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ENHANCING EFL LEARNING THROUGH MOBILE-ASSISTED LANGUAGE LEARNING IN A NATURE-BASED SCHOOL ENVIRONMENT: A MIXED-METHODS STUDY

Riyadi Ariyanto [1], Slamet Asari [2*]
[1,2,]*Master's Program in English Education, Universitas Muhammadiyah Gresik, Gresik, East Java, Indonesia*

***Corresponding author's email:** riyadiariyanto@gmail.com

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Abstract: Mobile-Assisted Language Learning (MALL) has been widely implemented in formal classroom settings; however, its application in alternative educational environments such as nature-based schools remains underexplored. This mixed-methods study investigated the effectiveness of MALL in enhancing EFL vocabulary learning, student engagement, and learning motivation in a nature-based school environment in East Java, Indonesia. Thirty-two seventh-grade students participated in a six-week intervention integrating mobile applications, including Quizlet, Google Lens, and digital vocabulary games, with outdoor experiential learning activities. Quantitative data were collected through pre-test and post-test vocabulary assessments and a Likert-scale questionnaire, while qualitative data were obtained through classroom observations and semi-structured interviews. Quantitative data were analyzed using paired-sample t-tests, whereas qualitative data were analyzed thematically. Before conducting inferential analysis, the Shapiro-Wilk test confirmed that the data were normally distributed. The findings revealed a statistically significant improvement in students' vocabulary achievement after the implementation of MALL, $t(31)=8.47$, $p < 0.001$. The mean score increased from 62.31 (SD=8.12) in the pre-test to 81.47 (SD=6.95) in the post-test. The effect size was large (Cohen's $d = 1.87$), indicating substantial practical significance. Questionnaire findings also demonstrated high levels of learning motivation (M=4.32), student engagement (M=4.25), and learner autonomy (M=4.18). Qualitative findings revealed that students perceived MALL positively because mobile applications helped them connect English vocabulary with authentic objects encountered during outdoor learning activities. The study concludes that integrating MALL with nature-based experiential learning effectively supports contextualized vocabulary acquisition and learner engagement in alternative EFL educational settings. The findings provide pedagogical implications for EFL teachers seeking to integrate technology-enhanced learning into contextualized outdoor instruction.

Keywords: *Mobile-Assisted Language Learning; nature-based school; vocabulary acquisition; student engagement; mixed-methods.*

INTRODUCTION

The rapid advancement of digital technology has significantly transformed English as a Foreign Language (EFL) teaching and learning practices. Technology-enhanced language learning environments provide flexible access to learning resources and support learner-centered instruction through interactive and autonomous learning activities (Bai, 2024; Guo, Jeyaraj, & Razali, 2024). One of the most widely implemented approaches is Mobile-Assisted Language Learning (MALL), which utilizes mobile devices and applications to facilitate language learning anytime and anywhere (Lai & Zheng, 2024).

Vocabulary mastery plays a fundamental role in language acquisition because it supports learners' ability to communicate effectively in receptive and productive language skills. Recent studies indicate that mobile learning applications positively influence vocabulary retention through multimedia exposure, contextual interaction, and repetitive practice (Fathi & Rahimi, 2024; Huang & Chang,

2024). Furthermore, mobile technologies enable learners to connect linguistic input with authentic real-world experiences, thereby strengthening meaningful learning and learner engagement (Zhang & Zou, 2025).

Previous studies have demonstrated that MALL positively influences vocabulary acquisition, learner autonomy, and motivation in formal classroom settings (Aşıksoy & Özdamlı, 2023; Rahman & Abdullah, 2024). Systematic reviews and meta-analyses further indicate that MALL contributes positively to students' language proficiency and collaborative interaction through interactive multimedia learning environments (Dou & Halim, 2024; Wang & Ruey Shing, 2024). However, most previous studies have focused primarily on urban schools and conventional classroom contexts, while limited research has investigated the implementation of MALL in alternative educational settings such as nature-based schools.

Nature-based schools emphasize experiential, contextualized, and outdoor learning activities that encourage students to interact directly with authentic environments. This educational approach creates meaningful learning experiences through exploration and real-world interaction rather than relying solely on textbook-based instruction (Hidayati & Suryati, 2025). In EFL contexts, nature-based education potentially supports contextual vocabulary acquisition because students directly encounter authentic objects and situations during learning activities. Nevertheless, outdoor EFL instruction often faces challenges related to limited learning resources, inconsistent language exposure, and maintaining students' engagement during experiential learning activities (Nurhayati, 2025).

Despite the growing body of research on MALL, empirical evidence regarding its implementation in Indonesian nature-based schools remains limited. Existing studies rarely explore how mobile learning technologies support contextualized vocabulary learning during outdoor experiential activities. Furthermore, limited research integrates quantitative learning outcomes with qualitative learner perceptions within alternative educational environments.

Recent studies have further confirmed that mobile-assisted language learning supports contextualized vocabulary acquisition and learner autonomy through authentic interaction and flexible learning environments. Mobile-supervised collaborative learning activities positively influence students' EFL learning outcomes by promoting interactive communication and contextual language exposure (Cai & Zhang, 2023). Similarly, context-aware mobile learning environments enable students to retain vocabulary more effectively because learners interact directly with authentic situations during language learning activities (Xu & Peng, 2024). Furthermore, mobile-assisted language learning encourages learner autonomy by allowing students to independently regulate their learning processes beyond classroom boundaries. (Tseng & Warschauer, 2023).

This study addresses these gaps by investigating the implementation of Mobile-Assisted Language Learning in an Indonesian nature-based school using a convergent mixed-methods design. The study specifically examines students' vocabulary achievement, engagement, learning motivation, and perceptions of contextualized language learning during outdoor MALL activities.

