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Thai EFL University Students' Views on the Effectiveness of Duolingo for Enhancing Listening and Speaking Skills

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Abstract

The current study aims to assess 150 Thai English as a Foreign Language (EFL) first-year university students' perspectives on the efficacies of Duolingo, a popular mobile language application in improving English listening and speaking skills. Given the growing importance of mobile-assisted language learning (MALL) in enhancing language proficiency, this study investigates Duolingo's potential to address the common challenges faced by EFL learners in developing these essential skills. The data were collected using a quantitative method, namely a structured questionnaire, to record participants' attitudes towards Duolingo and corresponding experiences. Simultaneously, Gibson and Brown's (2009) thematic technique was employed to analyse the open-ended responses. The results show that a high Duolingo usage level was discovered at 32.0% daily usage and 42.0% several times weekly, which underscored Duolingo integration into linguistic learning journeys. The participants also pinpointed crucial benefits, such as affordability, structured learning, convenience, diverse content, interactivity, audio exercises, and adaptive technologies. Nevertheless, 26.0% of the students described several limitations, including audio quality discrepancies, insufficient real-life conversational practices, and limited topic coverage. Furthermore, a significant gender distribution was demonstrated, with 70.7% females and 29.3% males. The findings posit that female students tended to or possessed higher accessibility to language learning technologies, including Duolingo. The findings reflect broader

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societal factors impacting educational preferences and opportunities. The study outcomes also contributed to educators and developers to improve digital tools for diverse language learning requirements.

Keywords: Duolingo, language learning, listening skills, speaking skills.

1. INTRODUCTION

English communication is identified as a vital 21st-century skill (Tight, 2022) owing to its status as the international language (Kruk, 2022), especially in non-native English-speaking nations. Therefore, modern technologies supporting English learning are increasingly crucial (Thuy & Yukawa, 2021) when more students have been proactively learning English across the globe, with certain learners employing English more than their mother tongue. Numerous nations also comprehend the significance of English in improving education by incorporating English learning as the primary aspect of educational development and blueprints (Gabriel et al., 2022). In addition, economic transformations in developing nations also encourage policymakers to reconsider English as the primary instruction medium across educational institutions (Y. Liu et al., 2020). The quality and depth of English as a medium of instruction (EMI) also serve as key indicators of higher educational internationalisation and competitiveness (Jablonkai & Hou, 2023; Macaro, 2020) as English is primarily utilised in multiple disciplines, including business, publication, education, medicine, and conference negotiations. A plethora of research articles were also produced and published in English.

Students experience multiple difficulties in learning English as a foreign language (EFL), such as cultural differences, motivation levels, teaching effectiveness, linguistic barriers, and the availability or instrumentality of tools, software, equipment, or technologies. Information technology (IT) advancements have engendered notable changes in higher educational policies and practices (Bonfield et al., 2020), which facilitate higher access to learning resources and create conducive environments for language acquisition. Particularly, computers, tablets, smartphones, and other digital equipment effectively support EFL students, which is reflected in the vicennial incorporation of more digital devices into various educational contexts (Zain & Bowles, 2021). Thus, more language learning opportunities are provided for EFL students.

In contemporary classrooms, technological use is ubiquitous (Seufert et al., 2021), with everyday communication and entertainment characteristics such as visual literacy in smartphones, mobile games, computers, emails, televisions, social networking sites, chat rooms, and instant messaging applications. Technological utilisation can also assist learning (Bernacki et al., 2020) to promote creativity and elevate students' autonomy (Agustina et al., 2022). Specifically, mobile learning (m-learning) through smartphones, laptops, tablets, and other portable devices serves as an instance of digital learning. Furthermore, the higher availability of mobile technologies positively impacts EFL learning (Karakaya & Bozkurt, 2022) by extending the learning journey beyond physical settings for students' autonomous learning decisions (Hatch et al., 2023). Similarly, mobile language learning applications have demonstrated the potential to enhance speaking proficiency among EFL learners in specific contexts, such as in Malaysia (John & Lo, 2024).

The introduction of commercial digital linguistic learning applications also indicates autonomous learning via digital technologies. Mobile applications have proven effective in improving speaking proficiency among non-English major learners in Malaysia (John & Lo, 2024), further supporting their potential for broader EFL contexts. The publicly accessible linguistic learning application (app) Duolingo announced possessing 200 million active users in 2022 (Sakalausė & Leonavičiūtė, 2022), whereas subscription-based Babbel possessed one million active users. Therefore, the efficacy of L2 learning applications should be comprehensively appraised. Nuesser et al. (2024) advocated for more studies on how the affordances of technology might best be exploited to provide learners with optimal language learning opportunities. Accordingly, the present study seeks to thoroughly comprehend Thai EFL

learners' perceptions of Duolingo's effectiveness in enhancing linguistics skills in terms of listening and speaking.

Although several studies have explored the effectiveness of mobile-assisted language learning (MALL), including apps like Duolingo (Vesselinov & Grego, 2016a), research focusing specifically on Thai EFL university students remains limited. Most studies concentrate on general or Western contexts, leaving a gap in understanding how Thai learners perceive the efficacy of these tools, especially in developing listening and speaking skills. This study addresses this paucity by examining Thai EFL learners' experiences, thus providing insights into how cultural and educational contexts influence the adoption and effectiveness of Duolingo. Limitations include the use of a structured questionnaire, which may restrict nuanced responses, and the focus on one language application, which could limit generalisability.

Theoretically, this research contributes to the existing body of knowledge on MALL by adding specific insights into the Thai EFL context, particularly in how Duolingo can facilitate autonomous learning in non-native English-speaking nations. It extends the discussion on the role of gamification and mobile technologies in enhancing language skills, aligning with connectivism theory, which emphasises learning through digital networks. Practically, the findings will provide educators, app developers, and policymakers with data to optimise mobile language learning tools for Thai learners and similar EFL contexts, thereby promoting more effective digital pedagogies in language education. The following research questions were formulated to guide the inquiry:

1. How do Thai EFL university students perceive the effectiveness of Duolingo in improving their English listening and speaking skills?
2. What are the perceived benefits and limitations of Duolingo from the perspective of Thai EFL university students in enhancing their language proficiency?
3. How do gender and age influence the adoption and usage patterns of Duolingo among Thai EFL university students for linguistic development?

2. LITERATURE REVIEW

2.1 Mobile Learning Evolution from Early Adoption to Mainstream Integration

The m-learning concept has continuously evolved. Early adoption commenced in the late 1990s and early 2000s when personal digital assistants (PDAs) and mobile phones were utilised for educational objectives (Sharples, 2000). Initial m-learning was primarily focused on experimental projects and small-scale implementations to determine the potential of mobile devices to support learning beyond physical environments. Quinn (2000) underscored several advantages of mobile devices, including context sensitivity, portability, and the supporting role of situated learning experiences. Nevertheless, technological constraints, such as small screen sizes, limited battery life, and limited connectivity, impeded extensive adoption.

Mobile technological advancements have expanded the potential of mobile-assisted language learning (MALL), with more sophisticated smartphones and tablets and the proliferation of high-speed mobile internet, propelling the significant evolution (Alam & Mohanty, 2024). MALL had been more frequently employed in mainstream applications by the mid-2010s when educational institutions commenced incorporating m-learning into their respective curricula due to its higher flexibility and the provision of personalised learning experiences. C. Liu and Hwang (2023) and Nikolopoulou et al. (2023) also recorded the evolution of mobile device usage for numerous educational activities, such as interactive simulations, accessing course materials, and collaborative learning.

