EFL Students' Agency in Self-study of English Language with AI-powered Learning Applications

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ABSTRACT

This study explores the self-study practices of English as a Foreign Language (EFL) students utilizing mobile devices and AI-powered language learning applications, examining the mediating role of these tools on learner agency through the lens of sociocultural theory (SCT). Employing a mixed-methods approach, the research investigates how these mobile devices and language learning applications mediate EFL students' self-study, and how they perceive the usability and effectiveness of the tools. The findings reveal that mobile devices and AI-powered applications significantly enhance learner agency, motivation, and engagement in self-study. Besides, the accessibility and flexibility of mobile platforms, combined with the personalized and interactive features of AI-driven applications, create supportive conditions for effective self-study. This study contributes to the understanding of the interplay between technology, learner agency, and language learning within the framework of SCT, providing insights into creating empowering, technology-mediated language learning experiences.

Keywords: Learner Agency, Sociocultural Theory, AI-powered Language Learning Applications

Introduction

The ubiquity of mobile devices and applications has revolutionized language learning, leading to a surge in Mobile Assisted Language Learning (MALL) research (Miangah & Nezarat, 2012). Studies exploring technology-mediated language learning, particularly among adult learners, have become increasingly common (Kimsesiz, 2023). However, while MALL offers flexibility, it also presents challenges. Learners might be distracted while using mobile devices and there is the critical need for effective self-study skills in online learning environments (Trinh, 2023). Despite the growing body of research, there remains a significant gap in our understanding of the MALL learning process, specifically regarding the interplay between

learner agency and digital tools (Guo, 2022). In other words, the question of how learners take control of their learning when using mobile devices and applications for self-study of language skills remains underexplored.

To address this gap, this study delves into the rapidly evolving landscape of AI-powered language learning tools within MALL. These innovative tools use artificial intelligence to personalize learning through features such as vocabulary practice, pronunciation feedback, conversation simulations, and adaptive learning pathways. Given the widespread adoption of these applications among language learners, it is crucial to investigate how they mediate EFL students' self-study practices and, more importantly, how they influence learner agency. This exploration is particularly relevant within the framework of SCT, which posits that learning occurs through a dynamic interaction between individuals and cultural tools. By examining the features of these AI-powered applications through the lens of sociocultural theory (SCT), we can gain valuable insights into how they shape learners' self-study strategies and their sense of agency.

Research Questions

This study seeks to answer the following research questions:

1. How do EFL students implement self-study of English language skills via AI-generated language learning applications on mobile devices?
2. What features of mobile devices assist EFL students' self-study of language skills?
3. What features of AI-powered language applications mediate EFL students' agency in learning language skills?

Literature review

Self-study in MALL

Self-study has been increasingly recognized as a key approach in language learning, particularly in higher education contexts. However, a comprehensive understanding of learners' perceptions and experiences of self-study remains limited (Al-Amri, 2021). For university students, self-study typically involves deliberate and active engagement in learning activities to acquire knowledge and achieve specific learning goals (Trinh, 2023). In the digital age, MALL offers a flexible platform for self-study, often referred to interchangeably as informal, self-directed, self-regulated, or learner-initiated MALL. These terms generally describe learner-driven and self-managed language learning facilitated by mobile devices in informal settings. MALL empowers learners by granting them agency and ownership over their learning journey. This empowerment is manifested in their ability to control the pace, location, and schedule of their studies, cultivating autonomy and a stronger sense of investment in the learning process (Traxler, 2007).

Tool Mediation in Sociocultural Theory

Sociocultural theory, developed by Vygotsky and his colleagues (Huong & Bui, 2021; Lantolf et al., 2020), posits that human activity is mediated by socially constructed and culturally developed artifacts - tools (physical) and signs (symbolic). Vygotsky (1978) explained that tools enable humans to externally manipulate the objects of their activity, while signs, particularly language, facilitate the mastery of internal mental processes. Thus, SCT views learning as a tool-mediated social process where individuals utilize artifacts to transform cognition and practice within a social context (Engeström, 1987).

