

The effectiveness of Duolingo in reinforcing English learning and the perceptions of struggling EFL students

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Highlights

- This study investigates the impact of Duolingo as a mobile-assisted language learning tool on struggling A1-level university EFL learners using a quasi-experimental design.
- Results show statistically significant improvement in the experimental group compared to the control group, highlighting the effectiveness of structured digital reinforcement.
- The findings connect CALL/MALL principles with sociocultural and motivational theories, offering practical implications for integrating gamified mobile tools in higher education language instruction.

Abstract

The widespread availability of technological tools for teaching and learning has motivated instructors at all levels of education to place more emphasis on integrating technology into the classroom. Mobile Assisted Language Learning (MALL) tools and the advancement in Web 2.0 applications have transformed instructional enhancements to be more convenient, practical, and accessible in all fields of academia including language learning. This study thought it was worthy to appraise the effectiveness of employing an educational technology such as Duolingo for language learning on struggling university-level English as a Foreign Language (EFL) learners in Türkiye and explore the students' perceptions toward the implementation. A quasi-experimental study was conducted on 38 participants of the English preparatory school of a private university divided into an experimental group (N=19) and a control group (N=19) with a Duolingo intervention applied to the experimental group for four weeks. The results revealed that the intervention of utilizing Duolingo as a reinforcement tool alongside conventional schooling significantly improved the achievement levels of the participants and comparatively, the learners demonstrated favorable emotions toward the scheme of utilizing the educational enhancement.

Article Info: Research Article

Keywords: *educational technology, instructional technology, ELT, ESOL, language learning*

1. Introduction

John King, the U.S. Secretary of Education, proclaims, “One of the most important aspects of technology in education is its ability to level the field of opportunity for students” (Office of Educational Technology, 2017, p.3). Raja and Nagasubramani (2018) assert that the utilization of modern technological equipment, tools, and resources leads to enhanced student engagement, learning outcomes, and interaction. The US Office of Educational Technology (OET) attests that the adoption of technology has the potential to significantly impact and enhance the process of acquiring knowledge and skills (Office of Educational Technology, 2017). OET further confirms that technology can strengthen and progress the connections between educators and students, revolutionize the methods of learning and cooperation, reduce persistent

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disparities in equity and accessibility, and modify learning experiences to cater to the requirements of all learners (Office of Educational Technology, 2017).

The implementation of technology has long been utilized in the field of language learning via the concept of Computer Assisted Language Learning (CALL) with applications such as game-based learning and automatic speech recognition (Beatty, 2010; Nst et al., 2023). As technology has become more widespread, compact, and convenient, it has become even more of an inevitable tool for both educators and students to take advantage of in language education. Within the last decade, the field of language acquisition has been exposed to portable applications through the advancements of Mobile Assisted Language Learning (MALL) and Web 2.0 applications such as Moodle, Canvas, Google Classroom, and Padlet (Arvanitis & Krystalli, 2021; Chakowa, 2018). On another note, more and more software, websites, and mobile applications have emerged to aid language learners with their learning process (e.g., Busuu, Memrise, and Babble). One other very popular language learning tool that this study has adopted in the exploration of effectiveness in language learning is the enhancement of Duolingo. According to Freeman et al. (2023), since Duolingo enhances language skills by integrating entertaining and exciting mini-lessons that imitate the experience of gamification, it has become an all-time favorite application among language students around the world.

There have been certain studies that focused on Duolingo and its ability to aid learners with the language acquisition process. Finardi et al. (2016) inquired about learner perceptions of acquiring an L2 with Duolingo, while Ajisoko (2020) looked into vocabulary development with Duolingo. Hazar (2022) inquired into a talented language student's perception of the effectiveness of the application, and Peláez-Sánchez and Velásquez-Durán (2023) analyzed Duolingo's ability to enhance linguistic competence as an aspect of communicative abilities. Apart from the mentioned research, this study holds the view that there is insufficient data on how effective Duolingo could be in assisting EFL learners who are specifically challenged by acquiring a foreign language due to various demographical attributes such as: (1) having insufficient background in the English language and (2) learning foreign language at adulthood (i.e., surpassing the critical period of language acquisition). Although prior research acknowledges MALL applications as accessible and engaging learning tools, the existing body of literature has largely focused on typical learners or high-achieving individuals rather than those who struggle significantly with foundational language acquisition (Noyan et al., 2023; Sürüç Şen, 2021). The limited attention to adult A1-level learners represents a meaningful gap, particularly because these individuals often require sustained reinforcement, structured guidance, and motivational support that extend beyond conventional instructional practices.

The study further argues that the empirical evidence attained from this study could shed light on the efficiency of utilizing technology for language learning, especially for those students who struggle with the process, and provide insight into the benefits of implementing educational enhancements (e.g., Duolingo) into the instructional curricula of language education establishments worldwide. By centering the investigation on struggling adult learners, the study contributes original evidence to an understudied area of educational technology research and underscores the importance of matching digital tools to the needs of specific learner profiles.

