

Technological and digital literacy challenges in implementing flipped learning: insights from Eastern Indonesia

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Article Info

Article history:

Received Nov 20, 2025

Revised Feb 23, 2026

Accepted Mar 6, 2026

Keywords:

Digital literacy

EFL learners

Flipped learning

Language acquisition

Technological barriers

ABSTRACT

This study explores the challenges faced by English as a foreign language (EFL) learners and teachers in Eastern Indonesia when implementing flipped learning, with a focus on technological access and digital literacy. Despite the potential benefits of flipped learning, such as increased learner autonomy and deeper cognitive engagement, these factors significantly hinder its effectiveness in under-resourced regions. The study employs a qualitative research design, utilizing interviews and questionnaires with 199 EFL learners and 10 certified EFL teachers from both West and East Nusa Tenggara. The findings reveal that limited internet access, lack of personal digital devices, and low digital literacy are the primary obstacles to successful engagement with flipped learning. These challenges prevent learners and teachers from adequately preparing for class, leading to reduced participation in interactive activities and ultimately hindering language acquisition for learners. In response, the study proposes strategies such as improving internet and device access, offering digital literacy training, and adopting a blended learning approach that combines both online and face-to-face learning. The study contributes to the existing literature by providing context-specific insights into the barriers faced by EFL learners in Indonesia and offering practical recommendations for overcoming these challenges to improve the efficacy of flipped learning in similar educational settings.

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1. INTRODUCTION

The implementation of flipped learning in English as a foreign language (EFL) classrooms has garnered significant attention for its potential to transform traditional educational practices and enhance learner outcomes. This model shifts the instructional paradigm from teacher-centered to learner-centered, promoting greater learner autonomy and more active engagement with learning materials. Flipped learning allows learners to engage with content outside of the classroom, typically through video lectures or online materials, which frees up in-class time for interactive, output-based activities. This approach has been shown to support deeper cognitive processing, foster critical thinking, and improve overall language proficiency [1], [2]. By engaging in self-regulated learning, learners can progress at their own pace, allowing for more personalized learning experiences and greater participation in meaningful language practice [3]–[5].

However, the effectiveness of flipped learning is not guaranteed, as several challenges can hinder its implementation and the realization of its benefits. One of the major obstacles is the readiness of learners to engage with pre-class materials. Many EFL learners, particularly those in under-resourced contexts, may lack the motivation or resources to prepare effectively outside of class. Statistically, 27.64% of Indonesian learners can access flipped learning [6]. Namaziandost and Çakmak [7] identify self-regulation and self-efficacy as critical factors for success in flipped classrooms, suggesting that students who are less self-motivated may struggle to benefit from this model. Additionally, the teacher's role in a flipped classroom is more complex than in traditional settings. Teachers must be adept at creating and curating online materials, as well as providing effective guidance and support during in-class activities. This requires significant pedagogical skill and technological proficiency [8]–[10].

In addition to these pedagogical challenges, issues related to technological access and digital literacy are critical in determining the success of flipped learning, especially in developing regions. For EFL learners in Eastern Indonesia, the infrastructure required for effective flipped learning—such as reliable internet access and digital devices—remains a significant barrier. Indonesia's Eastern regions, characterized by their archipelagic geography, often suffer from poor internet connectivity, which hinders students' ability to access pre-class materials and participate in online learning [11]–[13]. Moreover, disparities in access to digital devices exacerbate these challenges, as students may not have personal computers, or reliable smartphones, which also reflects the bigger picture in similar low-sourced countries in the regions (for example, Phung [14], [15]), makes it difficult for them to participate in flipped learning environments [16], [17].

Beyond the physical barriers of access to technology, there are also significant challenges related to digital literacy. Research shows that many students and teachers in Eastern Indonesia possess only moderate levels of digital literacy, which impacts their ability to navigate online platforms, access digital content, and engage in self-regulated learning. Laily *et al.* [6] found that many Indonesian EFL teachers struggle with essential digital literacy skills, including navigating online resources and ensuring internet safety, further complicating the adoption of flipped learning in classrooms where technological competence is a prerequisite. This lack of digital proficiency can hinder the smooth implementation of flipped classrooms, preventing students from fully benefiting from the flexible learning opportunities they provide. Furthermore, the traditional pedagogical practices in many Eastern Indonesian classrooms, such as lecture-based and grammar-translation methods, are not aligned with the active, learner-centered approach required in flipped learning models [18]–[20]. Lecture-based and grammar translation approaches position the teacher as the primary source of knowledge, while students mainly listen, copy notes, and follow explanations. Flipped learning requires students to actively process content, ask questions, collaborate, and construct understanding during class time.