This theory has evolved to incorporate the mediational role of digital tools (Huong et al., 2024), recognizing their potential to influence language learning through mediated interaction. While traditional SCT emphasizes social interaction between teachers and students, and among peers, as the primary means of mediation, self-directed learning with online resources and digital tools has expanded the concept. In such contexts, the features and functionalities of language learning applications themselves can serve as mediating tools, providing affordances that promote learning (Ünlüsoy et al., 2022). Furthermore, learners' engagement with these tools can enhance their digital competence (Hall, 2007).

Learner Agency in Language Learning

Learner agency, while multifaceted, generally refers to the capacity of learners to direct their own learning. Swain (2009) suggests that learners with agency actively evaluate, accept, or reject learning strategies, make autonomous choices, and demonstrate proactivity (pp. 100-101). Pu (2020) further delineates learner agency into four key components: intentionality (having a clear motive and plan), forethought (setting goals and developing strategies), self-reactiveness (possessing self-discipline and sustained motivation), and self-reflectiveness (reflecting on learning processes and adapting as needed). Guo (2022) defines language learning agency as "reflect[ing] learners' capacity to deal with language learning and impact their learning with mobile apps" (p. 58). Expanding on this, Guo (2022) elaborates,

> Learner agency [is] the learner's socioculturally mediated capacity to deal with language learning with mobile apps and influence their learning practices. Learner agency is a complex system that includes different aspects such as motivation, belief, and the actions learners take to control their learning practices. (p. 62)

Larsen-Freeman (2019) describes learner agency as the ability to cultivate an optimal learning environment and strategically utilize available communication tools (semiotic resources) to construct a desired identity within a multilingual world (pp. 70-71). This definition underscores learners' power of choice and their approach to learning resources. Gao (2021) argues that agency surpasses autonomy, encompassing individuals as embodied, cognitive, emotional, and social beings shaped by experiences and identities. These individuals act purposefully, pursuing interests and aims within specific contexts.

The emergence of SCT in the mid-1990s shifted the focus from individual learner attributes to learner agency within a social context (Kalaja et al., 2015). SCT considers learner agency as shaped by the surrounding social environment, encompassing the individual's life history, learning trajectory, and identity (Yashima & Fukui, 2020). Agency is a multifaceted system

involving motivation, beliefs, and actions learners take to manage their learning (Guo, 2022, p. 62). It embraces a socioculturally mediated nature and develops within a socio-cultural context (Guo, 2022). Schoon (2018) posits that agency is a relational process emerging from interactions, understood as interdependent through intersubjective processes (Vitanova et al., 2014). Learner agency "mediates and is mediated by the sociocultural contexts" (van Lier, 2008, p. 172). Consequently, learner agency is a historically, culturally, contextually, and interdependently developed concept. In this study, learner agency indicates learners' mediated capacity to do self-study of language learning with AI-generated applications and influence their learning practices. It is conceptualized as a psychological attribute influencing behavior, closely linked to motivation, and specifically defined as self-regulation capacity across metacognitive, cognitive, behavioral, and affective strategies (Guo, 2022; Yashima & Fukui, 2020).

Previous Studies

The field of MALL has witnessed a surge in research exploring learner agency in self-directed study using language applications. Various studies have highlighted common themes and identifying areas ripe for further investigation. One emerging theme is learner agency as a driver of MALL engagement. Studies suggest that learners with a strong sense of agency are more likely to actively select appropriate applications, set personalized learning goals, monitor their progress, and adapt their learning strategies (e.g., Matsumoto, 2021). This proactive approach aligns with broader definitions of learner agency as encompassing intentionality, forethought, self-reactiveness, and self-reflectiveness (Pu, 2020). However, the specific ways in which agency manifests in the MALL context require further scrutiny.