2. Literature

2.1 Technology in Education

The proliferation of technological teaching and learning tools has led to a heightened emphasis on the integration of technology in education among instructors across various educational levels (Sellami et al., 2024). The utilization of electronic and digital technologies is widely regarded as a means to augment the process of learning and offer a favorable educational encounter for students of all backgrounds (Flair, 2023). The expansion of technology has facilitated the administration of educational programs, enabling

more effective tracking and analysis of student development. This enables a precise adjustment of learning outcomes and their accompanying curricular components. From the historical overhead projectors and cassette recorders to today's augmented reality, Dron (2022) makes the argument that educational technology can be provisionally described as a field that encompasses the purposeful integration of pedagogies inside the technologies it coordinates. Dron (2022) further states that a variety of educational technologies, such as learning management systems (LMS), e-books, smartboards, and online courses, are specifically created and marketed to facilitate learning. However, Dron (2022) notes that nearly any technology, ranging from industrial machinery to word processing software, can be effectively utilized to support or promote learning when combined with suitable pedagogical approaches and other complementary technologies. Liu (2013) asserts that instructional technology serves as a conduit that facilitates the connection between human reproduction and the elucidation of the principles governing the advancement of scientific knowledge, while aiming to apply legal principles to practical scenarios and explore suitable methodologies to enhance the efficiency and efficacy of human reproduction.

On the other hand, Johnson and Jacovina (2016) question both the external and internal challenges of technology utilized in the classrooms today. According to the authors, firstly, some issues are unassociated with the instructor, such as (1) access (i.e., the deployment of educational technology is not viable in the absence of sufficient computer resources and high-speed internet connectivity), (2) training (i.e., in the absence of adequate professional development opportunities focused on emerging technologies, instructors may lack the necessary proficiency to fully use their potential) and (3) support (i.e., insufficient administrative and peer support, as well as poor technical guidance, are significant obstacles to integrating technology). Secondly, Johnson and Jacovina (2016) illustrate the following internal challenges concerning the instructors with education technology: (1) attitudes and beliefs (e.g., when educators do not anticipate new technology to be beneficial or lack confidence in their ability to effectively utilize these technologies) and (2) teacher resistance (e.g., when traditional instructional strategies adequately address the requirements of students, the teacher may see less incentive to include technology). Bearing in mind both the benefits and challenges of implementing technology into instruction, institutions and educators must (1) evaluate and assess the effectiveness of the technology for learning, (2) offer training and ongoing support, and (3) accept feedback from stakeholders and reconstruct the technological schemes accordingly (Islam et al., 2024). These considerations demonstrate that educational technology is not inherently transformative but becomes effective only when it is aligned with pedagogical intent, supported by institutional structures, and meaningfully integrated into learning environments. For this reason, studies examining specific tools such as Duolingo must not only evaluate learning outcomes but also consider how these technologies interact with the needs, limitations, and characteristics of particular learner groups.

2.2 Technology in Language Learning

MALL

As technological gadgets and enhancements became more compact and portable, the augmentation of the computer-assisted learning applications (CALL) deviated into mobile devices such as smartphones, tablets, and smartwatches under the emerging notion of Mobile Assisted Language Learning (MALL) (Li et al., 2023). According to Arvanitis and Krystalli (2021), mobile devices enable new teaching strategies that are often unattainable with standard educational tools. The researchers also point out that new technologies give teachers and students the flexibility to access course materials whenever they want, from anywhere, and to participate in learning opportunities outside of the classroom. MALL applications offer unique learning opportunities that take language learning one step further and provide the digital generation of learners with distinct benefits. As Karsenti et al. note, MALL practices can be used to encourage the use of recognizable technologies to increase student enthusiasm, support the use of the target language as a communication tool, and reinforce the educational process by selecting tasks with real-world relevance (Arvanitis & Krystalli, 2021). Research has proven that MALL implementations are suitable to enhance various skills of English language acquisition such as listening comprehension (Mujiono, 2023), speaking

fluency (Hwang et al., 2016), vocabulary development (Katemba, 2021), and pronunciation (McCrocklin, 2019).

An indispensable component of MALL is the utilization of the Internet. As mentioned in earlier sections, the downside to many educational technologies is their dependence on stable access to the Web. On the brighter side, when a reliable connection is available, a wide range of Web 2.0 applications can be employed through MALL (Mohammed et al., 2020). According to Hew and Cheung (2013), the use of Web 2.0 technologies and social media platforms enables students and educators to establish connections with individuals who have similar interests or expertise, thereby enhancing the learning experience and contributing to a sense of community (Mohammed et al., 2020). Some common forms of MALL applications utilized in the field of education and language learning are in the form of LMS platforms, such as Moodle, Canvas, NEO, and Blackboard. In addition, specific Web 2.0 applications such as Padlet, Google Classroom, Flipgrid, Kahoot, and Mentimeter can be directly implemented into instructional practices. It is important to keep in mind that, similar to CALL, mobile applications carry limitations (Mohammadi & Shirkamar, 2018). These include restricted access to audiovisual content, difficulties with mini keyboards, storage limits, and the fact that many mobile devices were not designed with education as their primary purpose. Lastly, self-directed applications have become popular in the realm of MALL. Students can download and utilize many types of applications to either learn a language from scratch or reinforce acquired skills (Kruchinin & Bagrova, 2021). Kruchinin and Bagrova (2021) highlight several m-learning applications designed to support language acquisition, such as LinguaLeo, Babbel, British Council apps, Memrise, and Busuu.

2.3 Evaluating Educational Technology

When employing e-learning tools, educators commonly try to choose an enhancement that is specifically developed to facilitate and enhance student learning (Anstey & Watson, 2018). However, this task could be a daunting process for most instructors due to the availability of vast amounts of technological tools in the market and the fact that instructors may not possess the requisite proficiency in determining the optimal standards for assessing e-learning resources (Anstey & Watson, 2018). There are a few frameworks that instructors could employ to evaluate a particular instructional enhancement before and after the imposition of teaching practices. First, educators could adopt the SAMR model for appraising any educational technology prior to implementation (Zamri & Mohamad, 2024). As asserted by Zamri and Mohamad (2024), the SAMR model has four distinct categories that pertain to the use of technology in educational contexts to facilitate learning activities: substitution, augmentation, modification, and redefinition. Although the framework was developed to assess e-learning applications, it is an appraisal scheme that can be adapted to evaluate websites and Web 2.0 applications as well.