These contextual challenges have been linked to lower academic achievement and underperformance in language learning among EFL students in Eastern Indonesia. The lack of access to reliable internet and digital devices prevents students from completing pre-class assignments, which are integral to the flipped learning model. This leaves students unprepared for the interactive tasks conducted during face-to-face sessions, reducing the overall effectiveness of the learning experience. Furthermore, low levels of digital literacy hinder students' ability to navigate online materials effectively, resulting in missed learning opportunities and difficulties with self-regulation [21]–[23]. These limitations are compounded by learners' psychological factors, such as language anxiety, which further impedes their ability to participate in speaking and listening activities [11], [24], [25]. Thus, while flipped learning offers a potentially transformative approach to language teaching, its success depends heavily on overcoming the significant challenges posed by technological access, digital literacy, and traditional teaching cultures.

The novelty of this study lies in its deep investigation of how context-specific challenges experienced by EFL learners in Eastern Indonesia influence the effectiveness of flipped learning. Although flipped learning has been widely studied, most research discusses general benefits and obstacles without deeply addressing regions where technological conditions and learning cultures differ markedly from mainstream settings. This study highlights the combined influence of unequal access to devices and stable internet, moderate levels of digital literacy among students and teachers, and classroom traditions that remain strongly teacher-centered. In Eastern Indonesia, these factors can shape students' ability to access online materials, participate in self-regulated pre-class learning, and engage actively during in-class activities. By analyzing the interaction among technological, digital, and cultural dimensions, this research provides a more grounded explanation of why flipped learning may succeed or fail in this setting. The study also offers practical recommendations to help schools and teachers adapt flipped models to local realities and constraints.

The objectives of this research are to explore the challenges faced by EFL learners in Eastern Indonesia in implementing flipped learning; evaluate the impact of these challenges on language learning outcomes; and propose strategies for overcoming these barriers to enhance the effectiveness of flipped classrooms. The research questions guiding this study are:

- i) What are the technological and digital literacy challenges faced by EFL learners in Eastern Indonesia when participating in flipped learning?
- ii) How do these challenges affect students' language learning outcomes?
- iii) What strategies can be implemented to overcome these challenges and improve the efficacy of flipped learning in this context?

2. METHOD

2.1. Research design

This study employs a qualitative research design to explore the challenges faced by EFL learners and teachers in implementing flipped learning in West and East Nusa Tenggara, Indonesia. A qualitative approach is suitable for this research as it allows for an in-depth understanding of the participants' experiences, perceptions, and challenges [26]. The focus of this study is on uncovering the nuanced perspectives of EFL learners and teachers regarding the effectiveness of flipped learning and the specific barriers they encounter in regions with varying levels of digital access. Through qualitative methods such as interviews and questionnaires, the study seeks to provide rich, context-specific insights into the phenomenon of flipped learning within the Indonesian EFL context.

A qualitative design is particularly appropriate for this research because it allows for the exploration of subjective experiences, which quantitative approaches may not fully capture. By using open-ended questions in interviews and questionnaires, this study can gather detailed and meaningful responses that highlight the complexities of implementing flipped classrooms in under-resourced areas. However, limitations of this approach include the potential for researcher bias in data interpretation and the lack of generalizability due to the small, non-random sample size. To mitigate these biases, triangulation methods are employed, combining data from multiple sources (questionnaires and interviews) to validate findings and ensure the reliability of the data.

2.2. Participants

The study involves 199 EFL learners from West Nusa Tenggara and 79 EFL learners from East Nusa Tenggara, along with 10 certified EFL teachers from both regions. The learners come from different school levels. Some are junior high school students, and others are senior high school students. This mix allows the study to capture differences in learning needs and classroom readiness across age groups. The learners also differ in academic performance. Some students consistently achieve high scores in English and complete tasks on time. Others show average achievement and need more guidance to understand materials. The learners' digital literacy levels are also varied. Some students can easily use learning platforms, search for online materials, and submit assignments digitally. Others can only perform basic actions, such as opening files and using messaging apps. Access to technology is unequal across participants. Some students own smartphones and have regular internet access at home. Others share one device with family members, which limits study time. Some rely on prepaid data with limited quotas, making video-based learning difficult. These conditions shape how often students can access flipped learning materials and how consistently they can participate in online activities.