This study offers three major contributions. First, it extends the implementation of MALL into alternative educational settings by examining its application in a nature-based school environment. Second, it integrates quantitative and qualitative findings to provide comprehensive insights into students' cognitive and affective learning outcomes. Third, it demonstrates how mobile technologies can complement experiential outdoor learning by supporting contextualized vocabulary acquisition and learner autonomy. How does the implementation of Mobile-Assisted Language Learning (MALL) influence students' English vocabulary achievement in a nature-based school environment? To what extent does Mobile-Assisted Language Learning enhance students' engagement and motivation during outdoor EFL learning activities? How do students perceive the use of Mobile-Assisted Language Learning in supporting autonomous and contextualized EFL learning in a nature-based school context?

This study offers three novel contributions to the field of Mobile-Assisted Language Learning (MALL) and English as a Foreign Language (EFL) education. First, it is among the first studies to investigate the implementation of MALL within an Indonesian nature-based school environment. Previous studies on MALL have predominantly focused on formal classroom settings and urban educational contexts, while limited attention has been given to alternative educational environments such as nature-based schools (Burston & Giannakou, 2022; Kukulska-Hulme, 2009). Therefore, this study addresses a significant

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research gap by exploring how mobile-assisted learning can support English vocabulary acquisition in outdoor and experiential learning settings (Pham & Li, 2023).

Second, this study employs a mixed-methods research design that combines quantitative and qualitative approaches. The integration of vocabulary achievement tests, questionnaires, observations, and interviews allows the researcher to obtain comprehensive insights into both students' learning outcomes and their perceptions, engagement, and motivation during MALL implementation. This approach provides a more holistic understanding of how mobile learning technologies function in experiential educational contexts (Creswell & Plano Clark, 2018).

Third, this study integrates mobile learning applications with outdoor nature-based activities to create contextualized vocabulary learning experiences. By combining digital learning resources with direct interaction with natural objects and environments, the study demonstrates how technology can enhance meaningful and authentic language learning (Kukulska-Hulme & Shield, 2008) This integration contributes to the growing body of literature on technology-enhanced language learning in non-conventional educational settings (Siraj et al., n.d.).

This study is significant for three main constituencies. First, for EFL teachers, this research provides a practical instructional model for integrating mobile-assisted language learning with outdoor experiential learning activities. The findings may help teachers design more interactive, contextualized, and student-centered language learning experiences using mobile applications. (Burston & Giannakou, 2022)

Second, for administrators and practitioners in nature-based schools, this study demonstrates that technology can complement rather than replace experiential learning principles. The integration of mobile learning technologies may support vocabulary development, learner engagement, and autonomous learning while maintaining the contextual and experiential characteristics of nature-based education (Naujoks et al., 2021).

Third, for researchers and scholars in the field of language education, this study contributes empirical evidence regarding the implementation of MALL in alternative educational contexts. The findings enrich the existing literature on technology-enhanced language learning and provide a foundation for future research investigating MALL implementation in outdoor, experiential, and non-formal learning environments (Duman, Orhon, & Gedik, 2014).

This study is grounded in the theoretical foundation of Computer-Assisted Language Learning (CALL) and its extension, Mobile-Assisted Language Learning (MALL), which emphasize the role of digital technology in facilitating flexible, learner-centered, and contextualized language learning experiences(Kukulska-Hulme, 2009). Within this framework, MALL is positioned as the independent variable, serving as a pedagogical intervention to support English as a Foreign Language (EFL) instruction in a nature-based school environment.

The implementation of MALL in this study involves the use of mobile devices and language learning applications to support instructional activities such as vocabulary practice, language exposure through multimedia content, collaborative learning tasks, and autonomous learning beyond the traditional classroom setting. These learning activities are integrated with outdoor and experiential learning practices characteristic of nature-based education, allowing students to connect linguistic input with real-world contexts and meaningful experiences (Kukulska-Hulme, A., & Shield, L. (2008)).

The dependent variables of this research consist of students' English vocabulary achievement, learning motivation, and learner engagement. Vocabulary achievement is reflected through improvements in students' vocabulary mastery and contextual vocabulary comprehension, which are commonly used indicators in MALL-based EFL studies Duman, G., Orhon, G., & Gedik, N. (2014). Meanwhile, learning motivation and engagement represent affective factors that influence students' participation and persistence in language learning activities, especially in technology-enhanced and non-conventional learning environments (Burston & Giannakou, 2022).

The research framework also considers the nature-based school environment as a contextual factor that mediates the relationship between MALL implementation and EFL learning outcomes. Nature-based learning emphasizes experiential, contextual, and student-centered instruction, which aligns with the affordances of mobile learning technologies that enable learning beyond classroom boundaries (Warden, 2015). The interaction between MALL and the outdoor learning context is expected to enhance meaningful language use, learner autonomy, and contextual understanding, thereby strengthening the

effectiveness of EFL instruction (Franjić & Božinovski, 2025)

Overall, this research framework proposes that the integration of Mobile-Assisted Language Learning within a nature-based school environment positively influences students' EFL learning outcomes and learning motivation. The framework provides a systematic basis for examining the pedagogical value of MALL in alternative education settings and supports the formulation of research questions and hypotheses tested in this study (Franjić & Božinovski, 2025)

Computer-Assisted Language Learning (CALL) refers to the use of computer-based technologies to facilitate and enhance language teaching and learning processes. CALL has long been recognized as an effective approach in EFL contexts because it provides learners with greater exposure to authentic language input, interactive learning opportunities, and immediate feedback, which are often limited in traditional classroom settings (Siraj et al., n.d.). The integration of CALL supports learner-centered instruction by allowing students to control the pace, time, and place of their learning, thereby promoting autonomy and motivation in language acquisition (Chen, 2024)

In EFL education, CALL has been widely applied to develop various language skills, including vocabulary, reading, listening, and speaking. Studies indicate that CALL-based instruction enhances learners' engagement and improves learning outcomes by combining multimedia resources such as audio, video, and interactive exercises, which support diverse learning styles (Chen, 2024) As technology continues to evolve, CALL has expanded beyond desktop-based systems to more portable and flexible platforms, leading to the emergence of Mobile-Assisted Language Learning (Kukulska-Hulme, 2009).