Another approach to assessing the effectiveness of educational technologies is the Rubric for E-Learning Tool Evaluation (ReLTE) developed by Western University (Anstey & Watson, 2018). According to Anstey and Watson (2018), the ReLTE framework includes the following eight components with regard to using technology for instruction: teacher presence, social presence, safety, mobile design, functionality, accessibility, technicality, and cognitive presence. Educators should adopt an instrument such as the ones mentioned above that appraise instructional effectiveness, learning outcomes, and the strengths and limitations of the educational tool.

2.4 Duolingo For Learning

According to Freeman et al. (2023), the Duolingo language application is widely recognized as the leading language learning platform and the most frequently downloaded educational application on a global scale. The authors further assert that the application enhances the process of acquiring new languages by incorporating enjoyable and stimulating mini-lessons that simulate the experience of playing games. Permatasari and Aryani (2023) highlight the fact that Duolingo incorporates instruction in several aspects of English language proficiency, encompassing listening, speaking, reading, and writing abilities. Moreover, when enrolling in Duolingo, learners have the option to select their desired proficiency level depending on their pre-test results (Permatasari & Aryani, 2023). Another benefit to Duolingo is that the program is accessible both from a mobile phone via an application and through a personal computer via a website. Therefore, users who do not possess smartphones can also benefit from the scheme through a computer.

As mentioned above, Duolingo targets all major skills of a language. Essafi et al. (2024) summarize the type of activities that the application offers to the users as follows: translation, matching, pairing, listening, and speaking tasks. Furthermore, with the help of Duolingo, students may feel more confident about accomplishing their learning objectives and overcome their anxiety about taking on a task as difficult as learning a language. The program allows learners to feel a sense of accomplishment through short practice sessions, which sustains engagement. Duolingo has been able to maintain learners' attention and reduce their self-consciousness about learning by gamifying the language acquisition process (Essafi et al., 2024). Lastly, the application shows student progress by publishing weekly performance reports and sending reminders via email or mobile notifications that encourage continued participation.

Despite the benefits of Duolingo, it is essential to mention some of the setbacks and deficiencies of the program. One drawback is that the app uses a computerized voice, thus, there is no interaction with real-life speakers (Essafi et al., 2024). Second, Finardi et al. (2016) state that Duolingo falls short in fostering comprehensive language development due to its limited opportunities for engagement and the absence of contextualized language creation. Third, Vizcarra Bazan (2022) reports that some educators hold the view that the degree of proficiency provided by this application is quite low, indicating it does not significantly contribute to one's English language aptitude. Lastly, Grygo and Gajek (2019) stress the fact that most phrases and word sequences that need to be translated appear as fragments of longer texts and are introduced without background information, making the examples seem impractical in everyday circumstances.

2.5 Previous Studies

There have been various studies that have looked into the effectiveness of using Duolingo in the learning endeavors of English. Yildiz (2020) employed a cross-sectional survey on Turkish adult mobile device owners' use of applications for learning language. The study's findings revealed that out of the 177 participants surveyed, only 49.7 percent utilized an application for language learning on their mobile devices. Duolingo was assessed to be the most widely used among the participants, with the Busuu app being second. According to Yildiz (2020), the top three reasons for utilizing language applications were vocabulary development, improving speaking, and enhancing listening.

Ajisoko (2020) conducted an experimental study on 19 students in Tarakan who utilized Duolingo for 30 days to improve their English vocabulary. The pre-test and post-test results revealed a notable enhancement in the average scores of the students. Jiang et al. (2021) executed an experimental study on 225 participants who had little or no proficiency in the target languages of Spanish and French when they adopted Duolingo as their learning tool. The study's findings provided compelling evidence that online language learning products may serve as effective tools for acquiring a second language, particularly in the areas of reading and listening proficiency.

Hazar (2022) conducted a case study to examine the perceptions of a highly talented Turkish student who dedicated around two months to acquiring proficiency in French using the Duolingo platform. The results showed that although the student found Duolingo engaging and user-friendly, their overall perception of the software was not entirely favorable, suggesting that talented learners may not derive the same benefits as struggling learners. Kuşcu and Zaimoğlu (2022) observed the opinions of 15 Turkish EFL lecturers on the utilization of Information and Communication Technology (ICT) in English language teaching. The study attested that instructors demonstrated the ability to modify and enhance their perspectives, since they held the authority to apply innovative practices that could impact the learning environment.

Although these studies provide valuable insights into learner perceptions, vocabulary development, and general learning outcomes through Duolingo, most of the existing research has concentrated on typical learners, higher-performing individuals, or general adult populations. Only limited empirical attention has been devoted to struggling adult EFL learners, particularly those at the A1 proficiency level who begin with minimal or unstable linguistic foundations. This group may respond differently to mobile-assisted language learning due to the need for structured reinforcement, reduced cognitive load, and supportive feedback mechanisms.

The present study seeks to contribute to this underexplored area by examining both the achievement levels and perceptions of struggling university-level learners who used Duolingo as a reinforcement tool. By focusing on a population with consistently low placement scores, the study offers new empirical evidence regarding whether and how Duolingo may function as an effective supplementary resource for learners who require additional support beyond traditional classroom instruction.