The 'From e-learning to m-learning' project classifies educational development and distance learning into three phases, namely, from distance learning (d-learning) to electronic learning (e-learning) and mobile-assisted language learning (MALL) (Okai-Ugbaje et al., 2022). D-learning development was contributed by technologies associated with the Industrial Revolution in the 18th and 19th centuries. E-learning was initiated in the 1980s by the Electronics Revolution in conjunction with the development of the telecommunications industry.

Subsequently, MALL emerged following the Mobile and Wireless Revolution in the late 20th century (Nurutdinova et al., 2021). Hence, mobile and wireless technologies as learning tools are the most recent learning methods.

E-learning refers to content delivery and instruction through computers, including CD-ROM, an intranet network, or the Internet, to accomplish individual or organisational objectives by increasing knowledge and skills (Baig et al., 2022). While MALL is highly associated with d-learning and e-learning, distinctiveness exists in contexts (mobility) and the usage of mobile technologies. MALL refers to portable learning or the utilisation of mobile technologies for learning (Qashou, 2021). Mobility is a distinct characteristic of serving as an alternative educational platform. Hameed and Sumari (2024) investigated the transition from e-learning to MALL and elucidated the underlying features and transformations (see Table 1).

The mainstream integration of m-learning worldwide has been accelerated by the coronavirus disease (COVID-19) pandemic when remote and hybrid learning models were imperative due to lockdown measures. Specifically, m-learning served as a pivotal platform to ensure educational continuity in regions with low accessibility to conventional educational infrastructure (Hodges et al., 2020). The pandemic also emphasised the significance of m-learning in ensuring equitable educational access, which motivated more scholars to concentrate on optimising m-learning contexts. Contemporary studies also underscored the importance of user-friendly interfaces, robust instructional design, and effective educational approaches to maximise m-learning advantages (Kearney et al., 2020). The significance of m-learning also suggests a crucial function in the future.

Table 1. Comparison of characteristics between e-learning and m-learning.

Characteristics	e-learning	m-learning
Definition	Learning is facilitated by electronic technologies, often over the Internet.	Learning is facilitated by mobile devices, allowing access to educational resources anywhere.
Dependency	Primarily dependent on desktop or laptop computers.	Utilizes mobile devices such as smartphones and tablets.
Accessibility	Requires access to a stable internet connection and appropriate software/hardware.	Provides more flexibility with access to learning materials anytime and anywhere.
Portability	Limited by the need for a stationary setup.	Highly portable, allowing for learning on the go.
Learning environment	Often requires a more formal setup and environment.	Supports learning in diverse environments, including informal settings.
Interactivity	Usually involves scheduled, interactive sessions, often in a synchronous manner.	Encourages on-demand, asynchronous interactions and quick access to information.
Content delivery	Typically delivers content through static formats like PDFs, videos, and online lectures.	Delivers content through apps, multimedia, and interactive platforms optimized for mobile use.
User Engagement	Engagement may vary based on the design and interactivity of the e-learning platform.	Higher engagement potential due to the personalized and interactive nature of mobile apps.
Cost	Costs can vary widely, often involving significant investment in software and infrastructure.	Generally lower cost, leveraging existing mobile technology and often more affordable apps.
Learning pace	Allows for self-paced learning but often within the confines of a structured curriculum.	Highly adaptable to individual learning paces, allowing learners to fit study into their schedules.
Technological requirements	May require specific software installations and stable internet connectivity.	Utilizes widely available mobile technology and typically requires minimal setup.
Flexibility	Offers some flexibility but is often constrained by the need for a more formal learning setup.	Offers significant flexibility, allowing learning in varied contexts and times.
Social interaction	Often includes forums and scheduled virtual interactions.	Enhances social learning through instant messaging, social media, and collaborative apps.

2.2 Effectiveness of Mobile Assisted Language Learning (MALL)

The efficacies of MALL for linguistic development were scarcely assessed owing to the lack of objective and quantifiable approaches to examining learning outcomes (Burston & Giannakou, 2022). Contrarily, appropriate measures demonstrated that MALL was beneficial for listening and speaking skills (Burston, 2014). The efficacy of commercial digital linguistic learning applications, including Duolingo, remained ambiguous. Research conducted on behalf of existing learning applications, including Duolingo (Vesselinov & Grego, 2012), Busuu (Vesselinov & Grego, 2016b), Rosetta Stone (Vesselinov, 2009), Babbel (Vesselinov & Grego, 2016a), and Italki (Vesselinov & Grego, 2018) discovered positive learning outcomes, which allowed the providers to assert equal or higher effectiveness than physical courses. Nonetheless, van Deusen-Scholl (2015) disagreed and explicated that “despite strong claims about learner success, very little research is as yet available for commercial products, and outcomes are questionable” (p. 399). Lord (2015) also reported no significant variations in standardised test scores between students participating in a physical first-semester Spanish course and Rosetta Stone beginner users within 45 hours.

Duolingo, as a widely popular application for language learners, plays a crucial role in supporting the development of listening skills and speaking skills among EFL learners. By integrating mobile-assisted language learning (MALL) into everyday use, EFL learners can engage with structured exercises that cater to their linguistic needs. The gamified approach of Duolingo, combined with regular feedback, offers EFL learners an effective method to practice pronunciation, comprehension, and conversational abilities, making it highly suited to enhancing both listening and speaking skills.

2.3 Theoretical Foundations

Connectivism postulates that knowledge is confined to a student and exists within the student’s informational network, such as organisational and social. Connectivity through social applications, social media, and blogs has become integral to learning (Khan et al., 2023), wherein connectivism serves as a suitable theoretical framework for the digital era (Koutropoulos, 2023). Particularly, learners are represented as nodes, and all developed connections via mobile applications and web pages contribute to knowledge creation, which propounds that technology redefines the learning methodology, location, and content (Langseth et al., 2023). Dziubaniuk et al. (2023) delineated that connectivism is a contemporary model accounting for classroom learning challenges and demands, which develops autonomous students (Omodan, 2023). Diverse perspectives will be encouraged via collaborative learning (Dziubaniuk et al., 2023), which fosters society to interact, convey personal ideas, and increase knowledge to develop the foundation of mobile-assisted language learning (MALL) (Wang & Xu, 2023). Connectivism also encourages students to be proactive in decision-making while expanding learning networks.

Connectivism advocates learner-centred approaches, with learners embracing self-initiative for their personal learning experiences. Teachers act as mentors to shape learning communities and expose students to different learning contexts. Diordieva and Bonk (2023) supported the idea by describing that contemporary learning settings should be driven by students and facilitated by teachers. Li et al. (2023) also elucidated that those learners who assume learning responsibilities will become accountable and independent, which differentiates connectivism from other theories, such as behaviourism and cognitivism. In addition, technological devices are leveraged for knowledge acquisition (Bozkurt, 2023). Yaqian and Qinhua (2023) highlighted the importance of engagement in effectively acquiring knowledge, which could be ensured through digital tools to increase the attractiveness of learning. In summary, connectivism underscores the significance of technological integration for digital learning through mobile devices and applications, including social media, apart from educational apps and gamification features. Mobile-assisted language learning (MALL) allows higher accessibility to required resources and content without physical constraints (Das & Roy, 2024).

3. METHODS

This section outlines the research design, participants, materials, instruments and data collection and analysis employed in the study. The methodology was carefully structured to assess the effectiveness of Duolingo in enhancing listening and speaking skills among Thai EFL university students. Both quantitative and qualitative approaches were integrated to ensure a comprehensive understanding of the participants' experiences and perceptions.

