptive statistics, the Shapiro-Wilk normality test, and hypothesis testing. Since the comparison of pre-test and post-test scores was analyzed using the Wilcoxon Signed Ranks Test, the results showed that 6 students achieved higher post-test scores, 1 student obtained a lower post-test score, and 11 students had equal scores. The Wilcoxon test yielded $Z = -1.951$ with Asymp. Sig. (2-tailed) = .051. These findings indicate that students' reading comprehension showed positive directional improvement after the treatment, although the statistical result was slightly above the conventional significance level of .05. The questionnaire instrument demonstrated very high reliability, with Cronbach's Alpha = .988 for 29 items. The study suggests that flipped classroom learning supported by digital technology can create opportunities for more active and independent EFL reading learning, but stronger experimental designs and larger samples are recommended for future research.

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INTRODUCTION

Reading comprehension is one of the most essential language skills in English as a Foreign Language (EFL) learning because it enables learners to construct meaning from written texts, develop critical thinking, and acquire academic knowledge. At the university level, reading

proficiency is particularly important since students are expected to understand textbooks, research articles, and other academic resources written in English. However, many EFL learners still encounter difficulties in comprehending English texts due to limited vocabulary, inadequate reading strategies, low motivation, and insufficient exposure to authentic reading materials (Samiei & Ebadi, 2021). Therefore, this paper seeks to delve deeper into these challenges, providing a comprehensive exploration of the underlying issues and proposing potential solutions to enhance reading comprehension among EFL learners.

The flipped classroom has emerged as an alternative pedagogical model that shifts direct instruction or preliminary content exposure outside the classroom and uses classroom time for active learning, discussion, practice, and problem-solving. In this model, students can access learning materials before class through videos, digital texts, or other online resources, while face-to-face sessions are used to deepen comprehension and facilitate interaction. Recent literature defines the flipped classroom as a pedagogical method that employs asynchronous digital materials and practice tasks outside class, followed by active and group-based problem-solving activities in the classroom (Fisher et al., 2024). This model is increasingly relevant in technology-supported EFL learning because digital tools allow students to revisit materials, control their learning pace, and prepare more effectively before classroom engagement.

The rapid advancement of digital technology has significantly transformed teaching and learning practices in higher education, making it a central component of contemporary education. Technology-supported learning environments provide flexible access to instructional materials through online videos, digital reading texts, learning management systems, and interactive applications. These digital environments enable students to learn at their own pace, revisit instructional content whenever necessary, and develop greater autonomy in the learning process. Moreover, the integration of digital technologies supports student-centered learning by promoting active engagement, collaboration, and personalized learning experiences, thereby improving the overall quality of education (Fisher et al., 2024; Hava, 2024). Furthermore, as (Haleem et al., 2022) explain, these digital technologies support collaboration, increase engagement, and make learning more interactive. In language learning specifically, digital tools such as instructional videos, online texts, and YouTube-based materials help students access authentic or semi-authentic input and repeat learning activities beyond classroom boundaries.

The integration of flipped classrooms and digital technology is closely related to deep learning. Deep learning in education refers to learning that goes beyond memorization and encourages students to understand concepts, connect ideas, apply knowledge, analyze information, and reflect on learning processes. In EFL reading learning, a deep learning orientation encourages students to process texts meaningfully, identify main ideas, infer meaning, interpret information, and evaluate textual content. When students are exposed to reading materials before class and then engage in classroom activities that require analysis and discussion, the learning process becomes more student-centered and cognitively meaningful.

Recent studies in EFL contexts have demonstrated the potential of flipped learning to improve students' writing performance. A quasi-experimental study conducted with Indonesian

tertiary EFL students found that learners who experienced flipped learning showed greater improvement in opinion essay writing than those receiving conventional instruction, particularly in sentence structure and mechanics. The study also reported that students generally held positive perceptions of flipped learning, although these positive perceptions were not directly associated with improvements in writing achievement. Overall, the findings suggest that flipped learning provides meaningful opportunities to enhance writing performance while fostering positive learning experiences in EFL classrooms (Putri et al., 2024).