2.6 Research Aim

Educational technologies provide the opportunity for educators to teach and reinforce content in ways that would not be possible through conventional teachings (Hamilton et al., 2016). Instructional enhancements such as Duolingo can be utilized as a reinforcement tool that could be especially beneficial for learners who are challenged in the classrooms due to insufficient backgrounds or low capabilities in acquiring a new language. Even though previous research has looked into learning languages through educational applications such as Duolingo (Hazar, 2022), Busuu (Khairunnisa et al., 2021), Memrise (Luczak, 2017), and Babbel (Kessler et al., 2023), there has not been a sufficient amount of empirical data to evaluate the effectiveness of educational technologies on struggling university students, defined here as those with English placement test scores averaging between 0 and 30 percent. The lack of targeted research on learners with minimal proficiency represents a notable gap, particularly because this group often requires repeated practice opportunities, explicit feedback, and structured reinforcement that may not be consistently available in traditional classroom settings. While general adult learners and highly proficient individuals have been examined in previous studies, struggling A1-level university students constitute a distinct population whose learning trajectories may respond differently to mobile-assisted approaches.

This quasi-experimental study aims to discover the extent of efficacy in implementing the use of Duolingo as an educational technology in the English learning endeavor of university-level adult learners and gather their perspectives on the experience with the following two research questions:

RQ1: Is there a significant difference in the achievement levels of EFL learners who use educational technology (e.g., Duolingo) for English learning compared to those who do not?

H01: There is no significant difference in the achievement levels of EFL learners who use educational technology (e.g., Duolingo) for English learning and those who do not.

RQ2: Do EFL learners perceive educational technology (e.g., Duolingo) as a beneficial reinforcement tool in their English learning process?

H02: EFL learners' perceptions do not significantly indicate favorable outcomes regarding the use of educational technology (e.g., Duolingo) as a reinforcement tool in their English learning process.

By addressing these research questions, the study seeks to determine whether Duolingo provides measurable academic benefits for low-performing adult learners and whether these learners view the tool as a meaningful supplement to traditional instruction. The focus on struggling learners positions the study to contribute new empirical evidence to the field of educational technology and online learning, supporting educators and institutions in making informed decisions about integrating mobile-based reinforcement tools.

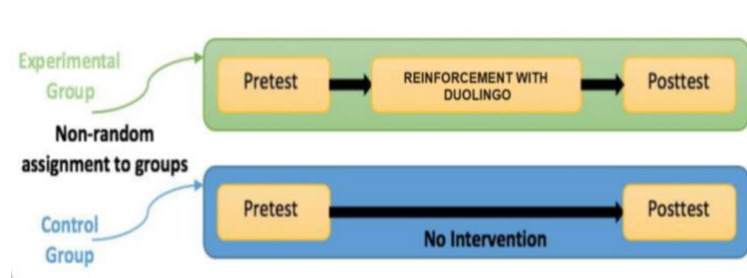
3. Methodology

3.1 Design and Implementation

The study adopted a quantitative, quasi-experimental design with a nonrandom assignment to explore the effectiveness of an educational technology, Duolingo for this instance, in the English learning of struggling university-level EFL learners in a private university in Türkiye. Creswell and Creswell (2018) emphasize that in many educational environments, it is sometimes impractical to randomly assign students to different conditions, leading researchers to employ a quasi-experimental design as an alternative. According to Creswell and Creswell (2018), quasi-experiments bear resemblance to actual experiments in all aspects, with the exception that they do not employ random assignment to establish the comparisons used to infer treatment-induced change. The study employed a control group and an experimental group with the intervention of Duolingo only being applied to the experimental group for a duration of four weeks. Because the participants were identified as struggling learners through placement exam scores, random assignment was not feasible without disrupting institutional grouping procedures. Figure 1 below demonstrates the quasi-experimental design of the research.

Figure 1

Quasi-Experimental Design with Duolingo



As displayed in Figure 1, the study consisted of two nonrandomized groups: experimental and control. A pre-test, which was an open-access English level exam obtained from a reputable English book publisher, was administered to both groups. The intervention followed, consisting of reinforcement of English instruction with Duolingo for the experimental group only. Both groups continued with their regular institutional English lessons, consisting of four 50-minute class periods daily. Instruction focused on grammar, listening, reading, and writing and followed the institution's standard curriculum using teacher-led activities and textbook-based materials. To monitor student progress, a Duolingo classroom was established that recorded user activity. A WhatsApp group supported communication and troubleshooting for the experimental group. At the end of the implementation, the same level exam was administered as the post-test to both groups. The use of the same test for both administration points was intentional in order to measure relative change rather than evaluate separate skills; however, this approach may have introduced familiarity effects, which should be acknowledged as a methodological limitation. Furthermore, the duration of four weeks reflects institutional constraints due to an academic holiday period, which is addressed in the limitations section.

3.2 Participants and Sampling

The study employed a non-probability sampling method that used both convenience and purposive approaches to select its participants. Gerrish and Lacey (2010) define convenience sampling as a method that enables researchers to recruit participants in the most approachable way possible, while purposive sampling is a technique in which individuals from a predetermined group are specifically selected.

The participants were students who were assessed to have the lowest level of English in the preparatory school of a private university in Türkiye. All participants scored between 0 and 35 out of 100 on the institutional placement exam and were considered A1-level learners based on the CEFR framework. Each group consisted of nineteen students. The selection of this population was deliberate, as struggling learners represent an understudied group in MALL-based research. Their inclusion supports the study's aim to generate empirical data on whether reinforcement tools such as Duolingo may be particularly effective for learners with limited linguistic foundations.