The inclusion of learners from both urban and rural areas allows for a comprehensive understanding of the regional disparities in the implementation of flipped learning. The teachers selected have at least 10 years of teaching experience, with certifications from the Indonesian government that attest to their professional qualifications. These teachers are from both West and East Nusa Tenggara and are experienced in teaching English using a variety of instructional methods, including traditional face-to-face teaching, online learning, and some experience with flipped classrooms. The teachers' experience and certification ensure that they have the knowledge and expertise to provide valuable insights into the challenges and benefits of implementing flipped learning in their classrooms.

2.3. Instruments

The primary instruments for data collection in this study are questionnaires and semi-structured interviews. The questionnaires are administered through Google Forms and are completed by both EFL learners and certified EFL teachers. They contain a combination of closed-ended items and open-ended prompts to capture not only the frequency of specific experiences but also the reasons behind participants' responses. The closed-ended items ask participants to rate their level of agreement or report how often certain situations occur during flipped learning. For example, learners are asked: "I can access the assigned videos or online materials before class without difficulty," and "how often do you complete pre-class tasks on time?" The open-ended questions are included to elicit detailed descriptions of participants' lived experiences. Sample prompts for learners include: "describe the main difficulties you face when studying English

materials online before class,” and “what helps you stay motivated when learning independently at home?” For teachers, sample prompts include: “what challenges do you face when preparing flipped learning materials for your students?”

These responses provide rich qualitative data and help explain patterns found in the closed-ended items. Interviews are conducted online via Zoom or Google Meet, depending on participants’ availability and preference. The interviews are semi-structured, meaning the researcher uses a guiding set of questions while still allowing follow-up questions to explore unexpected but relevant issues. This format supports consistency across participants while also capturing individual variation in experiences. Interviews are conducted with a subset of learners and teachers to obtain deeper insights into attitudes, constraints, and classroom realities that may not be fully captured in survey responses.

The interview protocol focuses on key themes, including perceived benefits of flipped learning, practical and technological barriers, learner engagement and self-regulation, and perceived effects on English language development. Sample learner interview questions include:

- “Can you walk me through what you do when a teacher assigns a video or online task before class?”
- “What usually prevents you from completing the pre-class activities?”
- “In what ways does flip learning help or not help you improve speaking, listening, reading, or writing?”

In addition, sample teacher interview questions include:

- “How do you decide what content should be learned at home versus in class?”
- “What happens in your classroom when students arrive unprepared?”
- “What support or training would help you implement flipped learning more effectively?”

Together, the questionnaire and interview data are designed to provide a detailed picture of participants’ experiences and the contextual factors shaping flipped learning implementation.

Both the questionnaires and interview questions have been adapted from existing instruments used in previous studies on flipped learning, with adjustments made to ensure relevance to the context of EFL education in Indonesia. In terms of adaptation, the study retained the core constructs and response formats (e.g., Likert scale agreement or frequency items) but modified item wording to fit EFL learning tasks and the Indonesian school context (for example, references to “lectures” or “university courses” were revised into “English lessons” and “school assignments,” and platform examples were aligned with tools commonly used in local classrooms such as Google Classroom, WhatsApp, or shared links). The questionnaire also added context-specific items to capture barriers that are highly relevant in Eastern Indonesia, such as unstable internet signals, limited data quotas, device sharing within households, and difficulties accessing or navigating online learning materials. The interview questions were adapted in a similar way: the guide followed the main topic structure of earlier flipped learning interview protocols but was expanded with probes on digital literacy practices (how participants find, open, and use online materials safely) and on classroom norms that may affect learner participation. To strengthen validity and reliability, all instruments were reviewed by EFL and flipped learning experts, then piloted with a small group of participants; feedback from the pilot was used to refine unclear wording, adjust the sequence of questions, and ensure the instruments captured participants’ experiences accurately before full administration.