Mobile-Assisted Language Learning (MALL) is a subset of CALL that utilizes mobile devices such as smartphones and tablets to support language learning anytime and anywhere. MALL emphasizes flexibility, portability, and contextual learning, allowing learners to engage with language content beyond formal classroom environments (Kukulska-Hulme, A., & Shield, L. (2008)). This approach is particularly beneficial in EFL contexts, where learners often require additional exposure and practice opportunities outside scheduled instructional time (Siraj et al., n.d.)

Previous research has demonstrated that MALL positively influences students' language development, especially in vocabulary acquisition, pronunciation, and reading comprehension. The use of mobile applications enables learners to interact with multimedia content and engage in repetitive practice, which enhances retention and understanding of language Duman, G., Orhon, G., & Gedik, N. (2014). Furthermore, MALL has been shown to increase students' motivation and engagement by incorporating interactive and learner-centered activities, such as gamified learning and collaborative tasks (Burston & Giannakou, 2022a.

Several studies have reported positive effects of MALL on EFL learning Duman, G., Orhon, G., & Gedik, N. (2014) found that mobile learning applications improved vocabulary acquisition and learner motivation through multimedia-based activities. Similarly,(Burston & Giannakou, 2022) highlighted that MALL promotes autonomous learning because students can independently manage their learning pace and practice frequency.

However, although many studies support the effectiveness of MALL, most research has concentrated on formal classroom environments. Only a limited number of studies have examined how MALL functions in experiential or outdoor learning contexts. Therefore, previous findings may not fully explain the implementation of MALL in alternative educational environments such as nature-based schools.

Recent literature reviews demonstrate that MALL not only improves language proficiency but also supports collaborative learning, learner autonomy, and contextual communication practices. (Burston & Giannakou, 2022) found that collaborative mobile-assisted language learning positively enhances interaction and student-centered learning experiences. Similarly, systematic reviews by (Burston & Giannakou, 2022) emphasized that mobile learning technologies provide meaningful language exposure through authentic and flexible learning activities. These studies collectively suggest that MALL is most effective when integrated with experiential and contextual learning environments rather than being used merely as supplementary classroom technology.

Numerous empirical studies have examined the effectiveness of MALL in EFL classrooms and reported positive outcomes. Research indicates that students who engage in MALL-based learning activities demonstrate significant improvements in language proficiency compared to those who rely solely on conventional instructional methods (Burston & Giannakou, 2022). In addition, MALL

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supports autonomous learning by enabling students to manage their learning processes independently, which is considered a key factor in successful foreign language acquisition (Kukulska-Hulme, 2009)

MALL also contributes to affective aspects of learning, such as motivation, engagement, and positive attitudes toward language learning. Studies reveal that learners perceive mobile learning as enjoyable and practical, which encourages sustained participation in learning activities and reduces anxiety often associated with foreign language learning(Tan et al., 2025). These findings highlight the pedagogical value of integrating MALL into EFL instruction, particularly in learning environments that emphasize flexibility and experiential learning (El, S. N., & Karakaya, S. (2009)

Vocabulary mastery is considered a fundamental component of language learning because it supports learners' reading, writing, listening, and speaking skills. MALL provides opportunities for vocabulary learning through multimedia exposure, repetitive practice, gamified learning activities, and contextual interaction with language input.

Recent empirical studies have demonstrated that mobile learning applications significantly improve vocabulary acquisition and learner engagement in EFL contexts. (Chen and Hsu 2023) reported that personalized mobile vocabulary learning systems positively influenced students' vocabulary achievement and learning motivation through adaptive multimedia features and contextualized learning tasks. Likewise, (Lin and Lin, 2023) found that mobile game-based language learning environments increased students' vocabulary retention and classroom engagement because learners perceived interactive mobile activities as enjoyable and meaningful.

In addition, recent meta-analytic findings indicate that mobile applications effectively support vocabulary acquisition, collaborative interaction, and learner-centered instruction in EFL classrooms (Alharbi & Khalil, 2024). These findings reinforce the argument that MALL contributes not only to cognitive learning outcomes but also to students' affective engagement and participation during language learning activities

Research by (Tan et al., 2025) emphasized that mobile technologies enable contextual learning by connecting language input with real-life situations. Students can immediately apply newly learned vocabulary in authentic contexts, which strengthens comprehension and retention. Furthermore, (El, S. N., & Karakaya, S. (2009)argued that MALL enhances learner engagement because mobile applications are perceived as interactive and enjoyable.

Nevertheless, previous studies rarely discuss how vocabulary learning through MALL can be integrated with outdoor experiential activities. This limitation creates an opportunity to investigate the pedagogical value of combining MALL with nature-based learning approaches.

Nature-based schools emphasize experiential, outdoor, and contextual learning by engaging students directly with their natural surroundings. This educational approach aims to foster meaningful learning experiences through real-life interaction and exploration rather than relying solely on textbook-based instruction (Han et al., 2024). In language learning contexts, nature-based education provides opportunities for authentic communication and contextualized language use, which are essential for effective language acquisition (Naujoks et al., 2021)

However, implementing EFL instruction in outdoor or non-conventional learning environments presents challenges, including limited access to learning resources and difficulties in maintaining structured language practice. Therefore, innovative instructional strategies are required to support language learning in such settings (Naujoks et al., 2021) .The integration of mobile technology offers a practical solution by providing access to digital learning materials and language practice tools that can be used during outdoor learning activities (Kukulska-Hulme, A., & Shield, L. (2008).

The integration of MALL with experiential and outdoor learning environments has also received increasing scholarly attention. (Huang and Lo, 2023) emphasized that mobile-assisted situated vocabulary learning enhances contextual understanding because students connect language input with authentic environmental interaction. Similarly, (Lee and Drajati 2024) found that mobile-assisted collaborative learning in outdoor educational settings improved students' engagement, communication, and contextualized language use during experiential learning activities.

Recent studies also suggest that experiential mobile-assisted language learning supports meaningful vocabulary acquisition because students interact directly with authentic real-world environments during language learning activities (Wu & Marek, 2025). These findings strengthen

the theoretical assumption that contextual and experiential interaction enhances vocabulary retention and learner engagement in EFL education.