Another theme is that leaners' perceived affordances and constraints of language learning applications. The study by Nguyen (2024) reveals that learners appreciate the accessibility, convenience, and perceived effectiveness of MALL for vocabulary acquisition and skill development (e.g., listening, speaking, reading, writing). Learners often report using applications like Duolingo, ELSA Speak, and YouTube for self-study. Huong and Bui (2024) further emphasize the value of personalized learning suggestions, engaging activities, timely feedback, and error correction features within these applications. However, other studies also point to constraints, including distractions, limited pedagogical explanations, and the potential for superficial learning (e.g. Chan & Ang, 2017; Marton & Säljö, 2005). Chan and Ang (2017) conducted a mixed-methods study, using surveys and interviews, to examine how Malaysian youth learn languages through smart devices in their everyday lives. Their research found that language learning often happened incidentally or serendipitously, driven by immediate communicative needs, with tools like Google Translate playing a significant role.

The influence of contextual factors seen from the perspectives of SCT on agency in using language applications has also documented, which reveals the interplay between contextual factors and learner agency in MALL. For example, Lai et al. (2018) demonstrated that learning patterns with online applications are influenced by factors such as learner proficiency, perceived usefulness and ease of use, and support from teachers and peers. These findings underscore the importance of considering the broader learning environment and the role of social interaction

in shaping individual agency within MALL. Ma (2017), in a multi-case study of ten Hong Kong university students, explored how learners utilize mobile resources for second language (L2) learning. The study revealed that students employed a variety of e-resources and integrated L2 learning with other activities, such as academic studies, communication, entertainment, and personal interests, resulting in highly personalized learning approaches. Using SCT to analyze mobile-mediated L2 learning, Ma (2017) highlighted the dynamic interplay of learner agency, personalized learning strategies, technological tools, and existing knowledge, providing insights into how mobile technology shapes learners' L2 experiences both within and beyond the traditional classroom.

While the previous studies have explored general perceptions and usage patterns of learners on mobile devices and language applications, there is a need for more analysis of how learners enact agency *during* their interactions with language learning applications, for examples, how learners make choices about which activities to pursue and how they adapt their learning strategies based on feedback from AI-generated tools. Besides, a deeper understanding of the impact of language applications on learners' intentionality, motivation, self-efficacy, and other learning strategies is needed to shed light on the topic of learner agency. By addressing these gaps, the findings of the current study hope to contribute to a more nuanced understanding of the complex relationship between learner agency, mobile technology, and language learning on applications, ultimately informing the development of more effective MALL practices and pedagogical approaches.

Methods

Design of the Study

A mixed-methods approach incorporating both questionnaire and in-depth interview was employed to investigate "EFL Students' Agency in Self-study of English with AI-powered Language Learning Applications" among 159 university students in Vietnam. This design is justified by its ability to provide a comprehensive understanding of the phenomenon. The quantitative data collected through the questionnaires allowed for the efficient gathering of perceptions, attitudes, and reported behaviors from a larger sample, enabling the identification of broad trends and patterns regarding students' use of AI-generated language tools and their perceived agency. Subsequently, the qualitative data obtained from in-depth interviews provided rich, detailed insights into the underlying reasons for these trends, exploring EFL students' lived experiences, motivations, challenges, and specific strategies in exercising agency in their self-study. This triangulation of data sources not only corroborated findings from both methods but also offered a deeper understanding of the complex interplay between AI-powered applications, self-study, and student agency, which would be difficult to achieve with a single method. Therefore, this mixed-methods design aimed to enhance the validity and depth of the research findings, offering deeper understanding of the topic.