Despite the increasing attention to flipped classroom implementation, studies on flipped classroom integration with digital technology and deep learning in EFL reading comprehension remain important, especially in local university contexts. Therefore, this study was conducted to examine the implementation of a flipped classroom integrated with digital technology and a deep learning approach to improve students' reading comprehension at Universitas PGRI Ronggolawe Tuban. The research questions were: How does the implementation of flipped classroom integrated with digital technology and deep learning improve students' reading comprehension at Universitas PGRI Ronggolawe Tuban?; To what extent does students' reading comprehension improve after the implementation of flipped classroom integrated with digital technology and deep learning at Universitas PGRI Ronggolawe Tuban?

LITERATURE REVIEW

Flipped Classroom in EFL Learning

The flipped classroom reverses traditional instruction by moving initial content exposure outside the classroom and allocating classroom time for active learning. In traditional instruction, teachers usually explain concepts during class, while students complete exercises afterward. In flipped learning, students first access materials independently, often through digital media, and then use classroom sessions for discussion, clarification, practice, and application. This structure provides more opportunities for interaction and guided learning.

A recent systematic literature review on flipped classroom research in higher education emphasizes that this pedagogy effectively combines asynchronous pre-class learning materials with active, constructivist learning activities in the classroom, thereby facilitating self-regulated learning and higher-order thinking skills (Fisher et al., 2024). Although early flipped classroom studies were often limited by single-group designs and perception-based measures, the model has continued to develop as digital technology has become more accessible.

In EFL learning, flipped classrooms can be useful because students need repeated exposure to language input and opportunities to practice language use. Reading materials, vocabulary explanations, or comprehension strategies can be introduced before class, allowing classroom time to focus on interpretation, discussion, and comprehension tasks. For EFL students, this approach may reduce dependence on teacher explanation and encourage more autonomous learning habits.

Digital Technology and Reading Comprehension

Digital technology supports EFL reading learning by providing flexible access to reading texts, instructional videos, and online learning resources. Students can preview materials, replay

explanations, and revisit texts when needed. Haleem et al. argue that digital technologies can make learning more interactive and meaningful while positioning learners more actively in the learning process (Haleem et al., 2022).

In this study, YouTube-based treatment, instructional videos, and digital reading texts were used as part of the flipped classroom implementation. These resources were intended to help students engage with reading materials before class and participate more actively during classroom learning. The use of digital technology also aligns with contemporary learning environments in which students are increasingly familiar with online platforms and multimedia learning resources.

Deep Learning Approach in Reading

Deep learning emphasizes meaningful understanding, analytical thinking, and the ability to connect knowledge. In reading comprehension, deep learning can be reflected in students' ability to interpret meaning, identify relationships among ideas, infer information, and evaluate textual content. A flipped classroom can support deep learning because students encounter basic content before class and then use classroom time for higher-level comprehension activities.

When students prepare through digital materials before class, they may come to class with prior knowledge that supports deeper text engagement. Classroom activities can then focus on clarification, questioning, discussion, and comprehension practice. In this sense, the flipped classroom model is not only a technological innovation but also a pedagogical strategy to encourage more active and meaningful learning.

Conceptual Framework of Deep Learning

Deep learning transcends traditional learning models by encouraging students to:

- a. Understand concepts, rather than merely memorizing facts.
- b. Connect ideas across different subject areas.
- c. Apply knowledge to real-world situations.
- d. Analyze and evaluate information critically.
- e. Reflect on their learning processes to foster self-awareness.

Deep Learning in EFL Reading

In the context of EFL reading, a deep learning orientation encourages students to engage with texts in a meaningful manner. This includes:

- a. Processing texts to extract deeper meanings.
- b. Identifying and articulating main ideas.
- c. Inferring meanings based on context and prior knowledge.
- d. Interpreting information to connect with personal experiences.
- e. Evaluating the textual content critically, considering factors such as bias and perspective.

By employing these strategies, students are better equipped to navigate complex texts, which ultimately enhances their language proficiency and comprehension skills.