3.1 Research Design

The current study measured 150 Thai EFL first-year university students' perspectives on using the mobile language application, namely Duolingo, to improve their English listening and speaking skills. Participants were recruited through convenience sampling, which depended on personal availability and willingness. The data were collected via a structured questionnaire designed to examine students' perceptions, attitudes, and experiences. Subsequently, descriptive statistics and possibly inferential tests based on data distribution and study hypotheses were performed to offer insights into the overall effectiveness and perceived benefits of Duolingo utilisation for language learning.

3.2 Research Participants

A total of 150 Thai EFL first-year university students were recruited through convenience sampling, depending on personal availability and willingness. Convenience sampling ensured that recruitment was more straightforward, effortless, and affordable with lower time consumption than non-random techniques. Research details were distributed via university-wide announcements and online media. Participants were provided with an informed consent form before participation. The participants were students from different academic backgrounds with diverse perspectives. The researcher targeted Thai EFL students from one university to develop a representative sample.

3.3 Research Material

In this study, various research materials were employed to investigate the effectiveness of Duolingo as a language-learning tool for Thai EFL university students. These materials were carefully selected to provide a comprehensive understanding of the application's features, usage patterns, and impact on developing listening and speaking skills. The research materials included both quantitative and qualitative instruments, with a particular focus on the Duolingo application, given its widespread usage and acclaimed benefits in fostering linguistic development. The following sub-section provides an in-depth overview of Duolingo features and how it was utilised in this study to support the learning objectives of the participants.

3.3.1 Duolingo

Duolingo was scrutinised in this study due to being one of the most popular language-learning applications worldwide, apart from the proclaimed benefits of fostering linguistic development and high availability without a subscription fee. The Duolingo homepage displays the learning topics for each unit (see Figure 1). Duolingo also constantly modifies relevant learning material while including and excluding pertinent features. The current section delineates several primary features and content in this study period. Specifically, Duolingo is highly accessible via mobile devices, with diverse resources for EFL university students endeavouring to improve their listening and speaking skills. The interactive platform also offers various pronunciation, comprehension, and conversational exercises. Simultaneously, the application provides exercises of listening to native speakers' audio clips with multiple accents, which ensures learners are familiar with linguistic nuances. Speaking exercises of Duolingo also enable

learners to practice speaking English aloud, which assists in developing higher self-assurance in practical communication skills.

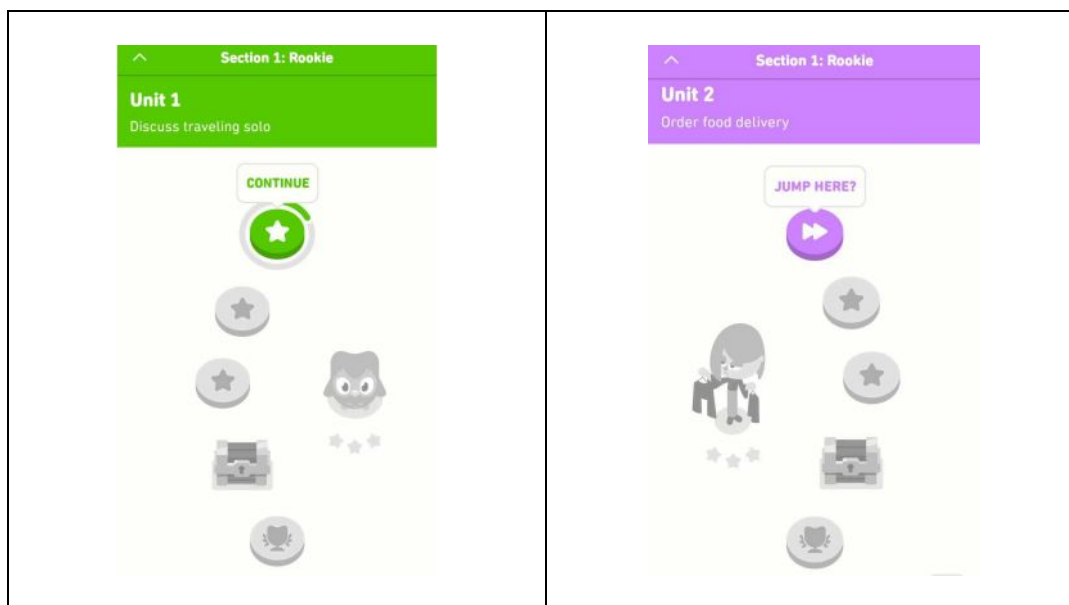


Figure 1. The learning topics covered in each unit are on the Duolingo dashboard.

Duolingo learners possess instant word translations, wherein any practice feedback involves demonstrating the correct answer or correct or wrong evaluations (Burston, 2014). Social networking features also enable learners to post discussion board comments about sentences practised in learning activities while checking friends' progress on a leaderboard. In addition, Duolingo employs gamification (Werbach, 2014) that allows learners to develop daily goals in terms of experience points (XP) accumulated through lesson completion (see Figure 4). Accomplishing daily XP goals will be rewarded with streaks, and the length of streaks indicates consecutive learning days. Accumulated skills and streaks will subsequently be converted into a digital currency, namely lingots, which enables learners to access timed practice sessions and purchase the platform avatar, namely Duo, which is a cartoon owl mascot. Nonetheless, inadequate contextual meaning and communicative tasks are the limitations of Duolingo, as the platform emphasises lexical and grammatical elements both explicitly (grammar-translation activities) and implicitly (input enhancement).

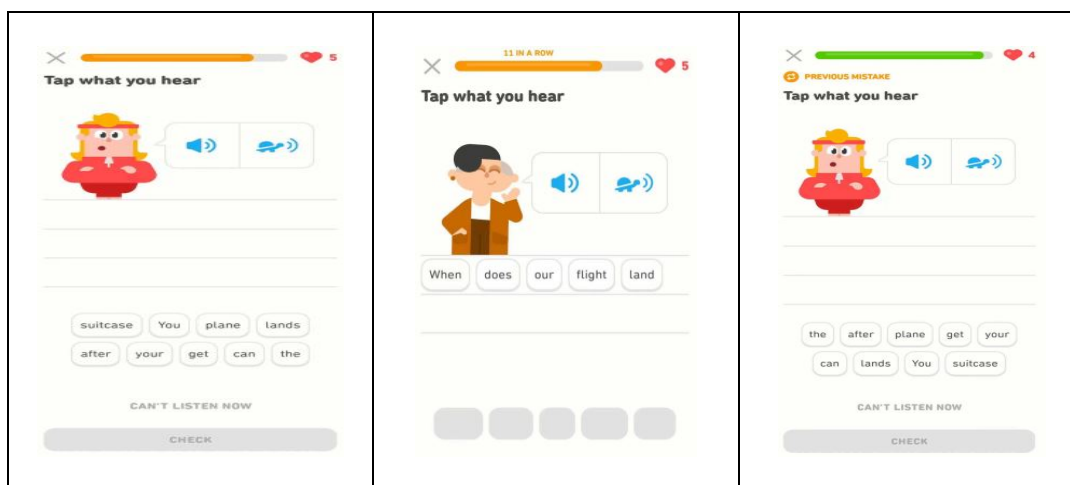


Figure 2. Listen and Repeat exercises on Duolingo.

Thai EFL university students could supplement classroom instruction, expand personal vocabulary, and observe significant progress in personal English proficiency by incorporating Duolingo into the learning journey. For instance, the ‘Listen and Repeat’ exercise is an active listening practice in which learners listen to a sentence spoken by a native speaker before repeating the same aloud (see Figure 2). As a result, students improve pronunciation and speaking skills by emulating the correct pronunciation and intonation of English words and phrases. Additionally, the “Dictation” exercise allows students to listen to and type out the same sentence, which aims to improve listening skills, spelling, and overall linguistic comprehension (See Figure 3). Therefore, all interactive and engaging activities in the application offered Thai EFL university students a structured and effective method to practice and enhance English listening and speaking abilities.

