

Integrating Duolingo in Mobile-Assisted Reading: Its Impact on EFL Learners' Comprehension and Engagement

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Abstract

This study investigates the effectiveness of Duolingo-assisted mobile learning in improving EFL students' reading comprehension and learner engagement in Indonesian vocational high school context. A quantitative approach employing a quasi-experimental design with a non-equivalent control group was used. The participants consisted of 50 eleventh-grade students of SMK Raudatus Syabab Sumberwringin, divided into an experimental group and a control group. Data were collected through reading comprehension pre-tests and post-tests and a learner engagement questionnaire. The data were analyzed using an independent-samples t-test. The results revealed a statistically significant difference between the experimental and control groups ($t(48) = -7.961, p < .001$). Students in the experimental group achieved a higher mean post-test score ($M = 80.32$) than those in the control group ($M = 62.72$). The findings also indicated high levels of behavioral, emotional, and cognitive engagement among students participating in Duolingo-assisted learning. The findings support the use of Duolingo as a supplementary tool in EFL reading instruction and mobile-assisted language learning, particularly for enhancing student engagement and reading achievement in vocational school settings. This study simultaneously examines reading comprehension achievement and multidimensional learner engagement within a Duolingo-assisted learning environment, providing empirical evidence from an Indonesian vocational EFL context that has received limited attention in previous studies.

Keywords: Duolingo, Learner Engagement, Mobile-Assisted Language Learning, Reading Comprehension

INTRODUCTION

Technology has become an integral part of contemporary education, transforming conventional teaching practices and enabling more flexible and interactive learning environments. In language education, the integration of digital tools allows educators to facilitate learning experiences that promote student engagement and adaptability. The widespread availability of smartphones and laptops enables learners to access English learning resources across various contexts, thereby fostering increased motivation and participation (Annamalai et al., 2022). A range of digital platforms, such as Grammarly, Quizizz, and Duolingo, has been widely adopted to support language instruction (Esen, 2025; Llausas et al., 2024; Permana et al., 2023).

In this context, mobile-assisted language learning (MALL) has emerged as an effective approach due to the increasing use of mobile devices and internet accessibility.

MALL enables learners to engage in interactive and multimodal learning activities supported by immediate feedback, which promotes autonomy and sustained engagement (Khan et al., 2024). In addition to supporting general language development, MALL also shows strong potential in improving reading skills by providing flexible and interactive access to digital texts. Among various applications, Duolingo provides structured and gamified learning experiences that integrate reading activities with vocabulary and comprehension tasks. This application offers free and accessible language learning through interactive exercises, adaptive feedback, and gamified elements such as points, levels, and streaks. Recent empirical studies have demonstrated that mobile-assisted language learning applications significantly enhance learners' engagement and learning outcomes. For instance, Amalia (2026) reported that Duolingo promotes sustained learner engagement through gamified and adaptive learning features. In addition, Ouyang et al. (2024) found that Duolingo positively affects EFL learners' willingness to communicate and engagement in online classes. These findings indicate that mobile-based applications are not only engaging but also pedagogically effective in supporting language learning.

From a theoretical perspective, the integration of mobile-assisted applications such as Duolingo can be explained through constructivist learning theory, which emphasizes active knowledge construction through interaction and experience. In this environment, learners engage with language input dynamically, receiving immediate feedback and repeated exposure that supports deeper understanding. In addition, the concept of self-regulated learning is relevant, as mobile applications enable learners to control their learning pace, frequency, and progression, thereby fostering greater autonomy in EFL contexts. Fathi et al. (2024) provided empirical support for this, demonstrating that Duolingo significantly enhances self-regulated learning among foreign language learners. These theoretical foundations suggest that Duolingo-mediated instruction aligns with contemporary pedagogical principles that prioritize learner-centeredness and active participation.