Participants

This study employed convenience sampling for participant recruitment. The method allowed for efficient and cost-effective data collection, as university students were readily accessible within the academic setting, which was crucial, given the typical research constraints and

logistical challenges in Vietnam. It was also suitable for an exploratory and mixed-methods research, enabling the rapid gathering of quantitative trends to inform deeper qualitative insights. Furthermore, this sampling aimed at a focused investigation on a specific, relevant population—Vietnamese university EFL students—and was pragmatic for the emerging research topic on the use of AI-generated tools in English learning at the research site. The convenience sampling, while practical and efficient, could be prone to bias due to its non-random selection process. To enhance the generalizability of findings, the study used two data collection methods combining survey and interview to provide a more comprehensive understanding and help triangulate findings.

Regarding the sample size, 159 students were considered sufficient for this mixed-methods design. For the quantitative component, 159 participants generally exceed minimum recommendations for basic sample size which is often around 100 (Hair et al., 2018) and provide a reasonable statistical basis for identifying broad trends and patterns. The qualitative component involved a subset of 20 out of the population of 159 students, meeting the principle of saturation (Guest, et al., 2006) which recommended a range from 12 to 30 participants for interviews. Thus, the sample of the 159 participants was considered to suffice to achieve rich insights into the 'why' and 'how' of students' agency in learning with AI-generated language applications.

The participants were undergraduates majoring in English-related fields, including linguistics, teacher education, and translation/interpretation. The university curriculum mandates self-study for all major courses. The participant demographic consisted primarily of 20 and 21-year-old students (49.7% and 43.4%, respectively), with a significant female majority (92.4%). Reported English proficiency levels ranged from B1 to C1 on the Common European Framework of Reference for Languages (CEFR), with the majority at B2 (56.6%). The participants reported varying amounts of time spent studying English using online applications: 24.1% less than three hours, 32.3% less than six hours, 23.4% less than nine hours, and 20.3% reported 10 hours or more. They were informed of the research purposes and consented to participate in the study.

Data Collection Tools

The questionnaire was designed using SCT, which views self-study as a mediated activity involving interaction between learners and mobile devices as well as AI-powered language learning tools, potentially leading to changes in language learning (Hall, 2007; Huong et al., 2024; Ünlüsoy et al., 2022). It also incorporated principles of learner agency, understood as a socio-culturally mediated capacity to manage language learning with mobile applications. Learner agency included aspects such as motivation, beliefs, and actions taken to initiate and implement learning (Guo, 2022, p.62). Furthermore, learner agency themes were adapted from Pu (2020), focusing on having clear self-study plans and goals, self-discipline, and self-reflectiveness. The questionnaire comprised three sections: implementation of self-study on mobile devices by EFL students (10 items), features of mobile devices assisting EFL students' self-study (8 items), and features of language learning applications mediating EFL learner agency in self-study (12 items). A pilot study was conducted with 15 students, distinct from the main study participants, to assess the questionnaire's reliability. The questionnaire demonstrated strong reliability, as evidenced by a Cronbach's Alpha (α) of .847. Minor linguistic adjustments

were subsequently made to enhance the questionnaire's clarity for the main study.

The interview protocol was designed to obtain in-depth reflections on the participants' self-study experiences with digital tools and language applications, serving as a crucial qualitative complement to the questionnaire findings. While the questionnaire identified broad trends and patterns of learners' agency in learning with AI-generated applications, the interviews, conversely, delved into the underlying reasons, perceptions, and lived experiences that quantitative data alone cannot fully capture. Grounded in SCT, which views self-study as a mediated activity involving interaction between learners and digital tools potentially leading to changes in language learning (Hall, 2007; Le et al., 2024; Ünlüsoy et al., 2022), the protocol specifically probed how the participants' interactions with language applications shaped their language learning. Furthermore, it incorporated the learner agency themes adapted from Pu (2020) to specifically explore the participants' self-study plans, goals, and reflections of their use of technology, thereby providing a deeper understanding of their agency in ways that the questionnaire with close-ended items could not obtain responses.