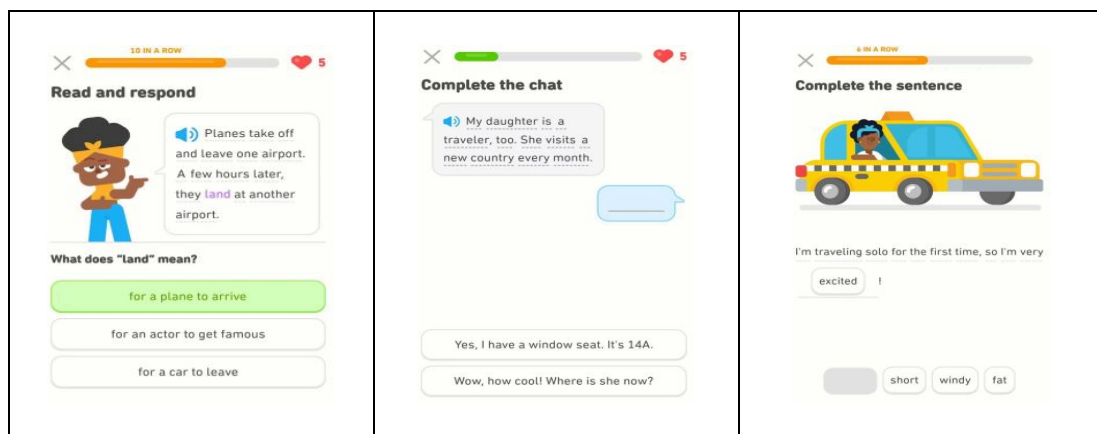


Figure 3. Listening comprehension exercise on Duolingo.

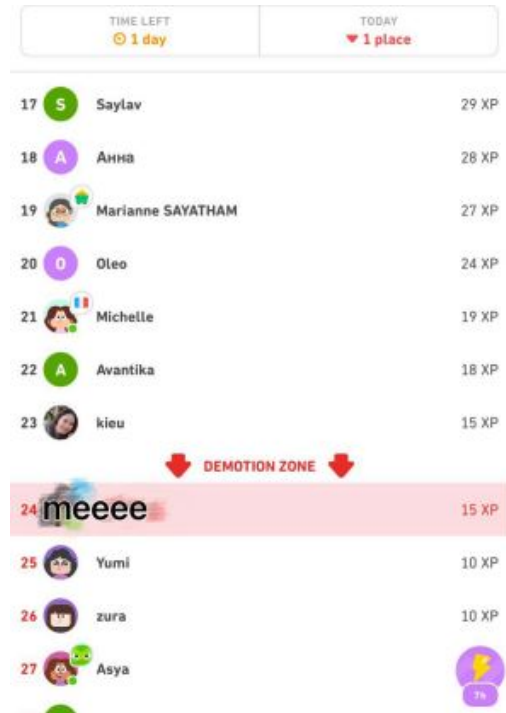


Figure 4. Learning leaderboard on Duolingo displaying users' XP.

3.4 Research Instrument

This section outlines the design and structure of the questionnaire, its development process, and the steps taken to ensure the reliability and validity of the instrument.

3.4.1 Questionnaire

A survey instrument was developed to measure Thai EFL university students' perceptions and usage of mobile technologies to improve listening and speaking skills. The questionnaire items were adopted from [Steel and Levy \(2013\)](#), [Lee \(2019\)](#), [Al-Shehab \(2020\)](#), [Niño \(2020\)](#), and [Zhang and Zou \(2021\)](#), which contained three sections. The first section focused on demographic information, such as age, gender, faculty, and types of employed mobile devices. The second section assessed the utilisation of mobile technologies for English listening and speaking. A list of 16 technology-related and 13 purpose-related items was derived from 60 representative participants' earlier responses, followed by an open-ended question to suggest additional technologies not listed in the questionnaire. The third section gathered participants' perspectives on the efficacies of Duolingo and other technologies.

The reliability and validity of measurement items were perused by an associate professor with a PhD in English language teaching. The questionnaire was designed in English before being translated into Thai to ensure that students' comprehension was thorough. A university lecturer with an associate professorship in English teaching performed back translations by translating the Thai version into English to ensure no major discrepancies. A pilot study was subsequently conducted with 30 non-participants with characteristics similar to the actual participants before data collection. Non-participants in the pilot study conveyed high questionnaire comprehensibility and the appropriate number of measurement items.

3.5 Data Collection and Analysis

Ethical approval was obtained from the Research Ethics Committee, and informed written consent was obtained from all participants before data collection. All participants were ensured of personal anonymity and confidentiality, and the participation was voluntary. Approximately 200 Thai EFL students enrolled in a communication course in the 2024 academic year were invited through a unique survey link. A total of 150 students completed and returned the questionnaire at a response rate of 75%. Quantitative analyses were conducted on closed-ended questionnaires to calculate frequencies and percentages. Open-ended responses were qualitatively analysed through [Gibson and Brown's \(2009\)](#) thematic method, which concentrated on discovering common themes, unique features, and data interactions.

4. RESULTS

The present section describes insights garnered from both quantitative and qualitative analyses by appraising demographic details before investigating preferences of mobile technologies in improving listening and speaking skills, Duolingo usage objectives, and perceived benefits and limitations.

4.1 Demographic Characteristics

A significant gender distribution was discovered, in which 70.7% of the participants were females, followed by 29.3% males. The finding posited that female students tended to or possessed higher accessibility to language learning applications in the academic environment. The finding might reflect wider societal factors impacting educational preferences and opportunities. Most participants were between 22 and 25 years old (77.3%), followed by 22.7% between 18 and 21 years old. A higher percentage of senior students postulated a higher inclination to employ supplementary linguistic learning applications in the latter academic phase. Thus, diverse educational requirements and preferences across different age groups should be considered. Meanwhile, the results demonstrated different Duolingo utilisation patterns. A total of 32.0% employed Duolingo daily, which suggested high habitual usage motivated by constant

academic demands or personal learning goals. A total of 42.0% utilised Duolingo several times weekly, which indicated a consistent but less intensive usage level. Only 1.3% of the participants never employed Duolingo, potentially owing to different preferences for alternative learning approaches or limited technological access. In summary, different utilisation frequencies underscored multiple integration levels of digital linguistic learning tools among Thai EFL university students, which might impact English listening and speaking proficiency (see Table 2).

Table 2. Demographic profile of the research participants.

Items	Number (n)	Percentage (%)
Gender		
Male	44	29.3
Female	106	70.7
Total	150	100
Age		
18-21	34	22.7
22-25	116	77.3
Total	150	100
Frequency of using Duolingo		
Daily	48	32.0
Several times a week	63	42.0
Once a week	21	14.0
Less than once a week	16	10.7
Never	2	1.3
Total	150	100

4.2 Preferences for Mobile Technologies

The significant number of students employing Duolingo daily (N = 48, 32.0%) and several times weekly (N = 63, 42.0%) highlighted the importance of Duolingo in linguistic learning owing to the beneficial structure and content for constant listening and speaking practices. Gamification and small-scaled lessons also made language learning more engaging and manageable on top of students' academic commitments, which engendered the higher popularity of Duolingo. The higher utilisation among female students (N = 106, 70.7%) also propounded the effectiveness of Duolingo. Moreover, the predominant age group of between 22 and 25 years old (N = 116, 77.3%) posited that senior students prioritised academic achievements and career prospects by capitalising on the application to improve personal linguistic skills. Senior students might also be more technologically literate and open to m-learning by incorporating the application into personal learning routines.