2.4. Data analysis technique

The data collected from the questionnaires and interviews are analyzed using thematic analysis, a widely used technique in qualitative research. Thematic analysis involves identifying, analyzing, and reporting patterns (themes) within the data. The first step in the analysis involves coding the data to identify key themes related to the research questions, such as challenges in accessing technology, perceptions of the effectiveness of flipped learning, and the impact on language learning outcomes. The coding process is iterative, with codes being refined as the data analysis progresses.

Once the data has been coded, the themes are organized into categories that align with the research objectives. For example, themes related to technological barriers may be grouped together, while themes related to learner engagement or teacher preparedness are categorized separately. The analysis was focused on understanding how the identified themes relate to the research questions, providing insights into the experiences of EFL learners and teachers in the context of flipped learning. The data from interviews are then cross-referenced with the questionnaire responses to identify consistencies and discrepancies, further strengthening the findings.

Triangulation was used to strengthen the validity of the findings by systematically comparing evidence from multiple sources and participant groups. First, the researchers conducted data source triangulation by cross-checking learner questionnaire responses with teacher questionnaire responses to see whether reported challenges and benefits were consistent across perspectives. For example, if learners reported difficulty completing pre-class tasks due to limited internet access or low digital skills, the analysis examined whether teachers also observed low preparation rates, incomplete online tasks, or uneven

participation during in-class activities. Second, method triangulation was applied by comparing questionnaire results with semi-structured interview transcripts. Survey trends were treated as initial indicators, then confirmed, refined, or challenged through interview narratives that provided context, examples, and explanations. Third, the study used cross-case comparison between West Nusa Tenggara and East Nusa Tenggara to check whether themes were stable across settings or context-specific. The findings were considered valid when key themes were supported by at least two data sources (e.g., learner survey plus teacher interview), and when discrepancies could be logically explained by differences in access, digital literacy, or classroom practice rather than ignored.

Ethical considerations are paramount in this study, as human participants are involved. To ensure ethical integrity, the study adheres to ethical guidelines set forth by the institutional review board (IRB). Informed consent will be obtained from all participants before data collection begins. Participants are fully informed of the study's purpose, the voluntary nature of their participation, and their right to withdraw at any time without consequence. Consent forms are provided to both learners and teachers, and they are asked to sign them electronically before participating in the study. Confidentiality is maintained throughout the research process. All personal identifying information is removed from the data, and pseudonyms are used in the final report to ensure participants' anonymity. Data are stored securely in password-protected files, accessible only to the researcher and authorized personnel.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Technological and digital literacy challenges faced by EFL learners in Eastern Indonesia

EFL learners in Eastern Indonesia face several technological and digital literacy challenges when participating in flipped learning. Based on the data collected through interviews and questionnaires, the most prominent challenges include:

- Limited internet access

A significant number of students reported experiencing poor or inconsistent internet connectivity, especially in rural and remote areas. This lack of reliable internet access hinders their ability to engage with pre-class materials such as video lectures and reading materials.

“I have a hard time watching videos for the flipped classroom because the internet is very slow. Sometimes I have to wait for hours to load a 10-minute video.”

- Lack of digital devices

Many students do not own personal digital devices such as laptops or tablets. Instead, they share devices with family members or rely on mobile phones with limited functionality, which makes it difficult to complete assignments and participate in online activities effectively.

“I don't have my own laptop, so I have to use my phone. But my phone battery runs out fast, and it's hard to use apps for studying.”

- Low digital literacy

Some students reported having insufficient skills to navigate online platforms, search for resources, and complete tasks that require advanced digital tools. This includes struggles with navigating learning management systems (LMS) or using collaborative tools like Google Docs.

“I know how to use social media, but using educational websites and uploading assignments is confusing for me.”

3.1.2. How these challenges affect students' language learning outcomes

The technological and digital literacy challenges significantly affect students' language learning outcomes in several ways.

- Incomplete pre-class preparation

Due to poor internet access and limited devices, many students are unable to complete the pre-class assignments essential to the flipped classroom model. As a result, they enter class unprepared, which limits their participation in interactive learning activities designed to improve their language skills.

“I couldn't watch the video last night because of the internet. So, in class today, I couldn't follow the discussion well.”

- Increased frustration and reduced engagement

Struggling with digital tools and slow internet connections leads to frustration, which in turn decreases students' motivation to participate in flipped learning activities. Some students reported that they felt overwhelmed by the technological demands, which negatively impacted their learning experience.