From a pedagogical perspective, the effectiveness of Duolingo can also be explained through constructivist learning theory, which emphasizes active knowledge construction through interaction and meaningful learning experiences. Through interactive exercises, immediate corrective feedback, and repeated exposure to language input, learners are encouraged to participate actively in the learning process rather than passively receiving information. In addition, self-regulated learning theory suggests that mobile-assisted applications enable learners to manage their own learning pace, monitor progress, and develop greater autonomy. These characteristics are particularly important in EFL reading instruction, where sustained engagement and continuous exposure to texts are essential for improving comprehension ability. Prior research has confirmed that technology-enhanced environments that promote active learning tend to yield better reading outcomes compared to traditional teacher-centered approaches (X. Chen, 2023; Majidi et al., 2025). Wang et al. (2024) further emphasized this by designing a pedagogical framework for MALL, underscoring the need for structured approaches to maximize its benefits.

Despite these advancements, reading remains one of the most challenging skills for EFL learners. Reading comprehension plays a crucial role in language learning because it enables learners to acquire information, expand vocabulary knowledge, and develop critical thinking skills. In EFL contexts, reading also serves as an important source of language input that supports the development of other language skills, including writing and speaking. Therefore, improving learners' reading comprehension is considered essential for achieving successful language acquisition. Recent studies suggest that digital learning tools can help address reading difficulties by providing structured input and immediate feedback. According to Klimova and Zamborova (2020), mobile applications support reading comprehension by enabling repeated exposure and interactive

engagement with texts. This suggests that technology-enhanced instruction can play a significant role in improving reading performance among EFL learners. The reading process becomes cognitively demanding as learners must simultaneously process vocabulary, grammar, and contextual meaning, which may overload their working memory. Without such support, learners may struggle to integrate linguistic knowledge effectively during reading activities.

According to Buttiler (2022), difficulties in reading comprehension are influenced by linguistic, cognitive, and affective factors. Limited vocabulary knowledge restricts learners' ability to understand texts (Biseko, 2025; Ngan, 2025), while insufficient mastery of reading strategies such as skimming, scanning, and inferencing, hinders effective text processing (Li et al., 2024). In addition, low motivation and reading anxiety may negatively affect learners' engagement and performance (S. Chen et al., 2022). Limited exposure to English texts further reduces reading fluency and reinforces these challenges (Ramadhianti & Somba, 2023). These conditions suggest that improving reading comprehension requires not only increased exposure but also the use of instructional strategies that promote active engagement and strategic interaction with texts. Therefore, integrating digital tools should be directed toward facilitating deeper cognitive processing rather than merely delivering content. This is particularly relevant in vocational high school settings, where students often have limited prior exposure to extensive English reading materials and may require more engaging approaches to develop their literacy skills.

Research in vocational contexts has shown the potential of Duolingo. For instance, Pusparini et al. (2025) found that Duolingo enhances speaking skills and reduces speaking anxiety, while Kurniati et al. (2025) demonstrated its effectiveness in improving oral communication skills, suggesting its broader applicability for language skill development in SMK settings. Furthermore, Furqon et al. (2025) specifically explored self-directed reading comprehension through Duolingo among novice vocational high school learners, providing direct contextual relevance for this study.

Previous studies have demonstrated that appropriate instructional strategies can improve reading comprehension (X. Chen, 2023). However, many studies still rely on conventional classroom-based approaches, with limited integration of mobile-assisted digital tools (Majdi et al., 2025; Wijaya et al., 2026). Although several applications, such as Babel, Busuu, Memrise, and Rosetta Stone, offer flexible learning opportunities, they also present limitations in terms of accessibility, feedback quality, or focus on specific language components (Alisoy, 2024; Furtak & Drabik, 2025; Şen, 2021). Compared to these platforms, Duolingo offers accessible, structured, and interactive learning experiences that allow learners to engage consistently with reading materials both inside and outside the classroom. Previous studies have reported that Duolingo supports learner autonomy, motivation, and engagement (Amalia et al., 2026; Saraswati et al., 2021), as well as improvements in language proficiency (Hasibuan & Assajidah, 2026). Nevertheless, most of these studies have focused on general language skills or learner perceptions. Only limited research has specifically examined the impact of Duolingo on reading comprehension, particularly in relation to learner engagement. Furthermore, previous studies have frequently emphasized general language proficiency, vocabulary acquisition, or learner perceptions rather than investigating reading comprehension through controlled classroom implementation. Al-Jarf (2026) emphasized that the effectiveness of mobile apps lies in the pedagogical framework guiding their use, a factor that is often underexplored in studies focusing solely on the technology itself. Learner engagement has also often been discussed as a supplementary outcome without examining its multidimensional aspects, including behavioral, emotional, and cognitive engagement simultaneously. Consequently, empirical evidence concerning the combined effect of

Duolingo on reading comprehension and learner engagement in Indonesian vocational EFL contexts remains insufficient.