Only two students (1.3%) never utilised Duolingo, which suggested alternative preferences or potential challenges in accessing the application. The two students might prefer or highly depend on traditional classrooms or other digital resources. Hence, thoroughly comprehending diverse preferences is pivotal to educators and developers in fulfilling different learning requirements while ensuring that effective linguistic learning equipment is readily accessible to various students. Summarily, the results underscored the significance of Duolingo in providing a valuable resource for Thia EFL students to enhance their English listening and speaking skills. Meanwhile, other language learning applications were employed (see Figure 5) on top of Duolingo (N = 48, 32%), namely Memrise (N = 15, 10%), Babbel (N = 12, 8%), Rosetta Stone (N = 12, 8%), Busuu (N = 9, 6%), HelloTalk (N = 9, 6%), Tandem (N = 9, 6%), Pimsleur (N = 9, 6%), FluentU (N = 9, 6%), Lingodeer (N = 6, 4%), Mango Languages (N = 3, 2%), Drops (N = 3, 2%), italki (N = 3, 2%), and Speaky (N = 3, 2%).

The diverse usage propounded that students valued different learning experiences integrating structured lessons (Duolingo and Babbel) with conversational practices (HelloTalk and Tandem). While Duolingo was highly preferred for gamified learning and a user-friendly interface, students also recognised the advantages of employing multiple resources to fulfil different aspects of language proficiency. The utilisation of multiple applications demonstrated a comprehensive language learning method in which EFL learners endeavoured to enhance

listening and speaking skills through interactive, engaging, and contextually rich digital environments.

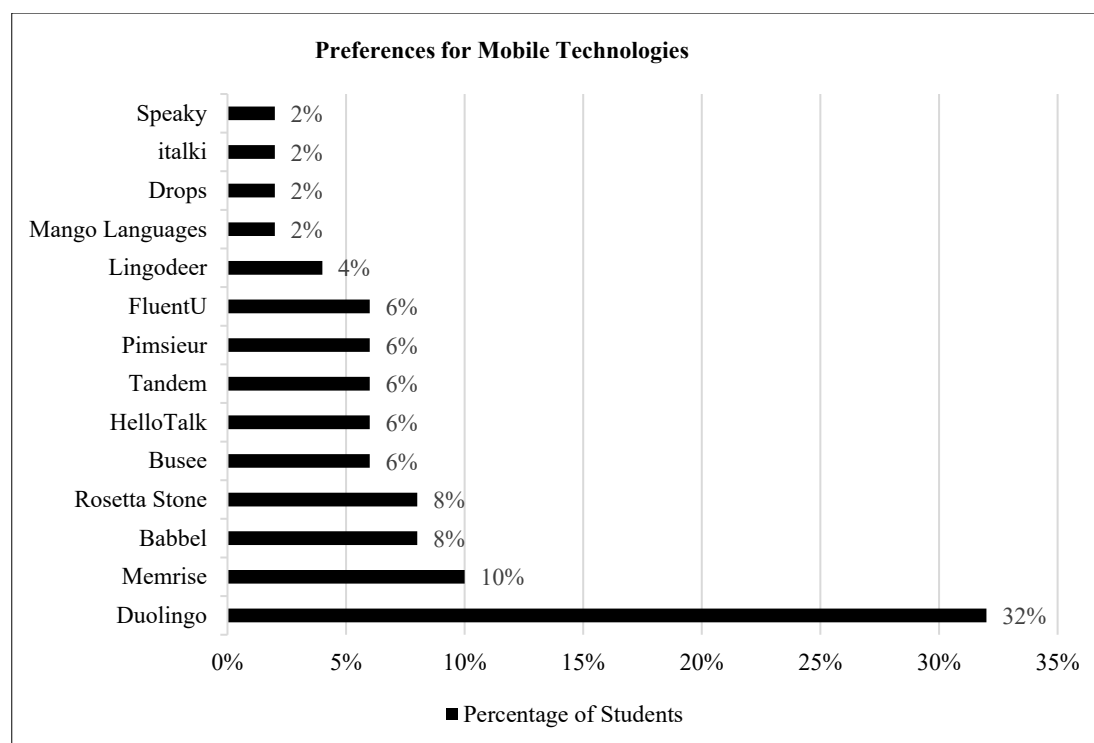


Figure 5. Thai EFL university students' preferences for mobile technologies.

4.3 Duolingo Usage Objectives

The findings revealed six primary Duolingo usage objectives (see Figure 6), namely expanding vocabulary, elevating speaking fluency, increasing listening comprehension, improving pronunciation, acquiring cultural insights, and preparing for language proficiency examinations. The objectives collectively underscored Duolingo's multifaceted function in supporting numerous learning aspects beyond mere linguistic proficiency. The most popular objective was to improve pronunciation ($N = 45$, 30%), which highlighted the essential function of effective communication for Thai EFL learners. A total of 16% ($N = 24$) of participants also utilised Duolingo to expand vocabulary, which suggested a ubiquitous approach to comprehensively improve language skills. In addition, 42 learners (28%) employed Duolingo for higher listening comprehension, which emphasised the crucial role of receptive language skills in comprehending spoken English across multiple contexts.

Elevating speaking fluency was another significant objective ($N = 39$, 26%) of employing Duolingo, which postulated proactiveness towards improving oral communication capabilities integral to interactive linguistic applications in academic and social settings. Furthermore, six participants (6%) sought to acquire cultural insights through Duolingo, which propounded an interest in comprehending cultural nuances in a language for effective cross-cultural communication. Six participants (6%) also utilised Duolingo to prepare for language proficiency examinations, which demonstrated a pragmatic usage to satisfy academic requirements or increase career prospects necessitating standardised language proficiency. Summarily, the findings contributed insights into the versatility of Duolingo in developing comprehensive linguistic skills among Thai EFL university students.

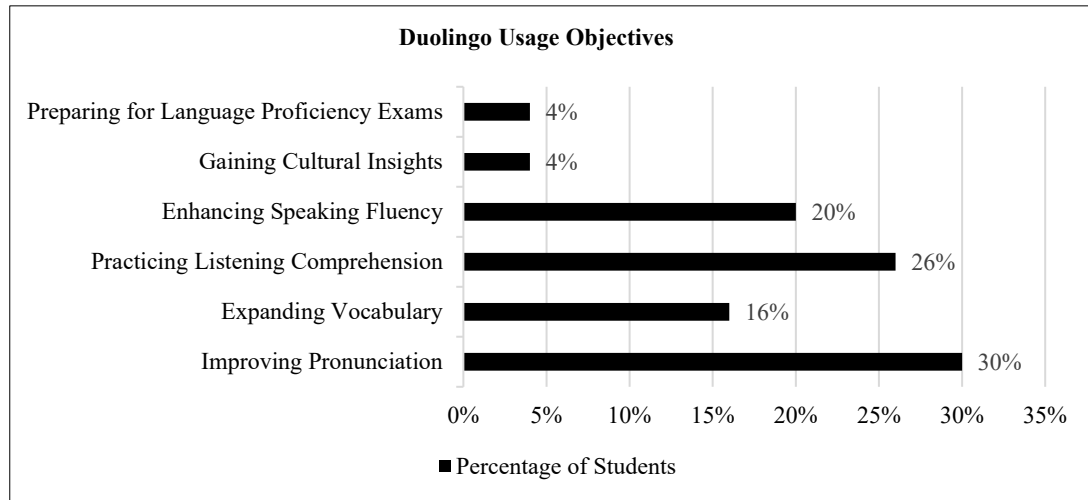


Figure 6. Thai EFL university students' objectives in using Duolingo.