Based on the previous studies reviewed above, it can be synthesized that MALL has strong potential to support EFL vocabulary learning through flexible and contextual instruction. However, empirical evidence regarding its implementation in Indonesian nature-based schools remains limited. Therefore, the present study attempts to fill this research gap by investigating the effectiveness of MALL in enhancing vocabulary learning, engagement, and motivation within a nature-based educational setting.

The integration of MALL within a nature-based school environment aligns with the principles of experiential and contextual learning. Mobile devices enable students to document observations, access multimedia language resources, and engage in collaborative learning activities while interacting with their natural surroundings, thereby creating meaningful connections between language input and real-world experiences (Shahzad et al., 2024)). This integration supports learner autonomy and enhances engagement by allowing students to learn in authentic and flexible contexts (Kukulska-Hulme, 2009)

Despite the growing body of research on MALL in formal classroom settings, studies focusing on its application in nature-based or alternative education environments remain limited. This gap highlights the need for empirical research that examines how MALL can enhance EFL learning in non-conventional educational contexts, particularly in developing countries such as Indonesia (El, S. N., & Karakaya, S. (2009) Therefore, the present study seeks to contribute to the existing literature by investigating the effectiveness of MALL in enhancing EFL learning within a nature-based school environment.

METHOD

This study employed a mixed-methods research design using a convergent parallel approach. Quantitative data were collected to measure students' vocabulary achievement before and after the implementation of MALL, while qualitative data were used to explore students' engagement, motivation, and perceptions regarding MALL implementation.

This study employed a mixed-methods research design using a convergent parallel approach. The convergent parallel mixed-methods design was selected because it allows quantitative and qualitative data to be collected simultaneously and analyzed independently before being integrated to obtain a comprehensive understanding of the research problem (Creswell & Plano Clark, 2018) Quantitative data were collected to measure students' vocabulary achievement and learning motivation after the implementation of Mobile-Assisted Language Learning (MALL), while qualitative data were used to explore students' engagement, perceptions, and learning experiences in the nature-based school environment.

Quantitative and qualitative data were collected concurrently during the six-week intervention. Integration occurred during the analysis stage, where quantitative findings, including vocabulary test scores and questionnaire results, were compared with qualitative themes derived from classroom observations and semi-structured interviews to identify convergence or divergence in findings. This integration enabled the researchers to interpret how statistical improvements in vocabulary achievement aligned with students' perceptions, engagement, and contextualized learning experiences during outdoor MALL activities (Guetterman, Fetters, & Creswell, 2023).

The use of a convergent mixed-methods designs also strengthened the validity of the study by triangulating numerical data with descriptive qualitative evidence. This approach provided a more comprehensive understanding of how MALL supports vocabulary acquisition, learner autonomy, and contextualized English learning within a non-conventional educational setting (Johnson & Christensen, 2024).

The participants of this study were 32 seventh-grade students at Nature-Based School Environment, East Java, Indonesia. The students ranged from 12 to 13 years old. The participants were selected using purposive sampling because the selected class had previously implemented outdoor learning activities and had adequate access to mobile devices.

The participants of this study were 32 seventh-grade students at Sekolah Alam Raya, East Java, Indonesia. The students ranged from 12 to 13 years old. The participants were selected using purposive sampling because the selected class had previously implemented outdoor learning activities and had adequate access to mobile devices.

The sample size was considered adequate for this mixed-methods study because it met the minimum requirement for conducting paired-sample statistical analysis and qualitative thematic

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exploration. A statistical power analysis indicated that a minimum of 30 participants was sufficient to detect medium effect sizes with a significance level of 0.05 and statistical power of 0.80 (Cohen, 1992).

This study received ethical approval from the Master's Program in English Education, Universitas Muhammadiyah Gresik. Informed consent was obtained from both parents and participants before the study was conducted. Participants were informed that their participation was voluntary and that all collected data would be treated confidentially and used only for research purposes.

Several instruments were used in this study:

The vocabulary test consisted of 30 multiple-choice questions administered as pre-test and post-test. The test aimed to measure students' vocabulary mastery before and after MALL implementation.

A Likert-scale questionnaire consisting of 15 items was distributed to measure students' engagement and learning motivation. Classroom observations were conducted during outdoor learning activities to examine students' participation and interaction.

Semi-Structured Interview: Interviews were conducted with selected students to explore their perceptions of MALL implementation.

The research instruments were validated by two experts in English language teaching and educational technology to ensure content relevance, clarity, and appropriateness for the participants. The vocabulary test obtained a Content Validity Index (CVI) of 0.87, which exceeds the acceptable threshold of 0.78, indicating that the instrument had high content validity and was appropriate for measuring students' vocabulary achievement (Polit & Beck, 2006).

The reliability of the questionnaire was measured using Cronbach's Alpha. The overall questionnaire reliability coefficient was 0.89, indicating high internal consistency. In addition, the reliability analysis for each dimension showed satisfactory results: learning motivation ($\alpha = 0.87$), student engagement ($\alpha = 0.85$), and learner autonomy ($\alpha = 0.83$). These coefficients indicate that each questionnaire dimension demonstrated acceptable reliability for educational research purposes (Taber, 2018).

Furthermore, the reliability of the vocabulary test was analyzed using the Kuder-Richardson Formula 20 (KR-20) because the test consisted of dichotomous multiple-choice items. The KR-20 coefficient was 0.86, indicating high reliability and internal consistency of the vocabulary assessment instrument. (Fraenkel, Wallen, & Hyun, 2019)

To ensure the trustworthiness of qualitative data analysis, two researchers independently coded the interview transcripts and classroom observation results. The inter-rater reliability reached 85% agreement, demonstrating consistent thematic interpretation and strengthening the credibility of the qualitative findings (Miles, Huberman, & Saldaña, 2014).