Data Analysis

The quantitative data collected through the questionnaire was analyzed using SPSS (Statistical Package for the Social Sciences) software for statistical analysis. This choice is justified by SPSS's user-friendly interface, comprehensive statistical capabilities, and its suitability for analyzing large datasets like those typically generated by questionnaires. For each of the questionnaire's items across its three sections—implementation of EFL self-study on mobile devices, features of mobile devices assisting EFL self-study, and features of language learning applications mediating EFL learner agency in self-study—mean (M) and standard deviation (SD) were tabulated and presented.

The tabulation of mean is crucial because it provides a measure of a central tendency, offering a concise summary of the average response for each item. The mean indicates the typical level of agreement, frequency, or importance attributed to a particular statement by the 159 student participants. This allows the researcher to quickly grasp the overall inclination or agreement of the group towards a specific aspect of AI-powered language application that mediates self-study and learner agency. The standard deviation (SD) was calculated to measure dispersion or variability. It indicates the average amount of spread or deviation of individual responses around the mean. A small standard deviation suggests that responses are clustered closely around the mean, indicating high agreement or consistency among participants. Conversely, a large standard deviation implies a wider spread of responses, signaling greater diversity or disagreement among the students. In this study, tabulating both the mean and standard deviation for each item allows for a comprehensive descriptive overview of the data, providing not only the central tendency but also an understanding of the homogeneity or heterogeneity of responses, which is essential for interpreting the quantitative findings accurately before delving into the qualitative data for deeper explanations. The quantitative analysis demonstrated high reliability, with a Cronbach's alpha of .832, exceeding the recommended threshold of .70 (Taber, 2018).

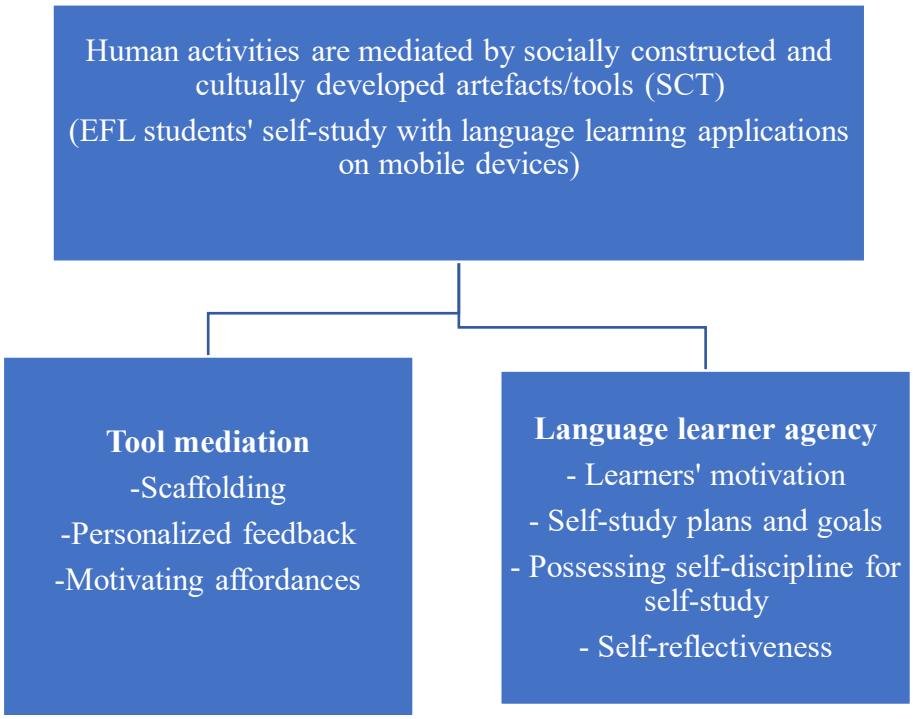
For the qualitative analysis of the interview data, the participants were assigned pseudonyms