4.4 Duolingo Usage Benefits

Thai EFL university students provided open-ended responses regarding the benefits of utilising Duolingo. The benefits encompassed (1) convenience, (2) structured learning, (3) interactive and gamified elements, (4) diverse content, (5) audio exercises, (6) affordability, and (7) adaptive technologies. Particularly, 28.7% (N = 43) of the students expressed that Duolingo allowed convenient access to language practices without physical and time constraints, which fostered flexible learning opportunities. The benefit corresponds to contemporary learning preferences and suits students' dynamic lifestyles, which effortlessly incorporate practices into quotidian routines. Furthermore, 13.3% (N = 20) of participants preferred structured lessons and the progression system, which offered an unambiguous journey for skill development. Specifically, Duolingo guides students through incremental phases of proficiency, which assists in developing foundational capabilities in listening and speaking while maintaining motivation in self-directed learning contexts.

A total of 12% (N = 18) of participants underscored the benefit of interactive exercises and gamification features, which increased engagement and ensured enjoyable and less intimidating learning tasks. Gamification, including rewards, challenges, and levels, could encourage students to persist in the learning journey through a sense of achievement and satisfaction upon task accomplishment. The method is highly efficacious in developing a positive learning experience, encouraging constant practices, and sustaining engagement with the application. Moreover, 8% (N = 12) of participants underscored the diverse content available on Duolingo. Various topics and themes in the application enabled students to study different contexts and vocabulary, which improved language proficiency beyond basic communication skills. The content availability fulfils different learning requirements and preferences while improving overall linguistic comprehension and communication skills.

A total of 14% (N = 21) of participants favoured audio exercises to enhance listening capabilities by being exposed to authentic pronunciation and intonation. The audio component allowed learners to practice listening comprehension in real-world settings, which increased the ability to effectively comprehend spoken English. The auditory reinforcement is vital to enhancing proficiency in identifying and interpreting spoken language nuances, which collectively contributes to overall fluency. Additionally, 20.0% (N = 30) of participants explained the cost-effectiveness. Duolingo provides accessible learning resources to students from diverse socioeconomic backgrounds as a free platform with optional paid upgrades. High affordability increases the attractiveness of the application for Thai EFL university students seeking quality linguistic education without financial burdens while gaining equal access to educational opportunities.

A total of 4% (N = 6) of students emphasised adaptive technologies as a beneficial feature of Duolingo. Adaptive algorithms personalise learning experiences based on individual progress and performance and adjust lesson difficulty and content suitable to every learner's proficiency and learning pace. The method also optimises learning outcomes by specifying improvement areas while reinforcing personal strengths to ensure efficient English skill development. To summarise, Duolingo is a beneficial platform for improving English listening and speaking skills by satisfying diverse learning preferences and providing holistic learning experiences for continuous improvement and engagement.

4.5 Duolingo Usage Limitations

Most students (N = 111, 74%) described that Duolingo did not present significant disadvantages, although certain participants (N = 39, 26%) pinpointed several limitations. Specifically, 15.4% of the students described inadequate real-life conversational practices despite the availability of structured exercises and speaking prompts. The application did not offer sufficient simulations of authentic and spontaneous conversations in real-world contexts. While Duolingo could reinforce vocabulary and grammar, students might not be entirely prepared for linguistic usage complexities. Moreover, 7.6% of participants expressed that certain audio recordings varied in quality or did not accurately reflect regional accents, which are vital to developing listening comprehension skills in diverse English-speaking settings. The finding highlighted the significance of exposure to authentic accents and speech patterns for effective linguistic learning beyond basic proficiency. Another 3% of the students delineated limited topics in Duolingo. The content might not entirely align with personal goals or academic requirements despite a structured curriculum, which might reduce the relevance and applicability of Duolingo for personal learning preferences. Thus, the content range could be expanded to include a wider range of linguistic learning objectives and preferences.

5. DISCUSSION

The significant gender difference at 70.7% females and 29.3% males postulated that female learners were more predisposed or possessed higher accessibility to linguistic learning technologies, such as Duolingo. The result might also indicate wider societal norms and educational opportunities favouring linguistic learning among females (Kutuk et al., 2022). Concurrently, the finding suggested that gender dynamics might significantly impact the adoption of digital learning tools and the existence of similar trends in different contexts. Meanwhile, most participants (77.3%) were aged between 22 and 25 years old, which indicated that senior students employed more supplementary linguistic learning technologies. The finding posited that students in the latter academic phase perceived higher instrumentality in employing linguistic learning technologies to be adequately prepared for job markets or higher education (Zhang & Zou, 2021). Therefore, tailored learning interventions should be developed to fulfil the specific requirements of different age groups.

Varied frequencies of Duolingo utilisation were revealed, with 32% employing the application daily while 42% several times a week. The consistent usage highlighted the significance of Duolingo in language learning, encouraged by gamification and a user-friendly interface (Ginting et al., 2022). Comparatively, only 1.3% of students never utilised Duolingo, potentially due to accessibility barriers or different preferences. Further investigations could be conducted to identify barriers preventing the effective usage of digital learning tools. Nonetheless, the high preference for Duolingo reflected the effectiveness in providing structured and engaging lessons (Vesselinov & Grego, 2016a, 2016b), especially among female students and older age groups. Duolingo was employed for multiple purposes, including expanding vocabulary, increasing speaking fluency, improving pronunciation, and elevating listening comprehension, demonstrating the multifaceted function (Al-Shehab, 2020). Specifically, the application

concentrates on pronunciation and listening comprehension, which is suitable for Thai EFL students' learning needs.

The lower usage for garnering cultural insights and examination preparation propounded improvement areas of Duolingo to provide diverse content in fulfilling academic and cultural requirements. Several limitations also indicated the imperativeness of expanding language learning tools to satisfy diverse learning requirements and preferences. For instance, insufficient real-life conversational exercises expressed by 15.4% of participants underscored the limited capacity to simulate authentic linguistic applications (Steel & Levy, 2013). While Duolingo was efficacious for developing foundational linguistic abilities, interactive real-world exercises should also be provided to adequately prepare learners for spontaneous communication. Inconsistent audio quality and accent variability (7.6%) also emphasised the requirement for high-quality audio resources with different accents to improve listening skills (Niño, 2020).

The limited range of topics in Duolingo (3%) indicated the need for expanding the curricular structure in the application to be more aligned with individual learners' requirements and preferences. In summary, Thai EFL students preferred the structured and convenient lessons provided by Duolingo to enhance their listening and speaking skills, although several limitations, including inadequate real-life conversations and limited content coverage, existed. Resolving the limitations could further increase the efficiency of the application in supporting linguistic learning.

6. CONCLUSION

This study explored Thai EFL university students' perceptions of Duolingo as a tool for improving English listening and speaking skills, revealing both its strengths and areas for improvement. Students valued Duolingo's accessibility, structured learning, and interactivity, highlighting its potential as a mobile-assisted language learning (MALL) platform. However, limitations such as the lack of realistic conversational exercises and audio quality suggest that enhancements are needed to support real-world language use better.

Findings also indicated demographic trends, such as gender imbalances and higher usage among senior students, suggesting the need for language learning technologies to cater to diverse groups with varying learning needs. While this study relied on self-reported data and had limited generalizability due to participant demographics, it provides valuable insights for educators and developers. For educators, integrating MALL tools like Duolingo into formal curricula could improve student engagement and supplement traditional instruction. For developers, refining features to support diverse learners and enhancing conversational components could make such tools more effective in fostering linguistic development.

Despite the promising findings, this study has some limitations. The reliance on self-reported data may affect objectivity, as responses could reflect social desirability rather than actual experiences. Additionally, the gender imbalance among participants and the absence of in-depth qualitative data limits the generalizability and depth of understanding regarding how diverse learners engage with Duolingo, particularly in real-life conversational contexts.