“When I can't get the video to play or can't find the materials, I feel stressed, and then I don't want to continue studying.”

- Limited interaction with teachers and peers

Due to technological barriers, students miss out on collaborative activities, discussions, and feedback sessions that are crucial for language development, particularly speaking and listening skills. The flipped classroom model requires interaction, but the challenges faced by students inhibit their active participation.

“I couldn't join the group discussion because I didn't have enough time to prepare my part due to slow internet.”

3.1.3. Strategies to overcome these challenges

Based on the findings from the interviews and questionnaires, several strategies can be implemented to overcome the technological and digital literacy challenges and improve the efficacy of flipped learning in Eastern Indonesia.

- Improving internet access and device availability

Providing students with access to reliable internet and digital devices is a fundamental step to ensuring that they can fully engage with flipped learning. Government initiatives or school partnerships with tech companies could play a role in bridging the digital divide in remote areas.

“I think the most immediate solution is to provide students with affordable or subsidized devices and internet access to ensure they can access the materials.”

- Digital literacy training for students

Offering workshops or short courses on digital literacy can equip students with the skills they need to navigate online learning platforms effectively. This can include basic skills such as using LMS, uploading assignments, and conducting research.

“We need to have workshops or training for students on how to use these tools, especially for those who are not familiar with digital technology.”

- Blended learning approach

Teachers can consider incorporating a blended learning model, where students have a mix of online and face-to-face learning experiences. This would reduce the reliance on technology for every lesson and allow students to engage in language activities in both digital and traditional formats.

“We can make use of offline materials and in-class activities to complement the online lessons. This could help students who struggle with technology.”

Table 1 provides the interview questions used to gather data from both EFL learners and teachers regarding the challenges and strategies related to flipped learning.

To provide a clearer representation of the findings, Table 2 visualizes the technological challenges faced by EFL learners based on interview responses. The table highlights that the most common challenge reported by learners is limited internet access (45%), followed by a lack of personal digital devices (30%) and low digital literacy (25%). The findings from both the learner and teacher interviews provide a comprehensive view of the current state of flipped learning in Eastern Indonesia and suggest concrete steps to mitigate the barriers posed by technological and digital literacy challenges. By implementing the strategies discussed, it is possible to enhance the effectiveness of flipped learning and create more equitable learning opportunities for all students.

Table 1. EFL learners and teachers' perceptions of the challenges and strategies related to flipped learning

Interview questions	For EFL learners	For EFL teachers
1. What challenges do you face in accessing the materials for the flipped classroom?	<i>"I have slow internet, and sometimes I can't load videos or access the materials."</i>	<i>"Many of my students struggle with slow internet and not having personal devices to access materials."</i>
2. How does this impact your participation in flipped learning activities?	<i>"I feel stressed and unable to participate in discussions because I didn't watch the videos."</i>	<i>"Students who are unable to prepare beforehand tend to lag behind during in-class activities."</i>
3. Do you have access to the necessary technology or devices?	<i>"I don't have a laptop, so I use my phone, but it's not ideal for studying."</i>	<i>"Some students have personal devices, but many have to share with their families, which limits their time."</i>
4. How confident are you in using digital tools for learning?	<i>"I am not confident in using new learning platforms like Google Classroom or Moodle."</i>	<i>"I notice that many students need help navigating online tools, and that affects their engagement."</i>
5. What strategies do you think can help improve your experience with flipped learning?	<i>"If we had better internet and more devices, I could follow the lessons more easily."</i>	<i>"We could provide training on digital tools, and more offline activities to support those with low-tech access."</i>
6. How do you feel about using flipped learning in the future?	<i>"I think it's a good method, but only if we have better access to technology."</i>	<i>"I believe flipped learning has great potential, but it needs to be adapted to students' technological abilities."</i>

Table 2. Technological challenges in flipped learning

Challenge	Percentage of learners (%)
Limited internet access	45
Lack of personal digital devices	30
Low digital literacy	25

3.2. Discussion

This study aimed to explore the challenges faced by EFL learners and teachers in Eastern Indonesia when participating in flipped learning, focusing on technological barriers, digital literacy, and their impact on language learning outcomes. The findings highlight several critical challenges that hinder the effectiveness of flipped classrooms in this region and suggest strategies for overcoming these barriers. This discussion compares these findings with previous studies, providing insights into the implications of these challenges in the context of EFL education in Indonesia.