using Vietnamese names. Inter-coder reliability was established through independent coding of themes by the researcher and a colleague, resulting in a 91.3% agreement rate. The interview coding scheme was adapted from Guo (2022), which emphasizes the mediational roles of mobile applications towards learner agency. Specifically, Guo (2022) explored how mobile applications mediate the interaction between learners' agency and their learning context. In this study, the interview data were sub-themed to examine the roles of mobile applications in this interaction and their effects on learners' agency and learning contexts. Thematic analysis, as outlined by Braun and Clarke (2006), was employed to identify, analyze, and report patterns in the data. To ensure consistency in the thematic analysis, the researcher repeatedly read the transcripts, focusing on evidence related to the research questions (Braun & Clarke, 2006). Following Guo's (2022) suggestion, the analysis transitioned from an inductive approach in the initial coding phase to a deductive approach in the subsequent phase. This aimed to obtain a detailed exploration of the types and patterns of language learning with mobile devices and online applications from a SCT perspective.

Overall, data analysis commenced with an initial coding phase, designed to familiarize the researcher and the other coder with the data and generate a preliminary code list, as depicted in Figure 1.

Figure 1

Coding scheme



To ensure the reliability of the coding process, initially, a subset of the data was independently

coded by two researchers to establish inter-rater reliability. Discrepancies were discussed and resolved through consensus, leading to the refinement of the coding manual and the establishment of clear operational definitions for each code. This interactive process ensured consistent application of the codes across the entire dataset. Themes were developed inductively, emerging directly from the data. Initial codes were grouped into broader categories, and these categories were then refined into overarching themes, including "tool mediation" and "language learner agency" (see Figure 1) and their respective subthemes through ongoing discussions and modifications. This cyclical process of coding, categorizing, and theme development allowed for a deep engagement with the data, ensuring the generated themes accurately reflected the patterns and meanings within the dataset.

Results/Findings and discussion

The mean scores and standard deviations of the three clusters of the questionnaire are presented in Table 1.

Table 1.

Mean scores of questionnaire clusters

Cluster	Mean	SD
How EFL students implement self-study of English language skills on mobile devices	3.4371	.52381
Features of mobile devices that assist EFL students' self-study of English language skills	4.0833	.47892
Features of language learning applications mediating EFL students' agency in self-study of English language skills	3.9953	.46287

The data reveal that the questionnaire items related to mobile device features mediating learning had the highest values, with language learning applications assisting learning showing the next highest. Detailed results are provided in the section that follows.

EFL Students' Self-study of English Language Skills on Mobile Devices

A range of language learning applications were used for self-study by EFL students, including TEDEd, Duolingo, DailyDictation, Engexam.info, Study4, Cake, Write&Improve, Memrise, Elsa Speak, Grammarly, Learn & Speak English, FluentU, and Tandem. The ways in which EFL students learned English on mobile devices are detailed in Table 2.

Table 2.

How EFL students implement self-study of English language skills on mobile devices

	Statement	Mean	SD
1.	I use non-smart handhelds (e.g. laptop computers) for my self-study of English language skills.	3.67	1.209
2.	I use smart handhelds (e.g. smartphones, tablets, iPads, etc.) for my self-study of English language skills.	4.26	.830
3.	I use other mobile devices (e.g. e-readers, digital notebooks, etc.) for my self-study of English language skills.	2.42	1.289
4.	I use mixed mobile devices for my self-study of English language skills.	3.60	1.109
5.	I follow online teachers/ YouTubers for my self-study of English language skills on mobile devices.	3.52	1.042
6.	I learn each language skill (e.g. listening or writing) separately during my self-study of English language skills on mobile devices.	3.67	1.004

7.	I integrate different language skills, such as reading and writing, as well as listening and speaking, during my self-study of English language skills on mobile devices.	3.57	1.058
8.	In case I encounter problems or have questions during my self-study of English language skills on mobile devices, I seek assistance from a provided AI assistant.	3.70	1.135
9.	In case I encounter problems or have questions during my self-study of English language skills on mobile devices, I ask for help from my friends.	3.23	1.102
10.	I adhere to a fixed schedule for self-study of English language skills on mobile devices.	2.74	1.064