Future research should address these gaps by including balanced gender representation and using mixed-methods approaches to gain richer insights into learner experiences. Investigating the long-term effects of Duolingo on language proficiency, especially in conversational settings, would further clarify its effectiveness. Comparative studies on various MALL tools could identify their respective strengths and limitations, enabling better integration into formal education. Enhancing Duolingo's scope through more diverse content, realistic conversational exercises, and improved audio features could significantly enrich its value for Thai EFL learners and beyond.

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REFERENCES

- Agustina, N., Mayuni, I., Iskandar, I., & Ratminingsih, N. M. (2022). Mobile learning application: Infusing critical thinking in the EFL classroom. *Studies in English Language and Education*, 9(2), 724-743. <https://doi.org/10.24815/siele.v9i2.23476>
- Alam, A., & Mohanty, A. (2024). Integrated constructive robotics in education (ICRE) model: A paradigmatic framework for transformative learning in educational ecosystem. *Cogent Education*, 11(1), 2324487. <https://doi.org/10.1080/2331186X.2024.2324487>
- Al-Shehab, M. A. S. (2020). The role of Mobile-assisted Language Learning (MALL) in enhancing the writing skills of Intermediate IEP students: Expectations vs reality. *Language Teaching Research Quarterly*, 20, 1-18. <https://doi.org/10.32038/ltrq.2020.20.01>
- Baig, M. I., Shuib, L., & Yadegaridehkordi, E. (2022). E-learning adoption in higher education: A review. *Information Development*, 38(4), 570-588. <https://doi.org/10.1177/02666669211008224>
- Bernacki, M. L., Greene, J. A., & Crompton, H. (2020). Mobile technology, learning, and achievement: Advances in understanding and measuring the role of mobile technology in education. *Contemporary Educational Psychology*, 60, 101827. <https://doi.org/10.1016/j.cedpsych.2019.101827>
- Bonfield, C. A., Salter, M., Longmuir, A., Benson, M., & Adachi, C. (2020). Transformation or evolution? Education 4.0, teaching and learning in the digital age. *Higher Education Pedagogies*, 5(1), 223-246. <https://doi.org/10.1080/23752696.2020.1816847>
- Bozkurt, A. (2023). Generative artificial intelligence (AI) powered conversational educational agents: The inevitable paradigm shift. *Asian Journal of Distance Education*, 18(1). <https://www.asianjde.com/ojs/index.php/AsianJDE/article/view/718>
- Burston, J. (2014). Twenty years of MALL project implementation: A meta-analysis of learning outcomes. *ReCALL*, 27(1), 4-20. <https://doi.org/10.1017/S0958344014000159>
- Burston, J., & Giannakou, K. (2022). MALL language learning outcomes: A comprehensive meta-analysis 1994-2019. *ReCALL*, 34(2), 147-168. <https://doi.org/10.1017/S0958344021000240>
- Das, S. S., & Roy, N. R. (2024). M-learning: A new definition in technology-based learning. In P. Kaliraj, G. Singaravelu, & T. Devi (Eds.), *Transformative digital technology for disruptive teaching and learning* (pp. 141-153). Auerbach Publications.
- Diordieva, C., & Bonk, C. J. (2023). Instructors' perspectives in design and L-MOOCs: A qualitative look. *Contemporary Educational Technology*, 15(3), Article number ep425. <https://doi.org/10.30935/cedtech/13099>
- Dziubaniuk, O., Ivanova-Gongne, M., & Nyholm, M. (2023). Learning and teaching sustainable business in the digital era: A connectivism theory approach. *International Journal of Educational Technology in Higher Education*, 20(1), Article number 20. <https://doi.org/10.1186/s41239-023-00390-w>
- Gabriel, C., Grünke, J., & Karsten, N. (2022). Production and perception of L3 French prosody: Approaching German-Turkish heritage bilingualism. In H. Brandt, M. Krause, & I. Usanova (Eds.), *Language development in diverse settings* (pp. 331-356). Springer Fachmedien Wiesbaden. http://dx.doi.org/10.1007/978-3-658-35650-7_11
- Gibson, W., & Brown, A. (2009). *Working with qualitative data*. SAGE Publications
- Ginting, D., Sulisty, T., Ismiyani, N., Sembiring, M. J., Asfihana, R., Fahmi, A., Suarniti, G. A. M. R., & Mulyani, Y. S. (2022). English language teachers multimedia knowledge in

- teaching using technology. *World Journal of English Language*, 12(6), 184-203. <https://doi.org/10.5430/wjel.v12n6p184>
- Hameed, A. R. A. G., & Sumari, P. B. (2024). Adoption and continued usage of mobile learning of virtual platforms in Iraqi higher education an unstable environment. *International Journal of Information Management Data Insights*, 4(2), 100242. <https://doi.org/10.1016/j.jjime.2024.100242>
- Hatch, P., Rahman, M. A., & Michaelis, J. E. (2023). PATHWiSE: An authoring tool to support teachers to create robot-supported social learning experiences during homework. *Proceedings of the ACM on Human-Computer Interaction*, 7(1), Article number 144. <https://doi.org/10.1145/3579620>
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020, March 27). *The difference between emergency remote teaching and online learning*. Educause Review. <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Jablonkai, R. R., & Hou, J. (2023). English medium of instruction in Chinese higher education: A systematic mapping review of empirical research. *Applied Linguistics Review*, 14(6), 1483-1512. <https://doi.org/10.1515/applirev-2021-0179>
- John, J., & Lo, Y. Y. (2024). Improving English speaking proficiency among non-English major learners in Malaysia through mobile language learning applications. *Pertanika Journal of Social Sciences & Humanities*, 32(4), 1599 - 1618. <https://doi.org/10.47836/pjssh.32.4.17>
- Karakaya, K., & Bozkurt, A. (2022). Mobile-Assisted Language Learning (MALL) research trends and patterns through bibliometric analysis: Empowering language learners through ubiquitous educational technologies. *System*, 110, 102925. <https://doi.org/10.1016/j.system.2022.102925>
- Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2020). Viewing mobile learning from a pedagogical perspective. *Research in Learning Technology*, 20(1), 14406. <https://doi.org/10.3402/rlt.v20i0.14406>
- Khan, T., Kend, M., & Nguyen, L. A. (2023). Social media academic networking–insights from first-year accounting university students' experiences. *Higher Education Research & Development*, 42(2), 306-321. <https://doi.org/10.1080/07294360.2022.2057449>
- Koutropoulos, A. (2023). Enabling rhizomatic collaborations: Social and technical factors that impact agile thinking and learning. In M. S. Khine (Ed.), *New directions in rhizomatic learning* (pp. 158-178). Routledge. <https://doi.org/10.4324/9781003376378-13>
- Kruk, M. (2022). Dynamicity of perceived willingness to communicate, motivation, boredom and anxiety in Second Life: The case of two advanced learners of English. *Computer Assisted Language Learning*, 35(1-2), 190-216. <https://doi.org/10.1080/09588221.2019.1677722>
- Kutuk, G., Putwain, D. W., Kaye, L. K., & Garrett, B. (2022). Relations between gender stereotyping and foreign language attainment: The mediating role of language learners' anxiety and self-efficacy. *British Journal of Educational Psychology*, 92(1), 212-235. <https://doi.org/10.1111/bjep.12446>
- Langseth, I., Jacobsen, D. Y., & Haugbakken, H. (2023). The role of support units in digital transformation: How institutional entrepreneurs build capacity for online learning in higher education. *Technology, Knowledge and Learning*, 28(4), 1745-1782. <https://doi.org/10.1007/s10758-022-09620-y>
- Lee, M. (2019). The impact of using machine translation on EFL students' writing. *Computer Assisted Language Learning*, 33(2), 157-175. <https://doi.org/10.1080/09588221.2018.1553186>
- Li, R., Lund, A., & Nordsteien, A. (2023). The link between flipped and active learning: a scoping review. *Teaching in Higher Education*, 28(8), 1993-2027. <https://doi.org/10.1080/13562517.2021.1943655>
- Liu, C., & Hwang, G. J. (2023). Roles and research trends of touchscreen mobile devices in early childhood education: Review of journal publications from 2010 to 2019 based on the technology-enhanced learning model. *Interactive Learning Environments*, 31(3), 1683-1702. <https://doi.org/10.1080/10494820.2020.1855210>