3.3 Demographics

Demographic information was collected prior to implementation. For the experimental group, there was one male and eighteen female students. The age range was predominantly between 18 and 22, with two outliers aged 40 and over 60. Nine students were psychology majors, and ten were in the translation and interpretation department. Seven participants reported previous exposure to Duolingo. For the control group, eight participants were male, and eleven were female. Most were between 18 and 22 years old, with one participant aged 29.

3.4 Ethics

According to McMillan and Schumacher (2014), researchers should consistently maintain transparency and integrity when interacting with participants, ensuring that all components of the study are openly communicated. The objectives of the research were clearly explained to the participants of the study and the selection of the experimental group and the control group was done voluntarily with the written consent of the participants. Fraenkel et al. (2012) also argue that research should be carried out with consideration for the participants' well-being and dignity, adhering to professional standards and federal, state, and local laws that regulate research involving human subjects. The consent forms provided information about the study's objectives, potential advantages, privacy protection measures, and the participants' voluntary participation in the research, and written permission was obtained from the director of the university's department of foreign languages for the study's execution and dissemination.

4. Data Collection

A 100-item English level exam was used to gather pre- and post-test data. The appropriateness of the exam and testing conditions were confirmed with testing office coordinators at the institution. Students were given one hour to complete the exam in both administrations to replicate the format of institutional assessments. After the four-week intervention period, the same exam was administered to both groups. Exams were graded and scores were recorded in an Excel workbook under four categories: pre-test experimental, pre-test control, post-test experimental, and post-test control. Survey data were collected from ten volunteers in the experimental group using an eight-item Likert-scale questionnaire. The survey was validated by three subject matter experts (SMEs) and piloted with three colleagues prior to administration. Table 1 below illustrates the survey items that the participants had to answer through a Google Form.

Table 1*Duolingo Online Survey Items*

Item #	Statement
1	Duolingo is an effective way to learn English.
2	Duolingo is an easy-to-use application for learning English.
3	Duolingo offers a fun way to learn English.
4	Duolingo motivated me to learn English.
5	Duolingo increased my confidence in learning English.
6	Duolingo offered a more convenient way to learn English than traditional classrooms.
7	Duolingo is an application that I would recommend to my friends.
8	Educational technologies such as Duolingo should be integrated into traditional education.

As demonstrated in Table 1 above, the English learning via Duolingo survey was constructed to gain the perspectives of the experimental group toward the implementation of the application as a reinforcement tool in the language learning process of the students. Moreover, all eight items in the survey comprise statements that support, favor, and advocate English learning with the assistance of the educational enhancement of Duolingo. Therefore, the responses would indicate whether the learners appreciated or rejected the utilization of the educational technology as a part of their language learning endeavor.

5. Data Analysis

5.1 Paired Sample T-Tests

To address the first research question, “*Is there a significant difference in the achievement levels of EFL learners who use educational technology (e.g., Duolingo) for English learning compared to those who do not?*”, both within-group and between-group analyses were conducted. Prior to the inferential analyses, the normality of score distributions was examined. Skewness and kurtosis values for all pre-test and post-test scores fell within the acceptable range of ± 1 , indicating approximate normal distribution and satisfying the assumptions required for parametric testing. Descriptive statistics for both the experimental and control groups are presented in Table 2. The results indicate that the experimental group demonstrated an increase in mean scores from pre-test ($M = 55.58$, $SD = 15.55$) to post-test ($M = 59.21$, $SD = 15.14$), resulting in a mean gain of 3.63 points. In contrast, the control group showed a slight decrease from pre-test ($M = 54.84$, $SD = 14.69$) to post-test ($M = 53.05$, $SD = 15.39$), yielding a mean decline of 1.79 points.

Table 2*Pre-test and Post-test Descriptive Statistics*

Group	N	Pre-Test M	Pre-Test SD	Post-Test M	Post-Test SD	Mean Gain	Gain SD
Experimental	19	55.58	15.55	59.21	15.14	+3.63	4.02
Control	19	54.84	14.69	53.05	15.39	-1.79	5.13

Paired-samples t-tests were conducted to determine whether these within-group changes were statistically significant. As shown in Table 3, the experimental group demonstrated a statistically significant improvement, $t(18) = 3.89$, $p = .001$, with a large effect size (Cohen’s $d = 0.89$). Conversely, the control group did not exhibit a statistically significant change, $t(18) = 1.52$, $p = .145$. Table 3 presents the paired-samples t-test results for both groups.

Table 3*Paired Sample T-Test for Pre-test and Post-tests*

Group	t	df	p (two-tailed)	Cohen's d
Experimental	3.89	18	.001	0.89
Control	1.52	18	.145	0.35

As shown in Table 4, an independent-samples t-test was conducted to compare the gain scores of the experimental and control groups. The analysis revealed a statistically significant difference between the two groups, $t(36) = 3.61$, $p = .001$. The experimental group demonstrated a mean gain of 3.63 points, whereas the control group exhibited a mean decline of 1.79 points. The effect size was large (Cohen's $d = 1.17$), indicating that the magnitude of the difference between groups was substantial.

Table 4*Independent Samples t-Test on Gain Scores*

Comparison	t	df	p (two-tailed)	Cohen's d
Experimental vs Control	3.61	36	.001	1.17

5.2 Online Survey Analytics

As mentioned in the previous sections, an online survey was distributed to the experimental group participants to obtain their perceptions of the intervention (i.e., utilization of the Duolingo app) used in the study. The questionnaire consisted of eight items with a five-point Likert Scale (1=completely disagree, 2=disagree, 3=not sure, 4= agree, and 5=completely agree) and a total of ten participants responded to the eight statements. To measure the reliability and consistency of the items, the Cronbach Alpha analysis was executed. According to Cohen et al. (2018), the Cronbach alpha measures the degree of inter-item correlations, specifically the correlation between each item and the total sum of all other items. The Cronbach Alpha analysis is an assessment of the degree of coherence within the elements. Table 5 below provides the results of the Cronbach analysis of the survey items utilized in the study.