Table 2 reveals that the 159 students exhibited the highest agreement regarding the use of smart handheld devices (smartphones, tablets, iPads) for English self-study (M = 4.26, SD = 0.830). This was accompanied by a notable tendency to seek AI assistance during their learning on mobile devices (M = 3.70). Conversely, the lowest agreement was observed for the use of other mobile devices (e-readers, digital notebooks) in self-study (M = 2.42, SD = 1.289), indicating greater variability in responses. Furthermore, the second-lowest mean score (M = 2.74) was recorded for adherence to a fixed self-study schedule, likely due to the opportunistic nature of self-study with language learning applications.

In the interview, Giang stated,

> I can multi-task by self-studying using mobile applications that offer audio and visual language tasks for practice. I found this method efficient, time-saving, and convenient for accessing rich learning resources on a mobile device.

Another student, Quynh, presented her perspective on learning English with mobile devices. She said, “Because my laptop is mobile, I can study anytime and anywhere, allowing me to arrange self-study times that align with my personal learning interests”. For Diem, learning with mobile devices has several advantages. In the interview, she stated,

> Learning with mobile devices has significantly improved my self-study skills. With just a smartphone, I can easily learn English vocabulary, grammar, and practice language skills. For instance, during university break times, I can use my smartphone to watch English movies, read bilingual online books, or practice short conversations using the Cake app. This allows me to efficiently utilize my time for English learning

Overall, the findings on how EFL students implemented self-study of the English language on mobile devices reveals varying degrees of engagement across different self-study activities, offering insights into the role of tool use within a sociocultural framework and the exercise of learner agency. Notably, the highest mean score (M = 4.26, SD = 0.830) was observed for "I use smart handhelds (e.g. smartphones, tablets, iPads, etc.) for my self-study of English language skills", suggesting that while the study focuses on mobile devices, students still use a broader array of mobile devices as tools in their language learning process. Following closely, "I use non-smart handhelds (e.g. laptop computers) for my self-study of English language skills" also showed a high mean score (M = 3.67, SD = 1.209), confirming the prevalence of tools for language learning. Lower mean scores were observed for activities such as "I integrate different language skills, such as reading and writing, as well as listening and speaking, during my self-study of English language skills on mobile devices" (M = 3.57, SD = 1.058) and "I

follow online teachers/YouTubers for my self-study of English language skills on mobile devices" (M = 3.52, SD = 1.042).

The qualitative feedback from the students like Giang, Diem and Quynh further illuminates the practical benefits and flexibility offered by mobile learning, such as efficient time management and personalized learning experiences. These choices reflect learners' agency in selecting and using tools to meet their specific learning needs and preferences, illustrating how they actively shape their learning environment and pathways. Generally, the data indicate that EFL students strongly favour using smart handheld devices for self-study, making use of AI assistance when needed. They valued the flexibility and convenience provided by mobile tools. The interviews further highlight the positive impact of mobile learning on students' self-study skills, motivation, and autonomy.

Features of Mobile Devices Assisting EFL Students' Self-study of Language Skills

Table 3.

Features of mobile devices assisting EFL students' self-study of English language skills

Statement	Mean	SD
11. I can practice English language skills with a mobile device anytime and anywhere.	3.97	.758
12. I am in charge of my English language skills learning and have great control over various aspects of my language learning via mobile devices.	3.91	.701
13. I feel unrestricted when I do my self-study of English language skills with a mobile device.	4.07	.780
14. I can easily install any applications for my English language skills learning on mobile devices.	4.38	.683
15. I can exploit various potentials of a mobile device (e.g. use of sound, video, speech recognition, etc.) when I do my self-study of the language skills on it.	4.32	.749
16. I can record/keep and follow up on my self-study of English language skills with a mobile device.	4.17	.781
17. I can collaborate with other learners at distant locations via mobile devices to learn English language skills.	3.86	.870
18. I can easily connect a mobile device to another device via Wifi, Bluetooth, etc. to share data with other learners during my self-study of English language skills.	3.99	.965