- Liu, Y., Wang, H., & Zhao, R. (2020). Teacher agency and spaces in changes of English language education policy. *Current Issues in Language Planning*, 21(5), 548-566. <https://doi.org/10.1080/14664208.2020.1791532>
- Lord, G. (2015). "I don't know how to use words in Spanish": Rosetta Stone and learner proficiency outcomes. *The Modern Language Journal*, 99(2), 401-405. https://doi.org/10.1111/modl.12234_3
- Macaro, E. (2020). Exploring the role of language in English medium instruction. *International Journal of Bilingual Education and Bilingualism*, 23(3), 263-276. <https://doi.org/10.1080/13670050.2019.1620678>
- Nikolopoulou, K., Gialamas, V., & Lavidas, K. (2023). Mobile learning-technology barriers in school education: Teachers' views. *Technology, Pedagogy and Education*, 32(1), 29-44. <https://doi.org/10.1080/1475939X.2022.2121314>
- Niño, A. (2020). Exploring the use of online machine translation for independent language learning. *Research in Learning Technology*, 28, 2402. <https://doi.org/10.25304/rlt.v28.2402>
- Nuesser, M., Zheng, D., & Dong, J. (2024). Optimizing affordances of high immersive virtual reality for language learning. *Journal of China Computer-Assisted Language Learning*. <https://doi.org/10.1515/jccall-2023-0006>
- Nurutdinova, A., Shakirova, D., Ismagilova, G., Fazlyeva, Z., Panfilova, E., Sheinina, D., Galeeva, G., & Ilminbetova, S. (2021). The integrating face-to-face learning, distance learning technologies and M-learning technologies: Effectiveness. In M. E. Auer & T. Tsiatsos (Eds.), *Interactive mobile communication, technologies and learning* (pp. 478-486). Springer International Publishing. https://doi.org/10.1007/978-3-030-96296-8_43
- Okai-Ugbaje, S., Ardzejewska, K., & Imran, A. (2022). A mobile learning framework for higher education in resource constrained environments. *Education and Information Technologies*, 27(8), 11947-11969. <https://doi.org/10.1007/s10639-022-11094-5>
- Omodan, B. I. (2023). Analysis of connectivism as a tool for posthuman university classrooms. *Journal of Curriculum Studies Research*, 5(1), 1-12. <http://dx.doi.org/10.46303/jcsr.2023.2>
- Qashou, A. (2021). Influencing factors in M-learning adoption in higher education. *Education and Information Technologies*, 26(2), 1755-1785. <https://doi.org/10.1007/s10639-020-10323-z>
- Quinn, C. (2000). *mLearning: Mobile, wireless, in-your-pocket learning*. LineZine. <http://www.linezine.com/2.1/features/cqmmwiyp.htm>
- Sakalauskė, A., & Leonavičiūtė, V. (2022). Strategic analysis of Duolingo language learning platform. *Mokslas – Lietuvos Ateitis / Science – Future of Lithuania*, 14. <https://doi.org/10.3846/mla.2022.17731>
- Seufert, S., Guggemos, J., & Sailer, M. (2021). Technology-related knowledge, skills, and attitudes of pre-and in-service teachers: The current situation and emerging trends. *Computers in Human Behavior*, 115, 106552. <https://doi.org/10.1016/j.chb.2020.106552>
- Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers & Education*, 34(3-4), 177-193. [https://doi.org/10.1016/S0360-1315\(99\)00044-5](https://doi.org/10.1016/S0360-1315(99)00044-5)
- Steel, C. H., & Levy, M. (2013). Language students and their technologies: Charting the evolution 2006–2011. *ReCALL*, 25(3), 306-320. <https://doi.org/10.1017/S0958344013000128>
- Thuy, N. T. T., & Yukawa, T. (2021). Mobile devices applied in self-studying English as a foreign language among non-native students in Vietnam and Japan. *International Journal of Interactive Mobile Technologies*, 15(9), 70-87. <https://doi.org/10.3991/ijim.v15i09.19993>
- Tight, M. (2022). Internationalisation of higher education beyond the West: Challenges and opportunities—the research evidence. *Educational Research and Evaluation*, 27(3-4), 239-259. <https://doi.org/10.1080/13803611.2022.2041853>
- van Deusen-Scholl, N. (2015). Assessing outcomes in online foreign language education: What are key measures for success? *The Modern Language Journal*, 99(2), 398-400. http://dx.doi.org/10.1111/modl.12234_2
- Vesselinov, R. (2009). *Measuring the effectiveness of Rosetta Stone* [Final report]. Rosetta Stone. https://resources.rosettastone.com/CDN/us/pdfs/Measuring_the_Effectiveness_RS-5.pdf

- Vesselinov, R., & Grego, J. (2012). *The Duolingo efficacy study* [Final report]. Duolingo. https://static.duolingo.com/s3/DuolingoReport_Final.pdf24
- Vesselinov, R., & Grego, J. (2016a). *The Babbel efficacy study* [Final report]. Babbel. <https://press.babbel.com/en/releases/downloads/Babbel-Efficacy-Study.pdf>
- Vesselinov, R., & Grego, J. (2016b). *The Busuu efficacy study* [Final report]. Busuu. https://blog.busuu.com/wpcontent/uploads/2016/05/The_busuu_Study2016.pdf
- Vesselinov, R., & Grego, J. (2018). *The Italki efficacy study* [Final report]. Italki. <https://www.gettingsmart.com/wp-content/uploads/2018/01/italki2018FinalReport.pdf>
- Wang, C., & Xu, Y. (2023). Who will work together? Factors influencing autonomic group formation in an open learning environment. *Interactive Learning Environments*, 32(7), 3799-3817. <https://doi.org/10.1080/10494820.2023.2190425>
- Werbach, K. (2014). (Re)defining gamification: A process approach, persuasive technology. In E. Bertina, W. Gao, B. Steffen, & M. Yung (Eds.), *PERSUASIVE 2014: Lecture Notes in Computer Science* (pp. 266-272). Springer. https://doi.org/10.1007/978-3-319-07127-5_23
- Yaqian, X., & Qinhua, Z. (2023). Research on the correlativity between individual status in social network and corresponding concept network characteristics in a cMOOC. *Interactive Learning Environments*, 32(7), 3193-3207. <https://doi.org/10.1080/10494820.2023.2170421>
- Zain, D. S. M., & Bowles, F. A. (2021). Mobile-assisted language learning (MALL) for higher education instructional practices in EFL/ESL contexts: A recent review of literature. *Computer-Assisted Language Learning Electronic Journal*, 22(1), 283-307.
- Zhang, R., & Zou, D. (2021). Types, features, and effectiveness of technologies in collaborative writing for second language learning. *Computer Assisted Language Learning*, 35(9), 2391-2422. <https://doi.org/10.1080/09588221.2021.1880441>