Table 5*Cronbach Coefficient for Survey Items*

Cronbach Coefficient	N
0.846	8

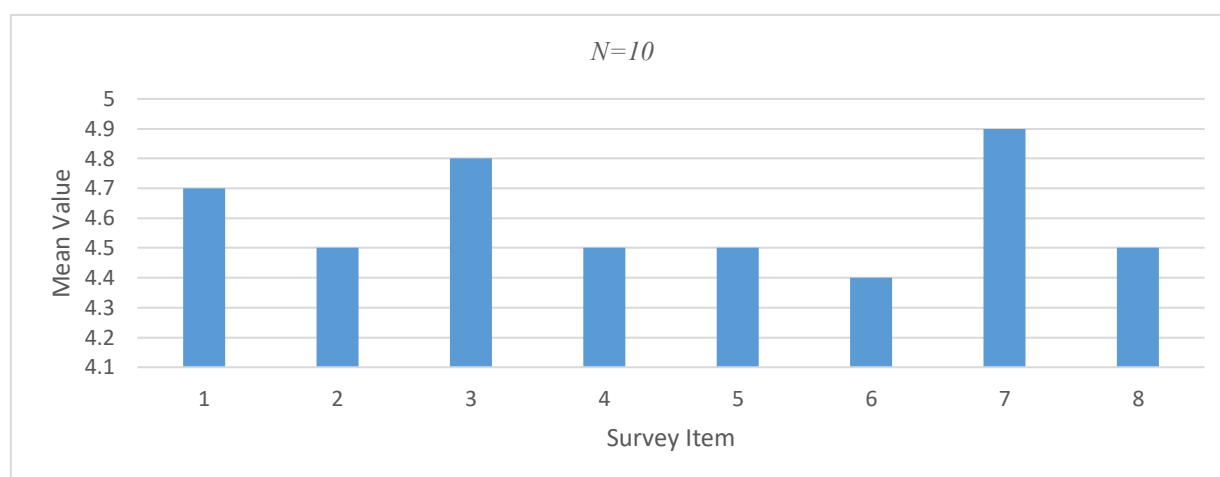
Note: *Reliability Rate: $0.9 > \alpha > 0.8$ = Acceptable

Each of the eight items in the survey was analyzed via descriptive statistics to attain the mean, median, and standard deviation values. Table 6 below displays the descriptive analysis of the statements abbreviated with their themes (See Table 1 for the complete descriptions).

Table 6*Descriptive Statistics for Survey Items*

Item # and Theme	N	Mean	Median	SD
1- Effectiveness	10	4.70	5	.483
2- Easy to Use	10	4.50	5	.850
3- Fun Way to Learn	10	4.80	5	.422
4- Motivating	10	4.50	5	.707
5- Self-Confidence	10	4.50	5	.850
6- Convenience for Learning	10	4.40	5	1.075
7- Recommending Duolingo	10	4.90	5	.316
8- Integration to Traditional Classroom	10	4.50	5	.972
Accumulated Average (Items 1-8)	10	4.60	5	.523

It can be seen in Table 6 above that each mean value of the items in the survey was revealed along with their standard deviation scores. The accumulated average value of each attribute was also calculated, which reported the average mean value to be $M=4.60$ ($N=10$) while the median value was $M=4.88$ ($N=10$) with the standard deviation showing at $SD=.523$ ($N=10$). A graphical representation of the mean values for each survey item is demonstrated in Figure 2 below

Figure 2*Mean Values of the Survey Items*

In addition to the descriptive statistics of the online survey on the effectiveness of Duolingo application for the experimental participants, a one-sample T-test was conducted on the responses of the questionnaire to (1) obtain empirical data for the second research question “*Do EFL learners perceive educational technology (e.g., Duolingo) as a beneficial reinforcement tool in their English learning process?*”. Table 7 below exhibits the one sample T-test results for the questionnaire.

Table 7*One Sample T-Test for Online Questionnaire*

t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval	
9.673	9	.000	1.60000	Lower	Upper
				1.2258	1.9742

Note. *Significant at $p < 0.05$ / test value= 3 (Not Sure)

6. Results

The study aimed to experiment with the effectiveness of utilizing an educational technology, Duolingo, as a reinforcement tool in the English learning of struggling university-level EFL students. The four-week implementation was designed to address two research questions: (1) whether there is a significant difference in achievement levels between learners who used Duolingo and those who did not, and (2) whether learners perceive Duolingo as a beneficial reinforcement tool. The following sections present the statistical results used to test the hypotheses associated with these questions.

Improving Learning with Educational Technology

Based on the descriptive statistics and inferential analyses, there is sufficient evidence that the implementation of Duolingo improved the language learning outcomes of the experimental group compared to the control group. The mean value of the experimental group increased from the pre-test ($M = 55.58$, $SD = 15.55$) to the post-test ($M = 59.21$, $SD = 15.14$), a difference of 3.63 points. In contrast, the mean value of the control group decreased slightly from the pre-test ($M = 54.84$, $SD = 14.69$) to the post-test ($M = 53.05$, $SD = 15.39$), a difference of -1.79 points, as illustrated in Table 2.

The paired sample t-test results further support these findings. The experimental group demonstrated a statistically significant improvement, $t(18) = 3.89$, $p = .001$ ($p < .05$), with a large effect size (Cohen's $d = 0.89$), while the control group showed no statistically significant change, $t(18) = 1.52$, $p = .145$ ($p > .05$), as presented in Table 3.