This gap is more evident in vocational high school (SMK) contexts, where learners often demonstrate distinct learning characteristics and needs. Vocational students typically require more practical, hands-on learning experiences that are directly relevant to their future careers. However, English instruction in many SMK classrooms still relies heavily on teacher-centered methods and textbook-based materials, which may not adequately address students' needs for interactive and meaningful language practice. Therefore, this study aims to investigate the effect of integrating Duolingo in mobile-assisted reading on EFL learners' reading comprehension and engagement. By focusing on both learning outcomes and engagement dimensions, this study provides more specific and contextual evidence regarding the role of mobile-assisted applications in supporting reading instruction. Despite the growing body of research on mobile-assisted language learning, there remains a lack of empirical evidence that specifically examines the combined effect of Duolingo on reading comprehension and multidimensional learner engagement within vocational high school contexts. Most prior studies have focused either on general language proficiency or learners' perceptions, without simultaneously addressing cognitive outcomes and engagement constructs in a controlled experimental setting. Therefore, this study attempts to fill this gap by providing empirical data on how Duolingo-mediated reading activities influence both comprehension achievement and learner engagement in an EFL classroom. Accordingly, this study proposed the following research questions:

1. Do students who are taught using the Duolingo application in mobile-assisted reading achieve better reading comprehension scores than students who are taught using conventional reading instruction?
2. Do students who are taught using the Duolingo application demonstrate higher learning engagement than students who are taught without using the Duolingo application?

This study aims to examine the effectiveness of integrating Duolingo into mobile-assisted reading instruction in enhancing EFL learners' reading comprehension and learner engagement in a vocational high school context. Specifically, this study investigates whether students who are taught through Duolingo-assisted reading activities achieve significantly better reading comprehension outcomes than those who receive conventional reading instruction. In addition, this study explores students' behavioral, emotional, and cognitive engagement during the implementation of Duolingo-assisted learning. This study is expected to contribute both theoretical and practical insights into how gamified mobile applications influence students' cognitive, emotional, and behavioral involvement in reading activities, particularly in EFL reading instruction. The findings of this study are expected to provide practical implications for EFL teachers in integrating mobile-assisted applications into reading instruction. In addition, this study may contribute to the development of more interactive and student-centered learning environments that promote both academic achievement and learner engagement.

METHOD

This study employed a quantitative approach with a quasi-experimental design involving a non-equivalent control group (Cham et al., 2024). Two intact classes were assigned as the experimental and control groups without random assignment due to institutional constraints. Both groups were administered by a pre-test and post-test procedure. The experimental group received reading instruction integrated with Duolingo through mobile-assisted learning activities, while the control group was taught using conventional instructional methods. This design enabled a comparative analysis of the treatment effect between the two groups.

Group	Pretest	Treatment	Post-test
Experimental (E)	O1	X (Duolingo-assisted reading)	O2
Control (C)	O1	Conventional instruction	O2

Although random assignment was not feasible, the quasi-experimental design with comparable groups is widely accepted in educational research for examining causal relationships in natural classroom settings (Cham et al., 2024). This approach maintains ecological validity while allowing for meaningful group comparisons.

The research was conducted at SMK Raudatus Syabab Sumberwringin, Jember, East Java, during the 2025/2026 academic year. The participants were eleventh-grade students selected through purposive sampling to ensure comparable initial proficiency levels. Based on preliminary data, two classes with relatively similar pre-test scores were selected: XI DKV_1 as the experimental group and XI DKV_2 as the control group, each comprising 25 students. This sampling technique aligns with quasi-experimental research practices that utilize existing groups to investigate treatment effects.