The study was conducted over six weeks. During the implementation, students used several mobile applications such as Quizlet, Google Lens, and digital vocabulary games during outdoor learning activities. Quizlet was primarily used for vocabulary practice through flashcards, quizzes, and repetition exercises. Google Lens was utilized to identify plants, animals, and environmental objects encountered during outdoor activities, enabling students to connect English vocabulary with authentic real-world objects. In addition, digital vocabulary games were implemented to increase students' engagement, motivation, and collaborative interaction during experiential learning activities (Kukulska-Hulme & Shield, 2008).

Students documented objects found in nature and practiced vocabulary related to plants, animals, and environmental contexts. These activities encouraged students to apply newly learned vocabulary directly within contextualized outdoor learning experiences (Burston & Giannakou, 2022).

Quantitative data from the pre-test and post-test were analyzed using paired-sample t-tests through SPSS. Questionnaire responses were analyzed descriptively using percentages and mean scores. Qualitative data from observations and interviews were analyzed thematically.

RESULTS AND DISCUSSION

The influence of MALL on students' vocabulary achievement

The quantitative findings showed significant improvement in students' vocabulary achievement after the implementation of MALL.

Table 1. *Comparison of pre-test and post-test vocabulary scores*

Test	Mean Score	Standard Deviation
Pre-Test	62.31	8.12
Post-Test	81.47	6.95

Before conducting the paired-sample t-test, the normality assumption was examined using the

Shapiro-Wilk test. The results indicated that both pre-test ($p = 0.121$) and post-test scores ($p = 0.089$) were normally distributed because the significance values exceeded 0.05. Therefore, the paired-sample t-test was considered appropriate for the data analysis.

The paired-sample t-test revealed a statistically significant improvement in students' vocabulary achievement after the implementation of MALL, $t(31)=8.47$, $p < 0.001$. The effect size was large (Cohen's $d = 1.87$), indicating substantial practical significance. These findings indicate that MALL effectively enhanced students' English vocabulary learning in the nature-based school environment.

Table 2. *Comparison of pre-test and post-test mean scores*

Indicator	Mean Score
Learning Motivation	4.32
Student Engagement	4.25
Learner Autonomy	4.18

The findings suggest that the integration of mobile applications with outdoor experiential learning activities positively contributed to vocabulary acquisition and contextualized language learning.

Students' engagement and motivation during MALL activities

Questionnaire findings revealed that students demonstrated positive attitudes toward MALL implementation.

Most students agreed that mobile applications made learning more enjoyable and interactive. Observation results also showed that students participated actively during outdoor vocabulary-learning activities.

Students' perceptions of MALL in contextualized learning

Interview findings indicated that students perceived MALL positively because it helped them connect English vocabulary with real-world objects encountered during outdoor learning activities.

One participant (S1) stated:

> "Learning English using mobile phones outside the classroom feels more interesting because we can directly see the objects and learn the vocabulary immediately."

Another participant (S2) explained:

> "The applications helped me remember vocabulary faster because there were pictures, sounds, and games."

These findings suggest that MALL supports contextualized and meaningful vocabulary learning by combining digital tools with authentic outdoor experiences.

Challenges and pedagogical considerations in implementing MALL

Several challenges emerged during the implementation of Mobile-Assisted Language Learning in the nature-based school environment. One major challenge involved unstable internet connectivity during outdoor learning activities, which occasionally interrupted students' access to mobile applications and online learning resources. In addition, several students were occasionally distracted by non-educational mobile applications during learning sessions.

Classroom observations also revealed that some students required additional guidance in operating mobile applications effectively during outdoor learning activities. Teachers therefore needed to provide continuous supervision and clear instructional guidelines to ensure that mobile devices were used appropriately for educational purposes.

Despite these challenges, the integration of MALL also provided important pedagogical advantages. Mobile learning applications enabled teachers to create more flexible, contextualized, and student-centered learning activities by connecting vocabulary instruction with authentic environmental objects and real-world experiences. These findings suggest that effective implementation of MALL in nature-based schools requires not only technological access but also structured classroom management and pedagogical planning.

The findings of this study demonstrate that Mobile-Assisted Language Learning significantly improved students' vocabulary achievement in a nature-based school environment. The increase in post-test scores indicates that mobile applications effectively supported vocabulary acquisition through multimedia exposure and repetitive practice. This finding is consistent with previous studies by Burston & Giannakou, 2022; Duman, G., Orhon, G., & Gedik, N. (2014) which reported that MALL enhances vocabulary learning and language retention.

In relation to the first research question, the results confirm that the implementation of MALL

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positively influenced students' English vocabulary achievement. The integration of mobile applications such as Quizlet and Google Lens enabled students to connect vocabulary learning with authentic environmental objects encountered during outdoor learning activities. This contextualized learning process may strengthen vocabulary comprehension and long-term retention because students directly interacted with real-world contexts while learning English vocabulary (Kukulska-Hulme & Shield, 2008).

Regarding the second research question, the findings revealed that MALL enhanced students' engagement and motivation during outdoor EFL learning activities. Students actively participated in vocabulary-learning tasks because mobile applications provided interactive multimedia features, immediate feedback, and collaborative learning opportunities. These findings align with previous studies indicating that mobile learning environments increase students' motivation and participation by creating more enjoyable and learner-centered instructional experiences (Tan et al., 2025; Bai, 2024).

In relation to the third research question, students perceived MALL positively because it supported autonomous and contextualized learning experiences. The interview findings demonstrated that students considered mobile learning applications practical, flexible, and effective in helping them connect English vocabulary with authentic objects found in nature-based learning activities. This finding supports the argument that MALL promotes learner autonomy by enabling students to independently manage learning activities beyond traditional classroom settings (Kukulska-Hulme, 2009).

From a theoretical perspective, this study contributes to the growing literature on technology-enhanced language learning by extending the application of MALL into alternative educational contexts, particularly nature-based schools. The findings may be interpreted through the lens of contextual and experiential learning theory, which emphasizes that meaningful learning occurs when students actively interact with authentic environments and real-life experiences. In this study, mobile technologies functioned not only as instructional tools but also as mediational resources connecting linguistic input with contextualized outdoor experiences. This interaction appears to strengthen vocabulary retention, learner autonomy, and cognitive engagement during language learning activities (Kolb, 2015).