To further examine the difference between groups, an independent-samples t-test was conducted on the gain scores. The analysis revealed a statistically significant difference between the experimental and control groups, $t(36) = 3.61$, $p = .001$ ($p < .05$), with a very large effect size (Cohen's $d = 1.17$), as shown in Table 4. These findings indicate that the improvement observed in the experimental group was not due to chance and was significantly greater than that of the control group. The results provide sufficient evidence to reject the first null hypothesis (H_01): "There is no significant difference in the achievement levels of EFL learners who use educational technology (e.g., Duolingo) for English learning and those who do not."

Perceptions of the EFL Learners Toward Duolingo

Survey data were collected to address the second research question regarding learners' perceptions of Duolingo. The descriptive statistics (See Table 6) indicate that all items yielded high mean values, ranging from 4.40 to 4.90 on a 5-point scale. Participants evaluated Duolingo as effective, enjoyable, motivating, easy to use, and convenient. They also expressed that they would recommend it to others and believed that such technologies should be integrated into traditional instruction. The accumulated average of the survey items was $M = 4.60$ ($SD = .523$), indicating generally positive perceptions among the participants. The reliability of the survey instrument was confirmed through a Cronbach alpha value of .846, demonstrating acceptable internal consistency.

A one-sample t-test was conducted with a test value of 3 ("not sure") to determine whether the participants' perceptions differed significantly from a neutral stance. The results showed a statistically significant difference, with $|t| = 9.673$ and $p = .000$ ($p < .05$), as shown in Table 7. These findings demonstrate that participants not only benefited academically from the intervention but also viewed Duolingo as a useful and supportive enhancement to their learning process. The consistently high perception scores complement the achievement data, reinforcing the conclusion that Duolingo functioned as a meaningful reinforcement tool for this population. Therefore, the results provide sufficient evidence to reject the second null

hypothesis (Ho2): “EFL learners' perceptions do not significantly indicate favorable outcomes regarding the use of educational technology (e.g., Duolingo) as a reinforcement tool in their English learning process.”

7. Discussion

The study aimed to evaluate the impact of educational technologies on university-level EFL learners and assess the students' perceptions of using the tool for their English learning. The results from the quasi-experimental study revealed that the use of Duolingo played a critical role in supporting struggling EFL learners, defined here as individuals who scored between 0 and 30 percent on the placement exams. In terms of academic achievement, the experimental group demonstrated a noticeable improvement from pre-test to post-test, whereas the control group experienced a slight decline. This decline warrants careful interpretation. Minor reductions in performance among control group learners are not unexpected, particularly in short-term studies involving low-proficiency students who do not receive additional reinforcement (Hjetland et al., 2023). Factors such as test fatigue, fluctuations in motivation, and inconsistent engagement with course material may contribute to these decreases (Agrawal et al., 2021). The absence of structured or motivational support between testing periods can lead to stagnation or minor regression, especially for individuals with fragile linguistic foundations, as literacy gains are known to fade without continued practice (Zuo et al., 2023). The divergence between the groups indicates that struggling learners often require consistent scaffolding and reinforcement to sustain academic growth (Zuo et al., 2023).

While external factors such as self-study, attendance patterns, or individual effort may have influenced performance, the data support the assumption that the structured reinforcement provided by Duolingo led to more favorable outcomes for learners in the experimental group. Although familiarity effects resulting from repeated exposure to the same test could have contributed to slight improvements, the statistically significant between-group difference indicates that the observed gains were not solely attributable to testing effects. The improvement observed among these learners suggests that educational technologies, when used strategically alongside traditional instruction, may enhance learning outcomes by offering additional opportunities for practice, feedback, and motivation (Dron, 2022; Essafi et al., 2024; Flair, 2023).

The findings also support theoretical perspectives within CALL and MALL. Duolingo offers feedback, repetition, and scaffolded learning sequences, features that align with theories emphasizing the importance of guided support and individual pacing. Sociocultural theory suggests that structured scaffolding facilitates learner development by enabling manageable progression through increasingly complex tasks (Lantolf & Thorne, 2006). Duolingo's design mirrors these principles by breaking language learning into incremental units supported by immediate corrective feedback, which may be particularly beneficial for struggling learners who require frequent reinforcement.

In addition, motivational frameworks such as self-determination theory (Ryan & Deci, 2022) help explain why the experimental group may have experienced greater gains. Features such as experience points, streaks, and performance indicators enhance learners' sense of competence and autonomy, which in turn can increase engagement. These motivational supports may be more salient for learners who experience low confidence or anxiety in traditional classroom environments.

Moreover, the use of Duolingo was found to promote a group learning environment, increase motivation, encourage goal-oriented learning, and foster competitive engagement. These features collectively supported a more interactive and manageable learning experience for the experimental group. As Essafi et al. (2024) note, gamification reduces self-consciousness and fosters sustained engagement, which may explain why struggling learners responded particularly well to the intervention. Importantly, the positive perception data further strengthen the argument that learners not only benefited academically but also viewed the tool as accessible, enjoyable, and meaningful. Perception is a crucial factor in the adoption and long-term use of educational technologies.

Nevertheless, the limitations of the study should be considered when interpreting the findings. The small sample size restricts the ability to generalize results to broader populations. The four-week duration further limits the scope of observable growth, particularly in language skills that develop over longer time frames. These constraints suggest that future research should explore longer-term interventions and include a broader set of language skills, particularly speaking and listening, which were not captured by the level exam used in this study.