Data were collected through reading comprehension tests and a learner engagement questionnaire. The reading test was administered as both a pre-test and post-test to measure students' comprehension before and after the intervention. It consisted of 25 multiple-choice items focusing on narrative texts and assessed various reading skills, including identifying main ideas, locating specific information, understanding vocabulary in context, and making inferences. The test items were developed based on the senior high school curriculum and validated through expert judgment to ensure content relevance and clarity. A pilot test involving 20 students outside the sample was conducted to evaluate item quality, resulting in several revisions. The reliability of the test was analyzed using SPSS, and item analysis was performed to ensure that each question met acceptable levels of difficulty and discrimination indices, thereby enhancing the overall quality of the instrument.

The learner engagement questionnaire was administered to the experimental group after the treatment. The instrument was adapted from established engagement frameworks by Fredricks (2004) and measured three dimensions: behavioral, emotional, and cognitive engagement. The questionnaire employed a Likert-scale format ranging from strongly disagree to strongly agree. Its validity was established through expert judgment, and its reliability was assessed using Cronbach's Alpha (Amirrudin et al., 2020; Kraemer, 2014). The use of a multidimensional engagement framework enabled a more comprehensive understanding of students' learning experiences, as engagement encompasses not only observable behavior but also emotional and cognitive involvement.

Instrument	Aspect measured	Number of items	Item format
Reading Comprehension Test	Main idea, specific information, vocabulary in context, inference	25	Multiple-choice
Learner Engagement Questionnaire	Behavioral, emotional, cognitive engagement	15	Likert-scale (1–5)

The treatment procedures in the experimental group were conducted through several stages of Duolingo-assisted reading activities. At the beginning of each session, pre-reading activities were carried out to stimulate students' interest and prepare them for the learning process. The teacher opened the lesson, checked attendance, and

introduced the learning objectives related to reading comprehension activities. To activate students' background knowledge, the teacher provided introductory questions and short reading prompts related to the topic. Subsequently, students were guided to use the Duolingo application during reading activities, where they completed interactive exercises involving vocabulary recognition, sentence comprehension, and short reading passages. Throughout the learning process, students received immediate feedback from the application and participated actively in classroom discussions guided by the teacher. At the end of the session, the teacher reviewed the learning materials and provided reinforcement to ensure students' understanding of the reading tasks.

During the while-reading activities, the teacher introduced students to reading materials integrated into the Duolingo application. Students were guided to complete interactive reading exercises involving vocabulary recognition, sentence comprehension, and short reading passages related to the lesson topics. The teacher first demonstrated how to access and complete the tasks within the application before students practiced independently. Subsequently, students engaged in various Duolingo-assisted activities, such as identifying vocabulary in context, matching words with meanings, and answering reading comprehension questions. Throughout the learning process, the teacher facilitated classroom interaction by discussing unfamiliar vocabulary, providing explanations, and encouraging students to respond to guided questions related to the reading tasks. The teacher also monitored students' progress during the activities and provided scaffolding, corrective feedback, and additional guidance whenever necessary to support students' comprehension and engagement.

In the post-reading activities, the teacher and students collaboratively reviewed the reading materials and summarized the main points learned during the lesson. The teacher facilitated reflection by discussing students' responses, difficulties, and overall learning experiences during the Duolingo-assisted activities. In addition, important vocabulary and reading strategies encountered throughout the lesson were reinforced to strengthen students' comprehension. At the end of the session, the teacher provided feedback on students' performance and introduced the learning objectives and materials for the following meeting.

The data were analyzed using both descriptive and inferential statistics. Prior to hypothesis testing, normality and homogeneity tests were conducted. The Shapiro-Wilk test was used to assess data normality, while Levene's test was applied to examine the homogeneity of variances (O'Neill & Mathews, 2002; Yitnosumarto & O'Neill, 1986). A paired-samples t-test was conducted to analyze the improvement within each group, and an independent-samples t-test was used to compare post-test scores between groups. The level of significance was set at 0.05 (Creswell & Poth, 2017). In addition, questionnaire data were analyzed descriptively using mean and standard deviation. The results were categorized into low, moderate, and high levels based on Likert scale intervals to determine students' engagement levels.