METHOD

This study employed a pre-experimental quantitative design, specifically the one-group pretest-posttest design. The participants were given a pre-test before the treatment, followed by the treatment using a flipped classroom integrated with digital technology and a deep learning approach, and then a post-test after the treatment. The improvement in students' reading comprehension was measured by comparing the pre-test and post-test scores.

To measure the dependent variable, a reading comprehension test was utilized as the primary instrument. The test consisted of 25 multiple-choice questions designed to assess various levels of reading comprehension, including identifying main ideas, making inferences, and understanding vocabulary in context. The reading texts and test items were adapted from standardized EFL reading materials and authentic digital articles to ensure relevance to the fourth-semester students' proficiency level. To ensure content validity, the instrument was reviewed and validated by two expert lecturers in English Language Education, who confirmed that the items accurately measured the intended reading skills and were appropriate for the target participants.

The scoring procedure was straightforward and objective. Each correct answer was awarded one point, while incorrect or unanswered items received zero points. The total raw score was then converted into a final score ranging from 0 to 100 to facilitate statistical analysis.

Table 1. One-Group Pretest–Posttest Research Design

Group	Pre-test (O_1)	Treatment (X)	Post-test (O_2)
Experimental	O_1	X	O_2

Note:

O_1 = Pre-test (Reading comprehension test before treatment)

X = Treatment (Flipped classroom integrated with digital technology and deep learning approach)

O_2 = Post-test (Reading comprehension test after treatment)

Research Setting and Participants

The research was conducted at the English Language Education Study Program, Faculty of Teacher Training and Education, Universitas PGRI Ronggolawe Tuban during the odd semester of the 2026/2027 academic year. The participants consisted of 18 fourth-semester EFL students. They were selected using total sampling because only one class was involved in the study.

Instruments

Table 2. Research Instruments

Instrument	Description
Reading comprehension test	Used to measure students' reading comprehension achievement
Pre-test	Administered before the treatment
Post-test	Administered after the treatment
Multiple-choice items	Consisted of 25 questions
Learning materials	Used during the treatment process
Instructional videos	Used as digital learning resources
Digital reading texts	Used to support students' reading activities
YouTube	Used as a platform for treatment delivery
Documentation	Used to collect students' test scores and learning activity records
Questionnaire	Used to obtain students' responses and support instrument analysis

Treatment Procedure

The treatment was implemented through a flipped classroom model supported by digital technology. Students were exposed to instructional videos, digital reading texts, and YouTube-based learning resources before classroom learning. The classroom session was then used to support reading comprehension activities through discussion, comprehension practice, and deeper engagement with reading materials.

The treatment was designed to encourage students to prepare independently before class and participate more actively during classroom activities. Through this process, the flipped classroom model was integrated with a deep learning orientation, in which students were expected to move beyond passive reading and engage more meaningfully with texts.

Data Analysis

The collected data were analyzed using SPSS. The analysis included descriptive statistics, normality testing using the Shapiro-Wilk test, and hypothesis testing. Based on the provided statistical output, the pre-test and post-test comparison was analyzed using the Wilcoxon Signed Ranks Test. The questionnaire instrument was analyzed using item correlation and reliability testing. Reliability was measured using Cronbach's Alpha.

FINDINGS

Descriptive Statistics

To provide a clearer picture of the students' learning progress, descriptive statistics including mean scores, standard deviations, and score improvements were calculated prior to hypothesis testing. As shown in Table 3, the post-test mean score showed an improvement

compared to the pre-test mean score, indicating a positive directional change in students' reading comprehension.

Table 3. Descriptive Statistics of Reading Comprehension Scores

Test	N	Mean	Std. Deviation	Minimum	Maximum	Mean Improvement
Pre-test	18	23.39	2.547	16	25	-
Post-test	18	24.67	1.414	19	25	1.28

Wilcoxon Signed Ranks Test

Table 4. Wilcoxon Signed Ranks Test Results

Comparison	Rank Type	N	Mean Rank	Sum of Ranks
Post-test - Pre-test	Negative Ranks	1	2.50	2.50
Post-test - Pre-test	Positive Ranks	6	4.25	25.50
Post-test - Pre-test	Ties	11	-	-
Total	-	18	-	-

The result shows that 6 students obtained higher post-test scores than pre-test scores, 1 student obtained a lower post-test score, and 11 students obtained the same scores in the pre-test and post-test. This indicates that there was a positive direction of improvement among some students after the treatment, although more than half of the participants showed unchanged scores.