Overall, the results indicate that Duolingo can serve as an effective reinforcement tool for struggling EFL learners when integrated thoughtfully into existing instructional models. The alignment between Duolingo's features and established pedagogical theories strengthens the argument for its use, while the distinct needs of struggling learners highlight the importance of tailored digital reinforcement approaches. The findings emphasize that mobile educational tools are most effective when grounded in pedagogical purpose, supported by motivational design, and responsive to learner characteristics.

8. Conclusion and Suggestions

The study highlighted the significant role that educational technologies such as Duolingo can play in supporting language development among university-level EFL learners, particularly those who struggle within traditional instructional models. The observed improvement in the experimental group's academic performance and the positive learner perceptions suggest that Duolingo's structured, gamified, and adaptive approach not only enhances engagement but also fosters motivation, autonomy, and confidence in language learning. While not a one-size-fits-all solution, the tool's success in addressing the needs of underperforming students underscores the importance of matching digital resources to learner profiles. The originality of the study lies in its focus on A1-level struggling adult learners, a population that remains underrepresented in research on mobile-assisted language learning (Noyan et al., 2023; Sürücü Şen, 2021). By examining both achievement outcomes and learner perceptions, the study contributes empirical evidence that expands understanding of how educational technologies may function for individuals with minimal linguistic foundations and persistent academic challenges.

The study affirms that effective integration of educational technologies must be guided by pedagogical purpose, contextual relevance, and evaluative frameworks. When used intentionally and strategically, digital educational tools can serve as powerful complements to traditional teaching methods, contributing meaningfully to a more inclusive, motivating, and responsive learning environment. It is important to note that not all educational technologies automatically lead to positive outcomes (Anstey & Watson, 2018; Zamri & Mohamad, 2024). The success of any tool depends on its ability to meet key learning criteria. For an educational technology to be truly effective, it must facilitate the connection of new information to existing knowledge, help students grasp the significance of the material being learned, support the application of acquired skills in real-world contexts, foster the analysis of complex topics, guide students to assess content thoughtfully, and provide scaffolding that helps them build upon their current understanding to create new knowledge (Belland, 2017). This study demonstrates that Duolingo aligns with several of these criteria, particularly through its structured progression, immediate feedback, and adaptive learning sequences. These features appear to have been especially meaningful for the struggling learners examined in this study.

To make informed decisions about which educational tools to implement, educators must consider the following criteria. Educational technologies must align with the learning goals and contexts of the students they intend to serve. Frameworks such as the SAMR Model and the Rubric for E-Learning Tool Evaluation offer guidelines for assessing how well a tool enhances teaching and learning (Anstey & Watson, 2018;

Zamri & Mohamad, 2024). By using these frameworks, institutions can make more informed decisions about which tools to incorporate into the curriculum, ensuring they provide valuable support for students.

For struggling learners in particular, reinforcement-oriented tools like Duolingo may offer essential benefits that complement in-class instruction. The present study suggests that technologies emphasizing repetition, scaffolding, and motivational design may help mitigate challenges related to low confidence, limited language background, and inconsistent academic engagement. Educators and institutions should prioritize the evidence-based integration of technology, selecting tools that are supported by empirical research and shown to positively impact learning outcomes across varied student demographics. The implementation of digital tools should be intentional and grounded in pedagogical purpose (Gümüş et al., 2023). Reflective practice is essential in this process, requiring educators to assess whether technologies align with instructional goals and effectively support student engagement and achievement. Continuing professional dialogue can enhance the adoption process by enabling educators to share experiences, challenges, and effective strategies (Darling-Hammond et al., 2017).

Finally, attention to digital equity remains critical. Learners with limited access to technology or inconsistent connectivity may be unable to benefit fully from mobile-assisted learning tools. Institutions should ensure that technological initiatives are supported by adequate infrastructure and equitable access so that all learners, including those who struggle academically, can benefit from reinforcement-oriented tools.

9. Limitations

The study had a few limitations that should be taken into consideration. The first limitation concerns generalizability. The study was conducted at a single private university in Türkiye with a relatively small sample of A1-level EFL learners. With nineteen students in each group, the sample size limits the extent to which the findings can be applied to broader populations. Smaller groups reduce statistical power and may increase the influence of individual variability on overall results, which is particularly relevant for populations with unstable proficiency profiles.

The second limitation is the duration of the study. The four-week implementation period was shortened due to an upcoming academic holiday, and most of the learners in the experimental group were unavailable beyond the four-week period. Short-term interventions may not capture the longer developmental trajectory required for sustained language growth, especially in areas such as productive skills that typically require extended practice and feedback. A longer intervention might have yielded additional insight into how reinforcement tools such as Duolingo affect learners' progression over time.

Another limitation relates to the study design. The impossibility of random assignment led to the use of a quasi-experimental structure. Although this design is appropriate for institutional contexts in which existing class groupings cannot be altered, it reduces the degree of experimental control. Pre-existing differences among participants could have influenced outcomes, even though both groups demonstrated similar placement test profiles. Furthermore, the use of the same test as both pre-test and post-test, while necessary to measure comparable performance, may introduce familiarity effects or practice-related gains.

The last limitation pertains to the focus of the measurement instrument. The 100-item level exam primarily targeted reading, vocabulary, and grammar skills and did not evaluate learners' speaking or writing abilities. Hence, findings should not be generalized to all areas of English language proficiency, since using an application such as Duolingo could yield different learner responses in terms of speaking and writing. Given that tools like Duolingo often emphasize receptive tasks, a more comprehensive assessment battery would be needed to evaluate the full range of language skills influenced by mobile-assisted learning.

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