RESULT AND DISCUSSIONS

1. Descriptive Statistics and Assumption Testing

Prior to hypothesis testing, the data were examined to ensure that the assumptions of normality and homogeneity were met. The normality test was conducted using the Shapiro-Wilk test, while Levene's test was applied to examine the homogeneity of variances between groups. The results of the normality test are presented below.

Group	Test	N	Shapiro-Wilk Sig.	Interpreation
Control	Pre-test	25	0.440	Normal
Control	Post-test	25	0.235	Normal

Experimental	Pre-test	25	0.615	Normal
Experimental	Post-test	25	0.380	Normal

As shown in the table, all significance values obtained from the Shapiro–Wilk test were higher than 0.05, indicating that the data were normally distributed and fulfilled the assumption for parametric statistical analysis.

The homogeneity test was conducted using Levene's test to determine the equality of variances between groups. The results are presented in the following table.

	Levene Statistic	df1	df2	Sig.
Based on Mean	3.834	1	48	.056
Based on Median	3.115	1	48	.084
Based on the Median and with adjusted df	3.115	1	46.638	.084
Based on the trimmed mean	3.661	1	48	.062

The results showed that the significance value based on the mean was 0.056, which was higher than the significance level of 0.05. This indicates that the variances between the control and experimental groups were homogeneous. Therefore, the assumption of homogeneity was fulfilled, and the data were considered appropriate for further parametric statistical analysis.

The reliability of the research instruments was analyzed using Cronbach's Alpha. The reading comprehension test yielded a reliability coefficient of 0.722. This indicates acceptable internal consistency. The learner engagement questionnaire demonstrated a Cronbach's Alpha of 0.948 for 15 items, indicating excellent reliability.

Reliability	Cronbach's Alpha	N of Items
Reading Comprehension Test	0.722	25
Learner Engagement Questionnaire	0.948	15

2. Reading Comprehension Achievement

To investigate students' improvement within groups, a paired-samples t-test was performed. The descriptive statistics are presented in the following table.

Group	Test	Mean	N	Std. Deviation
Control	Pre-test	55.84	25	7.526
Control	Post-test	62.72	25	8.848
Experimental	Pre-test	56.48	25	8.510
Experimental	Post-test	80.32	25	6.625

The results indicate that both groups experienced improvement; however, the experimental group showed a substantially higher increase compared to the control group. The experimental group's mean score increased from 56.48 to 80.32 (an increase of 23.84 points), while the control group's mean score increased from 55.84 to 62.72 (an increase of only 6.88 points). This initial comparison suggests that while both groups benefited from instruction, the magnitude of improvement in the experimental group indicates a stronger instructional effect associated with the integration of Duolingo.

To further examine the significance of this improvement, the paired-samples t-test results are presented in the table below.

Mean Difference	t	df	Sig. (2-tailed)
-23.840	-33.528	24	0.000

The significance value ($p < 0.05$) indicates that there was a statistically significant difference between the pre-test and post-test scores in the experimental group. This finding suggests that the use of Duolingo had a significant effect on students' reading comprehension.

To compare the performance between groups, an independent-samples t-test was conducted. The descriptive statistics are shown in the table.

Group	N	Mean	Std. Deviation
Control	25	62.72	8.848
Experimental	25	80.32	6.625

The table shows that the experimental group outperformed the control group in the post-test, with a mean difference of 17.60 points. This substantial mean difference indicates that students who received Duolingo-assisted instruction achieved considerably better reading comprehension outcomes compared to those who experienced conventional instruction.

The results of the independent-samples t-test are presented in the following table.

Mean Difference	t	df	Sig. (2-tailed)
-17.600	-7.961	48	0.000

The significance value ($p < 0.05$) indicates that there was a significant difference between the two groups. This confirms that Duolingo-based instruction was more effective than conventional teaching in improving students' reading comprehension. This result provides strong statistical evidence that the integration of Duolingo contributes significantly to students' reading development beyond what is achieved through conventional instruction.