Table 5. Wilcoxon Test Statistics

Test	Value
Wilcoxon Z	-1.951
Asymp. Sig. (2-tailed)	.051

The Wilcoxon result showed $Z = -1.951$ and Asymp. Sig. (2-tailed) = .051. Since the significance value was slightly higher than .05, the improvement was not statistically significant at the conventional .05 level. However, the number of positive ranks was greater than the number

of negative ranks, indicating a positive tendency in students' reading comprehension scores after the implementation of the flipped classroom integrated with digital technology and deep learning.

Questionnaire Validity And Reliability

The questionnaire consisted of **29 items**. The correlation output showed that the questionnaire items had positive item correlations, with several items marked significant at the .05 and .01 levels in the provided SPSS output. This indicates that the items were positively associated with the overall response pattern.

Table 6. Questionnaire Reliability Statistics

Reliability Indicator	Value
Valid cases	18
Excluded cases	0
Cronbach's Alpha	.988
Number of items	29

The reliability analysis showed that the questionnaire had a Cronbach's Alpha of .988 across 29 items, indicating very high internal consistency. This suggests that the questionnaire was reliable for measuring students' responses related to the implementation of the flipped classroom, digital technology, and deep learning approach in the reading class.

DISCUSSION

The findings of this study indicate that the implementation of a flipped classroom integrated with digital technology and a deep learning approach produced a positive tendency in students' reading comprehension. The Wilcoxon Signed Ranks Test showed that 6 students improved from pre-test to post-test, 1 student decreased, and 11 students remained unchanged. Although the statistical significance value was .051, slightly above the conventional .05 threshold, the distribution of ranks suggests that the treatment had a positive direction.

This result should be interpreted carefully because the study used a one-group pretest-posttest design without a control group. Therefore, the findings cannot establish strong causal claims. However, the positive ranks indicate that some students benefited from the treatment. The flipped classroom model may have provided students with opportunities to access reading materials before class through digital technology, allowing them to prepare for classroom activities. This is consistent with recent literature emphasizing that flipped classrooms in higher education EFL contexts effectively combine asynchronous pre-class learning with active in-class engagement, thereby supporting students' self-regulated learning (Fisher et al., 2024).

The use of instructional videos, digital reading texts, and YouTube as part of the treatment also reflects the role of digital technology in supporting flexible and student-centered learning. Haleem et al. argue that digital technologies can support interactive learning environments and

encourage learners to take a more proactive role in the learning process (Haleem et al., 2022). In this study, digital technology enabled students to engage with reading materials beyond the classroom, which is one of the central features of flipped learning.

The findings of the present study are consistent with recent evidence from flipped learning research in EFL contexts. A systematic review by Hava (2024) found that the implementation of flipped learning generally has a positive impact on students' language learning outcomes, learning engagement, motivation, and classroom interaction in English as a Foreign Language (EFL) education. Although the present study focused specifically on reading comprehension, whereas the studies reviewed by Hava encompassed various language skills, both provide evidence that the flipped classroom approach contributes positively to EFL learning (Hava, 2024).

The deep learning orientation in this study was reflected in the effort to encourage students to engage with reading materials before class and use classroom time for deeper comprehension activities. Reading comprehension requires students to identify information, understand meaning, interpret ideas, and engage with texts actively. The flipped classroom may support these processes by reducing the amount of time spent on direct explanation during class and increasing opportunities for guided comprehension practice.

However, the result of Asymp. Sig. = .051 shows that the improvement did not reach statistical significance at the .05 level. This may be related to the small number of participants, the high number of tied scores, and the limited scope of the one-group design. Since 11 out of 18 students had unchanged scores, the treatment effect may not have been strong enough to produce statistically significant improvement for the whole group. Future studies should consider using a larger sample, a control group, and a more extended treatment period to obtain stronger evidence.