Furthermore, the present study expands previous MALL research by demonstrating that technology-assisted learning can effectively complement experiential outdoor education rather than replace it. This finding is important because some earlier studies argued that excessive reliance on mobile devices may reduce direct social interaction and distract students during learning activities (Gómez-Trigueros & De Aldecoa, 2021). In the present study, although several students experienced distractions from non-educational applications, structured classroom management and teacher supervision helped maintain students' focus during outdoor learning activities. Therefore, the findings suggest that the effectiveness of MALL largely depends on pedagogical planning and appropriate instructional guidance.

Despite the positive findings, several limitations should be acknowledged. First, the study involved a relatively small sample size consisting of only 32 students from one nature-based school, which may limit the generalizability of the findings to broader educational contexts. Second, the intervention was conducted over a relatively short duration of six weeks, making it difficult to examine the long-term impact of MALL on vocabulary retention and other language skills. Third, the study primarily focused on vocabulary learning; therefore, future studies are recommended to investigate the effectiveness of MALL in improving other language skills such as speaking, listening, reading, and writing in experiential learning environments.

Overall, this study provides empirical evidence that Mobile-Assisted Language Learning can serve as an effective pedagogical approach for supporting contextualized English vocabulary learning within nature-based educational environments. The integration of mobile technologies with experiential outdoor activities appears to create more meaningful, flexible, and student-centered language learning experiences. These findings contribute to the growing body of research on technology-enhanced language learning and offer practical implications for EFL educators seeking to implement innovative instructional practices in alternative educational settings.

The positive influence of MALL on students' engagement and motivation also aligns with previous research emphasizing the interactive and learner-centered nature of mobile learning technologies (El, S. N., & Karakaya, S. 2009). Students appeared more enthusiastic and actively involved during outdoor learning activities because

mobile applications provided immediate access to vocabulary resources and interactive exercises.

Another important finding is that MALL facilitated contextual learning in the nature-based school environment. Students were able to connect English vocabulary directly with authentic objects and experiences encountered during outdoor activities. This supports (Burston & Giannakou, 2022) argument that mobile learning technologies strengthen contextual understanding through real-world interaction.

Furthermore, this study contributes to the existing literature by addressing the limited research on MALL implementation in alternative educational settings. Previous studies primarily focused on formal classrooms, whereas the present research demonstrates that MALL can also function effectively in experiential and outdoor learning environments.

Despite the positive findings, several challenges were identified during the implementation. Some students experienced internet connectivity issues during outdoor activities, while others were occasionally distracted by non-educational mobile applications. Therefore, teachers should establish clear learning guidelines and provide structured supervision during MALL activities.

The present findings also support recent mixed-methods studies indicating that mobile learning applications positively influence students' emotional engagement and foreign language enjoyment. (Bai, Y. (2024) reported that mobile-assisted language learning significantly improved EFL students' listening and speaking skills while reducing language anxiety. Likewise, recent studies highlighted that mobile-supported learning environments enhance students' motivation, collaborative interaction, and contextual vocabulary retention through real-world communication practices (Benlaghrissi, H., & Ouahidi, L. M. (2024 Therefore, the integration of MALL within a nature-based learning environment may provide both cognitive and affective benefits for EFL learners.

The present findings are also supported by previous studies conducted by Slamet Asari and colleagues regarding the effectiveness of technology-enhanced learning in EFL education. (Asari & Ma'ruf, 2023) reported that multimodal digital learning environments increase students' engagement and improve language learning outcomes by combining interactive multimedia resources with student-centered instructional strategies. Similarly, (Asari & Ma'ruf, 2023) found that mobile collaborative learning encourages active participation and enhances students' writing achievement through collaborative interaction and flexible learning access. These findings reinforce the argument that MALL not only improves vocabulary acquisition but also promotes learner autonomy, motivation, and meaningful language interaction in alternative educational contexts such as nature-based schools.

The present findings align with recent studies emphasizing that contextualized mobile learning environments strengthen students' vocabulary retention and learner autonomy through authentic interaction and flexible learning opportunities (Xu & Peng, 2024). Furthermore, the positive perceptions expressed by students in this study support (Zheng and Satar's 2024) findings that learners perceive mobile-assisted contextual English learning as practical, interactive, and motivating because mobile applications facilitate immediate access to authentic learning resources and contextual communication practices.

The findings are also consistent with Lee and (Drajati 2024), who reported that mobile-assisted collaborative learning activities in outdoor educational settings positively influence learner engagement and contextual communication. Therefore, the integration of MALL with nature-based experiential learning may provide both cognitive and affective benefits for EFL learners.

Overall, the integration of MALL into nature-based learning environments offers important pedagogical implications for EFL teachers seeking to create flexible, contextualized, and technology-enhanced language learning experiences.

The findings may be interpreted through the perspective of contextual and experiential learning theory, which emphasizes that meaningful learning occurs when students interact directly with authentic environments and real-life experiences. In the present study, mobile technologies functioned not merely as instructional tools but also as mediational resources connecting linguistic input with contextualized outdoor experiences. This interaction may explain why students demonstrated stronger vocabulary retention and higher engagement during outdoor learning activities.

CONCLUSION

This study concludes that Mobile-Assisted Language Learning (MALL) positively supports EFL vocabulary learning in an Indonesian nature-based school environment. The integration of mobile applications with outdoor experiential

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learning activities significantly improved students' vocabulary achievement, engagement, motivation, and learner autonomy.

The findings demonstrate that mobile technologies can effectively complement experiential outdoor learning by supporting contextualized vocabulary acquisition and meaningful language interaction. Therefore, MALL may serve as an effective pedagogical approach for EFL teachers seeking to create flexible, contextualized, and student-centered learning environments.

Despite these positive findings, this study was limited by its relatively small sample size and short intervention period. Future studies are recommended to investigate the long-term effects of MALL on broader language skills across diverse educational contexts.

Overall, this study contributes empirical evidence regarding the implementation of Mobile-Assisted Language Learning in alternative educational environments and offers practical implications for integrating technology-enhanced language learning into experiential outdoor education.