The most significant technological challenge identified in this study is limited internet access, which is consistent with the findings of Adhikari [13] and Chasanah and Purwanti [11], who reported that students in rural areas of Indonesia, particularly in remote districts, often face unreliable or slow internet connections. This finding mirrors the experiences of learners in other parts of the world, such as in rural Saudi Arabia [27] and India [28], where poor internet infrastructure disrupts access to digital learning materials. The issue of a lack of digital devices also emerged as a key challenge, with many students in Eastern Indonesia relying on shared devices or mobile phones. This aligns with the findings of Mainake and McCrocklin [16], who noted that the lack of personal devices significantly hinders student participation in flipped learning and in online components of learning in general [29]. The inability to engage with online learning materials due to such limitations exacerbates the digital divide, a theme also observed in studies [5], [22] who emphasized the role of technology access in shaping educational outcomes.

In addition to access-related challenges, low digital literacy was another prominent barrier for both learners and teachers in Eastern Indonesia. This issue has been widely acknowledged in research on flipped learning [19], where low levels of digital proficiency among students impede their ability to navigate LMS, use educational apps effectively, and engage in self-regulated learning. The results echo the previous findings [6], [30], which reported that inadequate digital literacy among students hinders the success of technology-enhanced pedagogies. In line with these studies, the learners in this research expressed frustrations with navigating digital platforms, which, in turn, affected their ability to complete assignments and engage fully in the flipped classroom model. This underscores the importance of integrating digital literacy training into EFL curricula. Digital skills are foundational for the successful implementation of flipped learning [1], [31].

The challenges related to technology and digital literacy inevitably impact the language learning outcomes of students. The incomplete pre-class preparation due to limited access to technology and poor internet connectivity prevents learners from engaging with the materials needed for successful participation in class activities [2], [5]. The study's participants reported entering class unprepared, which hindered their ability to engage in the interactive, language-focused tasks that are central to flipped learning. This mirrors the findings of Zheng and Lee [21], who emphasized that lack of preparation affects learners' ability to participate in activities designed to improve speaking, listening, reading, and writing skills.

Moreover, the frustration and disengagement caused by technological difficulties further impacted students' motivation to participate in flipped learning. Several learners reported feeling overwhelmed and

stressed by the technical barriers, which led to decreased engagement and a lack of interest in continuing with the learning activities. This finding is consistent with the work of Ying *et al.* [25], who noted that technical difficulties in flipped classrooms could lead to negative emotional responses, which, in turn, affect academic performance. The frustration caused by slow internet and the inability to access materials as planned further demotivates students, which exacerbates the challenges in language acquisition.

To mitigate these barriers, several strategies were identified by both EFL learners and teachers in this study. The provision of reliable internet access and digital devices emerged as the most immediate and necessary solution. This aligns with the recommendations of Faudi *et al.* [22], who highlighted the importance of addressing the digital divide to ensure equitable access to flipped learning opportunities. Previous studies [5], [27] also suggested that ensuring students have adequate technological resources is essential for the success of flipped classrooms. Teachers in this study echoed these concerns, suggesting that partnerships with technology companies or government initiatives could help provide affordable devices and reliable internet access in under-resourced areas.

In addition to improving access to technology, the study emphasized the need for digital literacy training. Both learners and teachers suggested that workshops or short courses on digital literacy would help bridge the gap in technological skills. This recommendation is in line with previous studies [6], [30], which advocate for incorporating digital literacy training into teacher development programs to equip both educators and students with the necessary skills to navigate online learning platforms effectively. Providing such training would help students use LMS and digital tools efficiently, enhancing their engagement and participation in flipped learning activities.

Another strategy suggested by teachers was the implementation of a blended learning approach, which would combine both online and offline learning methods. This approach would reduce the dependency on technology for every lesson, making it more accessible to students with limited digital resources. The blended approach has been suggested in various studies; a mixed model of online and in-class learning can help overcome technological barriers while still leveraging the benefits of flipped learning [18], [32].