The questionnaire reliability result provides additional support for the quality of the response instrument. A Cronbach's Alpha value of .988 indicates very high internal consistency among the 29 questionnaire items. However, because no questionnaire mean scores, category distributions, or qualitative interview data were provided, this study cannot make broader claims about students' perceptions beyond the reliability and item-correlation.

Beyond the theoretical contributions, the findings of this study offer practical implications for English language teachers aiming to enhance reading instruction. First, teachers can implement the flipped classroom model by curating or creating concise digital materials such as short instructional videos and interactive digital texts for students to engage with prior to class. This pre-class exposure allows teachers to transform face-to-face sessions into active learning spaces focused on deep comprehension activities, such as collaborative text analysis, inferencing discussions, and critical evaluation of the reading materials. Second, to ensure students are adequately prepared for in-class engagement, teachers should provide clear scaffolding and specific guiding questions for the pre-class digital tasks. Finally, teachers are encouraged to leverage digital platforms not only for content delivery but also for formative assessment, enabling them to identify students' specific reading difficulties before class and tailor their in-class interventions accordingly. By shifting their role from primary knowledge transmitters to active

learning facilitators, EFL teachers can create a more responsive, student-centered, and cognitively demanding reading classroom.

CONCLUSION

This study examined the implementation of a flipped classroom integrated with digital technology and a deep learning approach to improve EFL students' reading comprehension at Universitas PGRI Ronggolawe Tuban. The study involved 18 fourth-semester EFL students and used a pre-experimental one-group pretest-posttest design. The Wilcoxon Signed Ranks Test showed that 6 students achieved higher post-test scores, 1 student showed a lower post-test score, and 11 students had unchanged scores. The test produced $Z = -1.951$ and Asymp. Sig. (2-tailed) = .051. This means that the students' reading comprehension showed a positive tendency after the treatment, but the improvement was not statistically significant at the .05 level.

The questionnaire instrument showed very high reliability, with Cronbach's Alpha = .988 for 29 items. This indicates that the questionnaire had strong internal consistency. Overall, the flipped classroom integrated with digital technology and deep learning has potential as an innovative approach to EFL reading learning, but further research with stronger experimental control, larger samples, and richer data is needed.

This study has several limitations. First, it used a pre-experimental design without a control group, so the findings cannot be generalized as strong causal evidence. Second, the sample consisted of only 18 students from one class. Third, many students had tied pre-test and post-test scores, which limited the statistical strength of the findings. Fourth, although a questionnaire was used, only item correlation and reliability data were available; therefore, the study could not report detailed perception scores or qualitative themes.

Future researchers are recommended to use a quasi-experimental or true experimental design involving control and experimental groups. A larger sample should also be used to increase statistical power. Future studies may also include qualitative data such as interviews, classroom observation, or open-ended questionnaire responses to explore how students experience flipped classroom learning. In addition, longer treatment duration may help determine whether flipped classrooms integrated with digital technology and deep learning can produce stronger improvements in EFL reading comprehension.

Based on the findings, several practical implications and specific recommendations can be drawn for English language teachers regarding classroom implementation. First, teachers are encouraged to adopt the flipped classroom model by providing concise, targeted digital materials (e.g., short instructional videos or interactive digital texts) for students to review before class. This pre-class preparation allows teachers to repurpose face-to-face classroom time for higher-order thinking activities, such as collaborative text analysis, group discussions, and guided reading comprehension practice, rather than traditional lecturing. Second, to ensure students effectively engage with the pre-class materials, teachers should provide clear scaffolding, such as guiding questions or short online quizzes, to monitor their initial understanding. Finally, teachers should leverage digital platforms not only for content delivery but also to foster a student-centered

learning environment where learners can control their own reading pace and revisit materials as needed, thereby directly supporting a deep learning approach to reading comprehension.

Future researchers are recommended to use a quasi-experimental or true experimental design involving control and experimental groups. A larger sample should also be used to increase statistical power. Future studies may also include qualitative data such as interviews, classroom observation, or open-ended questionnaire responses to explore how students experience flipped classroom learning. In addition, longer treatment duration may help determine whether flipped classrooms integrated with digital technology and deep learning can produce stronger improvements in EFL reading comprehension.

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