3. Learner Engagement Levels

In addition to reading performance, students' engagement was analyzed using descriptive statistics. The questionnaire measured three dimensions: behavioral, emotional, and cognitive engagement.

Dimension	N	Mean	Std. Deviation
Behavioral	25	4.08	0.54
Emotional	25	4.05	0.45
Cognitive	25	4.08	0.47

The results indicate that all dimensions of engagement were categorized as high, with mean scores ranging from 4.05 to 4.08 on a 5-point Likert scale. The behavioral engagement dimension demonstrated that students actively participated in the Duolingo-assisted learning activities, completed assigned tasks, and sustained their involvement during reading sessions. The emotional engagement dimension reflected positive affective responses toward the learning experience, including enjoyment, interest, and reduced anxiety. The cognitive engagement dimension indicated that

students invested considerable mental effort, employed learning strategies, and demonstrated self-regulation during the reading activities.

The consistently high mean scores across all engagement dimensions suggest that the use of Duolingo not only supports academic achievement but also fosters positive learning experiences. These findings indicate that students demonstrated active participation, positive emotional responses, and strong cognitive involvement during Duolingo-assisted learning, which collectively contributed to their improved reading comprehension outcomes.

DISCUSSION

The findings of this study provide empirical evidence that the integration of Duolingo in mobile-assisted reading instruction significantly improves EFL learners' reading comprehension and learner engagement. The results of the independent-samples t-test revealed a statistically significant difference between the experimental and control groups ($t = -7.961$, $df = 48$, $p = 0.000$), confirming that students who participated in Duolingo-assisted reading activities achieved substantially higher reading comprehension scores compared to those who received conventional instruction. Furthermore, the experimental group demonstrated high levels of behavioral, emotional, and cognitive engagement, with mean scores ranging from 4.05 to 4.08 on a 5-point Likert scale. These findings are discussed in relation to relevant theoretical frameworks and previous empirical studies.

1. Duolingo's Effectiveness in Enhancing Reading Comprehension

The significant improvement in reading comprehension observed in the experimental group aligns with the core principles of Mobile-Assisted Language Learning (MALL), which posits that mobile technologies promote flexible, interactive, and autonomous learning environments that enhance language learning outcomes (Wang et al., 2024; Zhang & Pan, 2025). The experimental group's mean score increased from 56.48 to 80.32, representing a gain of 23.84 points, whereas the control group improved only from 55.84 to 62.72 (a gain of 6.88 points). This substantial difference underscores the pedagogical value of integrating gamified mobile applications into reading instruction.

The effectiveness of Duolingo can be attributed to several key pedagogical mechanisms. First, the application's immediate feedback system enables learners to identify and correct errors in real time, which supports the process of language acquisition through error awareness and self-correction (Jiang et al., 2024). This feature is particularly valuable in reading comprehension, where learners often struggle to recognize their misunderstandings independently. Second, gamification elements such as points, levels, and streaks provide extrinsic motivation that sustains learner engagement and encourages consistent practice (Shortt et al., 2023). The repetitive exposure to vocabulary and reading passages through gamified activities reinforces word recognition and contextual understanding, which are essential components of reading comprehension (Klimova & Zamborova, 2020).

Moreover, the scaffolded learning structure of Duolingo guides learners from simpler to more complex tasks, reducing cognitive overload and facilitating incremental comprehension development (Yang & Ying, 2025). This aligns with Vygotsky's (1980) concept of the Zone of Proximal Development (ZPD), where learners achieve higher levels of understanding through structured support and gradual progression. The application's ability to adapt to individual proficiency levels further enhances this process, allowing each learner to progress at their own pace. This finding extends the work of Loewen et al. (2019), who reported that Duolingo users demonstrated measurable language proficiency gains, by specifically

demonstrating its effectiveness in improving reading comprehension within a vocational high school context.

The findings also corroborate recent studies that have examined the impact of Duolingo on specific language skills. For instance, Pratama and Lolita (2025) found that a gamified approach using Duolingo strengthens vocabulary and reading competence, supporting the present study's results. Similarly, Yang and Ying (2025) reported that Duolingo positively affects L2 reading, self-efficacy, and learner experiences, which is consistent with the significant improvement observed in the experimental group. The present study extends these findings by focusing specifically on vocational high school students, a population that has received limited attention in previous Duolingo research.