REFERENCES

Alharbi, M. A., & Khalil, L. K. (2024). Mobile applications and vocabulary acquisition in EFL classrooms: A meta-analytic review. *ReCALL*, *36*(1), 58–79. https://doi.org/10.1017/S0958344023000187

Application of artificial intelligence powered digital writing assistant in higher education: Randomized controlled trial. (n.d.). *ScienceDirect*.

Arifani, Y., Asari, S., Anwar, K., & Budianto, L. (2020). Individual or collaborative WhatsApp learning? A flipped classroom model of EFL writing instruction. *Teaching English with Technology*, *20*(1). [suspicious link removed]

Asari, S., Amiruddin, N., & Rahmad Rahim, A. (2021). Pandemi Covid-19 dan kembalinya pendidikan dalam keluarga guna pencegahan Covid-19 serta untuk mewujudkan kehidupan baru. *Journal of Community Service*, *3*(4).

Asari, S., & Ma'ruf, N. (2023). Digital authentic resource and activity needs of English major students for autonomous learning over Self-Access Center (SAC). *Edulitics Journal*, *8*(2). http://e-journal.unisda.ac.id

Aşıksoy, G., & Özdamlı, F. (2023). A systematic review of MALL vocabulary learning. *Smart Learning Environments*, *10*(1), 1–21. https://doi.org/10.1186/s40561-023-00231-7

Assessing L2 writing in the digital age: Opportunities and challenges. (n.d.). *ScienceDirect*.

Bai, Y. (2024). A mixed methods investigation of mobile-based language learning on EFL students' listening, speaking, foreign language enjoyment, and anxiety. *SAGE Open*, *14*(2). https://doi.org/10.1177/21582440241255554

Benlaghrissi, H., & Ouahidi, L. M. (2024). The impact of mobile-assisted project-based learning on developing EFL students' speaking skills. *Smart Learning Environments*, *11*(1), 1–18. https://doi.org/10.1186/s40561-024-00303-y

Brasoveanu, A., Moodie, M., & Agrawal, R. (2020). Textual evidence for the perfunctoriness of independent medical reviews. *CEUR Workshop Proceedings*, *2657*, 1–9. https://doi.org/10.1145/nnnnnnn.nnnnnnn

Burston, J., & Giannakou, K. (2022). MALL language learning outcomes: A comprehensive meta-analysis 1994–2019. *ReCALL*, *34*(2), 147–168. https://doi.org/10.1017/S0958344021000240

Cai, Y., & Zhang, L. J. (2023). Mobile-supervised collaborative dialogues and EFL learning outcomes. *Frontiers in Psychology*, *14*, Article 1187642. https://doi.org/10.3389/fpsyg.2023.1187642

Chapelle, C. A. (n.d.). *The relationship between second language acquisition theory and computer-assisted language learning*.

Chen, C. M., & Hsu, S. H. (2023). Personalized mobile vocabulary learning system for EFL learners: Effects on learning achievement and motivation. *Computer Assisted Language Learning*, *36*(5–6), 987–1008. https://doi.org/10.1080/09588221.2021.1901746

Chen, Y. C. (2024). Perceptions of AI-facilitated creativity in language education: A study on digital storytelling. *JALT CALL Journal*, *20*(3). https://doi.org/10.29140/jaltcall.v20n3.2089

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155–159. https://doi.org/10.1037/0033-2909.112.1.155

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

Dou, K., & Halim, H. A. (2024). A bibliometric study of Mobile-Assisted Language Learning research trends. *Journal of Curriculum and Teaching*, *13*(1), 56–71. https://doi.org/10.5430/jct.v13n1p56

Duman, G., Orhon, G., & Gedik, N. (2014). Research trends in mobile assisted language learning from 2000 to 2012. *ReCALL*, *27*(2), 197–216. https://doi.org/10.1017/S0958344014000287

El, S. N., & Karakaya, S. (2009). Olive tree (*Olea europaea*) leaves: Potential beneficial effects on human health. *Nutrition Reviews*, *67*(11), 632–

638. https://doi.org/10.1111/j.1753-4887.2009.00248.x

Fathi, J., & Rahimi, M. (2024). Mobile-assisted vocabulary learning strategies and learner autonomy in EFL contexts. *Language Teaching Research*, *28*(2), 345–367. https://doi.org/10.1177/13621688231124567

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). *How to design and evaluate research in education* (10th ed.). McGraw-Hill Education.

Franjić, M., & Božinovski, B. (2025). Exploring ChatGPT's impact on ESL writing proficiency: An experimental approach. *Teaching English with Technology*, *2025*(2), 53–81. https://doi.org/10.56297/vaca6841/ZDDD4208/LUZG7476

Godwin-Jones, R. (2024). Distributed agency in second language learning and teaching through generative AI. *Language Learning & Technology*, *28*(2). https://hdl.handle.net/10125/73570

Gómez-Trigueros, I. M., & De Aldecoa, C. Y. (2021). The digital gender gap in teacher education: The TPACK framework for the 21st century. *European Journal of Investigation in Health, Psychology and Education*, *11*(4), 1333–1349. https://doi.org/10.3390/ejihpe11040097

Guetterman, T. C., Fetters, M. D., & Creswell, J. W. (2023). Integrating quantitative and qualitative results in mixed methods research. *Methods in Psychology*, *8*, Article 100115. https://doi.org/10.1016/j.metip.2022.100115

Guo, P., Jeyaraj, J. J., & Razali, A. B. (2024). Collaborative MALL practices and student engagement in EFL classrooms. *Humanities and Social Sciences Communications*, *11*, Article 241. https://doi.org/10.1057/s41599-024-02741-9

Han, J., Yoo, H., Myung, J., Kim, M., Lee, T. Y., Ahn, S.-Y., & Oh, A. (2024). *RECIPE4U: Student-ChatGPT interaction dataset in EFL writing education* (arXiv:2403.08272). arXiv. http://arxiv.org/abs/2403.08272

Hidayati, T., & Suryati, N. (2025). Outdoor MALL for vocabulary acquisition in Indonesian EFL contexts. *TEFLIN Journal*, *36*(1), 45–67.