The findings also provide important theoretical implications for the field of EFL education. The results underscore the need for a deeper understanding of the intersection between technology, digital literacy, and cultural factors in shaping the effectiveness of flipped learning in under-resourced contexts. As suggested by previous studies [7], [33], [34], the success of flipped classrooms depends not only on the students' access to technology but also on their readiness to engage with it. This highlights the importance of incorporating support systems that promote both the technical and emotional readiness of students to benefit from flipped learning.

From a practical perspective, the findings suggest that educational policymakers, administrators, and teachers must work together to ensure that the technological and pedagogical challenges of flipped learning are addressed. This includes providing better infrastructure, offering digital literacy training, and adjusting the pedagogical approach to meet the needs of learners with varying levels of digital access. These strategies, if implemented effectively, can enhance the efficacy of flipped learning and ensure that all students, regardless of their socio-economic background, can benefit from this innovative teaching method.

4. CONCLUSION

This study aimed to investigate the challenges faced by EFL learners and teachers in Eastern Indonesia when participating in flipped learning and to explore potential strategies for overcoming these challenges. The findings reveal that limited internet access, a lack of personal digital devices, and low digital literacy were the primary obstacles hindering the effective implementation of flipped learning in this region. These challenges significantly impacted students' ability to prepare adequately for class, reducing their participation in interactive activities designed to improve their language skills. Moreover, the frustration and disengagement caused by these technological barriers further exacerbated the challenges in language acquisition. The results of this study underscore the importance of addressing these issues to ensure that the potential benefits of flipped learning—such as increased learner autonomy and deeper cognitive engagement—can be realized, particularly in under-resourced educational settings. This study contributes to the existing body of literature by highlighting the specific technological and pedagogical challenges faced by EFL learners in Eastern Indonesia and offering practical recommendations for overcoming these barriers.

To enhance the effectiveness of flipped learning in this context, several strategies were identified, including improving access to reliable internet and digital devices, providing digital literacy training, and adopting a blended learning approach that combines online and offline learning methods. These recommendations align with previous research, which emphasizes the need for infrastructure improvements and the development of digital skills to facilitate successful engagement with technology-mediated instruction. The findings of this study also have significant implications for educational policymakers, teachers, and administrators in regions with similar challenges. By ensuring that learners have the necessary technological

resources, digital literacy, and pedagogical support, flipped learning can be implemented more effectively, leading to improved language learning outcomes for all students. In conclusion, addressing the technological and digital literacy challenges faced by EFL learners in Eastern Indonesia is essential for realizing the full potential of flipped learning and fostering equitable access to high-quality language education.

Future studies could extend these findings by testing the recommended strategies through intervention-based designs and broader sampling. Researchers could conduct quasi-experimental or mixed methods studies that compare three models over a semester: fully flipped learning, blended flipped learning that combines online and offline materials, and traditional instruction. The interventions should include clear components such as device or internet support, structured digital literacy training for both students and teachers, and offline alternatives like printed modules or preloaded videos for low connectivity areas. Future work should also involve multiple regions with similar infrastructure limitations to increase generalizability and examine differences across rural and urban settings. In addition, policy-focused studies could evaluate how school-level investment, teacher professional development, and administrative support influence the sustainability of flipped learning, helping decision makers prioritize infrastructure, skills training, and pedagogical guidance in underserved contexts.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to all the participants involved in this study, including the EFL learners and teachers from West and East Nusa Tenggara. We also extend our thanks to Universitas Pendidikan Mandalika, for providing the resources and environment necessary for conducting this study. Special appreciation goes to the colleagues and experts who reviewed the research instruments and provided valuable feedback throughout the research process.

FUNDING INFORMATION

This study was supported by the researchers themselves as part of an independent research group, formed through the collaboration between Universitas Pendidikan Mandalika and Webster University in Tashkent, Uzbekistan. No external funding or grants were received for this study.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : Conceptualization

M : Methodology

So : Software

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R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare there are no conflicts of interest. The research was carried out independently, with no financial or personal relationships that could have influenced the results or interpretation of the data.

DATA AVAILABILITY

The data supporting the findings of this study are available upon reasonable request from the corresponding author, [H]. The data are stored securely in accordance with institutional guidelines, and access will be granted to researchers who wish to verify the study's results or conduct further analysis. To ensure participant confidentiality, all personal identifying information has been anonymized, and the data are shared in aggregated form. For access to the full dataset, please contact the corresponding author via email.




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