2. Learner Engagement as a Mediating Factor

The high levels of engagement demonstrated by the experimental group provide additional insight into the effectiveness of Duolingo-assisted instruction. Engagement was measured across behavioral, emotional, and cognitive dimension as conceptualized by Fredricks et al. (2004). The mean scores for all dimensions exceeded 4.00 on a 5-point scale, indicating consistently high engagement.

Behavioral engagement was reflected in students' active participation, task completion, and sustained involvement during Duolingo-assisted reading activities. This finding aligns with the work of Indrawan et al. (2023) and Suherman et al. (2024), who reported that Duolingo enhances students' motivation and engagement in EFL classrooms. The gamified features of the application appear to be particularly effective in encouraging behavioral engagement, as students are motivated to complete tasks to earn points and maintain streaks. This observation is consistent with Shortt et al. (2023), who noted that Duolingo's game-like environment promotes sustained learner engagement through immediate rewards and progress tracking.

Emotional engagement was demonstrated through students' positive affective responses, including interest, enjoyment, and reduced anxiety toward reading activities. This finding is particularly significant given the well-documented challenges of reading anxiety in EFL contexts (van Gelder et al., 2026; Yousefabadi et al., 2022). The interactive and low-stakes nature of Duolingo's reading exercises appears to create a supportive learning environment that mitigates reading anxiety and fosters positive attitudes toward reading in English. This aligns with Pusparini et al. (2025), who found that Duolingo reduces speaking anxiety in vocational education, suggesting that its affective benefits may extend to other language skills, including reading.

Cognitive engagement reflected students' investment of mental effort, use of learning strategies, and self-regulation during reading activities. This dimension is particularly important because it indicates that students were not merely passively consuming content but actively processing information and employing strategies to understand texts. The self-regulated learning features of Duolingo, such as progress tracking and personalized pacing, appear to support cognitive engagement by enabling learners to monitor their own learning and adjust their strategies accordingly (Fathi et al., 2024). This finding supports the theoretical framework of self-regulated learning, which emphasizes the importance of learner autonomy in successful language acquisition (Zimmerman, 2002).

The relationship between engagement and reading comprehension is consistent with the constructivist learning theory, which emphasizes active knowledge construction through interaction and experience. In the Duolingo-assisted learning environment, students engaged dynamically with language input, receiving immediate feedback and repeated exposure that supported deeper understanding. This interaction is a key mechanism through which learning occurs, as learners actively construct meaning rather than passively receiving information. The high engagement

scores in this study suggest that Duolingo effectively facilitates this active learning process, leading to improved comprehension outcomes.

CONCLUSION

This study examined the effect of integrating Duolingo in mobile-assisted reading instruction on EFL learners' reading comprehension and engagement in a vocational high school context. The findings provide robust empirical evidence that Duolingo-assisted instruction significantly improves students' reading comprehension achievement and promotes high levels of behavioral, emotional, and cognitive engagement. The experimental group, which received Duolingo-integrated reading instruction, demonstrated a substantial mean score increase from 56.48 to 80.32, outperforming the control group that received conventional instruction (mean score increase from 55.84 to 62.72). The independent-samples t-test confirmed a statistically significant difference between the two groups ($t = -7.961$, $df = 48$, $p = 0.000$), indicating that the integration of Duolingo was more effective than conventional teaching methods in enhancing reading comprehension. In addition to academic achievement, the study revealed that students in the experimental group exhibited consistently high engagement across behavioral, emotional, and cognitive dimension with mean scores ranging from 4.05 to 4.08 on a 5-point Likert scale. This finding underscores the multidimensional benefits of Duolingo-assisted learning, as it not only facilitates cognitive development but also fosters positive affective responses and active participation. The interactive, gamified, and self-paced nature of Duolingo appears to create a learning environment that sustains learner motivation, reduces reading anxiety, and encourages autonomous learning.

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