Huang, H. T. D., & Lo, Y. F. (2023). Mobile-assisted situated vocabulary learning in authentic environments. *Educational Technology Research and Development*, *71*(4), 1765–1785. https://doi.org/10.1007/s11423-023-10234-7

Huang, S. Y., & Chang, Y. J. (2024). Mobile-assisted language learning and contextualized vocabulary acquisition. *Interactive Learning Environments*, *32*(3), 456–472. https://doi.org/10.1080/10494820.2023.2176541

Indriyani, V., Fendi, H., & Haron, R. B. (2024). The influence of online self-regulated learning on BIPA teaching material development skills using the Canva application. *KEMBARA: Journal of Scientific Language Literature and Teaching*, *10*(1), 147–160. https://doi.org/10.22219/kembara.v10i1.27812

Jao, C.-Y., Yeh, H.-C., & Hung, H.-T. (2024). Exploring the effects of robot-assisted multimodal composition on students' audience awareness for English writing. *Computer Assisted Language Learning*, *38*(7), 1423–1451. https://doi.org/10.1080/09588221.2023.2300972

Johnson, R. B., & Christensen, L. (2024). *Educational research: Quantitative, qualitative, and mixed approaches* (8th ed.). SAGE Publications.

Karakaya, S. (2004). Title missing from original text. *Critical Reviews in Food Science and Nutrition*, *44*(6).

Kolb, D. A. (2015). *Experiential learning: Experience as the source of learning and development* (2nd ed.). Pearson Education.

Kukulska-Hulme, A. (2009). Will mobile learning change language learning? *ReCALL*, *21*(2), 157–165. https://doi.org/10.1017/S0958344009000202

Lai, C., & Zheng, D. (2024). Self-regulated learning in Mobile-Assisted Language Learning environments. *System*, *118*, Article 103145. https://doi.org/10.1016/j.system.2023.103145

Lee, J. S., & Drajati, N. A. (2024). Mobile-assisted collaborative learning and EFL learner engagement in outdoor educational contexts. *Computer Assisted Language Learning*, *37*(4), 612–634. https://doi.org/10.1080/09588221.2023.2198874

Lin, C. C., & Lin, V. (2023). Effects of mobile game-based language learning on EFL vocabulary acquisition and engagement. *Interactive Learning Environments*, *31*(8), 4952–4967. https://doi.org/10.1080/10494820.2022.2033695

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). SAGE Publications.

Naujoks, N., Bedenlier, S., Gläser-Zikuda, M., Kammerl, R., Kopp, B., Ziegler, A., & Händel, M. (2021). Self-regulated resource management in emergency remote higher education: Status quo and predictors. *Frontiers in Psychology*, *12*, Article 672741. https://doi.org/10.3389/fpsyg.2021.672741

Nurhayati, D. A. (2025). MALL implementation in Indonesian alternative schools. *CALL-EJ*, *26*(3), 112–134.

Pham, Q. N., & Li, M. (2023). Digital multimodal composing using Visme: EFL students' perspectives. *The Asia-Pacific Education*

p-ISSN 2301-7554, e-ISSN 2541-3643
Volume 14, Issue 2, June 2026

Researcher, *32*(5), 695–706. https://doi.org/10.1007/s40299-022-00687-w

Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Research in Nursing & Health*, *29*(5), 489–497. https://doi.org/10.1002/nur.20147

Rahman, M., & Abdullah, N. (2024). Mobile-Assisted Language Learning in ESL classrooms: A systematic review. *International Journal of Academic Research in Progressive Education and Development*, *13*(1), 214–230. https://doi.org/10.6007/IJARPED/v13-i1/20987

Rebolledo, R., Veas, C., & Gisbert, M. (2025). Refining EFL essay writing with multimodal GenAI tools. *Computer-Assisted Language Learning Electronic Journal: LatinCALL Special Issue*, *26*(6).

Shahzad, M. F., Xu, S., Lim, W. M., Yang, X., & Khan, Q. R. (2024). Artificial intelligence and social media on academic performance and mental well-being: Student perceptions of positive impact in the age of smart learning. *Heliyon*, *10*(8), Article e29523. https://doi.org/10.1016/j.heliyon.2024.e29523

Siraj, D., Zain, M., & Bowles, F. A. (2021). Mobile-Assisted Language Learning (MALL) for higher education instructional practices in EFL/ESL contexts: A recent review of literature. *Computer Assisted Language Learning Electronic Journal*, *22*(1).

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Tan, X., Cheng, G., & Ling, M. H. (2025). Investigating the mediating role of TPACK on teachers' AI competency and their teaching performance in higher education. *Computers and Education: Artificial Intelligence*, *9*, Article 100461. https://doi.org/10.1016/j.caeai.2025.100461

Tseng, W. T., & Warschauer, M. (2023). Mobile-assisted language learning and learner autonomy in EFL contexts. *Language Learning & Technology*, *27*(2), 45–63. https://doi.org/10.10125/73522

Wang, Y., & Ruey Shing, S. (2024). The effects of MALL on listening and speaking development among EFL learners. *Selangor Humaniora Review*, *8*(2), 1–29.

Wu, W. C. V., & Marek, M. (2025). Experiential mobile-assisted language learning for vocabulary development in outdoor environments. *Interactive Learning Environments*, *33*(2), 245–263. https://doi.org/10.1080/10494820.2024.2298765

Xu, B., & Peng, H. (2024). Context-aware mobile language learning and vocabulary retention among EFL students. *System*, *120*, Article 103210. https://doi.org/10.1016/j.system.2024.103210

Zhang, R., & Zou, D. (2025). Mobile-Assisted Language Learning and experiential learning environments. *Computer Assisted Language Learning*, *38*(2), 234–256. https://doi.org/10.1080/09588221.2024.2311456

Zheng, Y., & Satar, H. M. (2024). Learner perceptions of mobile-assisted contextual English learning. *Language Teaching Research*, *28*(5), 1021–1043. https://doi.org/10.1177/13621688241234567