The highest mean score (M = 4.38) was recorded for the statement, "I can easily install applications for my English language skills learning on mobile devices." This result highlights the perceived mobility and accessibility of these devices. The respondents also demonstrated high agreement regarding their ability to utilize various mobile device functionalities (e.g., sound, video, speech recognition) for self-study (M = 4.32). However, the students expressed the lowest agreement with the statement concerning collaboration with distant learners via mobile devices (M = 3.86), which aligns with the nature of self-study.

The flexibility of mobile devices was a key feature highlighted by students. One student, Nhu, reported effectively utilizing her device during university breaks and lunch periods for self-study on campus. Diem found that mobile devices facilitated English learning through engaging activities such as games, videos, podcasts, and online applications. Quynh further noted,

> I used to spend time surfing TikTok and playing games. However, once I learned to leverage mobile devices for learning, I felt that every moment spent on my phone contributed to gaining more knowledge.

Free access of materials downloaded on mobile devices was also appreciated by the participants. For example, Trang pointed out another feature of the mobile device that she used for her study,

> Instead of photocopying learning materials, self-studying with a mobile device eliminates the need for photocopy services. More importantly, the materials are saved in the device's history, allowing me to easily retrieve sources, unlike print materials which can be easily lost.

The participants valued the ability of mobile devices to allow access and store downloaded learning materials, particularly free resources. Phuong noted that mobile devices allowed her to save numerous learning materials, including coursebooks, which could be accessed at any time, saving time, storage space, and the cost of purchasing printed books.

Furthermore, the mobile devices facilitated connections with other learners, as reported by Phuong, Thuy, and Huyen. Phuong mentioned using mobile devices to participate in online courses with others. Thuy highlighted the use of online forums in English, both domestically and internationally, to expand her network. Ngoc found the application HiNative useful for English learning, as it allowed her to ask questions and receive answers from native English speakers. Huyen elaborated on the benefits of learning with mobile devices, emphasizing access to a wide range of materials and courses.

> Learning with mobile devices provides access to online courses and platforms like Coursera, Khan Academy, and Udemy, which offer a variety of courses focusing on English language skills and other English-related aspects. I can also access extensive resources from Kindle, iBooks, and Audible to read or listen to audiobooks, improving both reading and listening skills. Furthermore, I can practice speaking English with native speakers using apps such as Tandem, HelloTalk, and Speaky.

Notably, all the 20 interviewed students reported advantageous features of mobile devices for English language learning. This suggests a purposeful selection and utilization of mobile devices for self-study, fostering student agency in material selection and learning strategies. The perceived benefits extended beyond convenience, accessibility, and flexibility, encompassing features that enabled students to develop self-study habits.

Overall, the finding on the features of mobile devices assisting EFL students' self-study of language skills presented in Table 3 illustrates the perceived utility of mobile device features in self-study. The highest mean score (M = 4.38) was recorded for the statement related to easy installment of applications for English language skills learning on mobile devices. This suggests that the inherent portability and ease of access of mobile devices are highly valued by the students, allowing them to engage in language learning anytime and anywhere. Other highly

rated features include the ability to exploit various potentials of a mobile device such as use of sound, video, and speech recognition for self-study (M = 4.32, SD = .749). Conversely, features related to collaboration, such as "I can collaborate with other learners at distant locations via mobile devices to learn English language skills" (M = 3.86, SD = .870), received a lower mean score, indicating a preference for individual self-study. Qualitative feedback from students further elaborates on these findings. For examples, Diem noted that mobile devices facilitated English learning by allowing engaging activities to be viewed and studied on the devices, while Huyen highlighted the benefits of using mobile devices to access learning resources. This data suggests that students perceive and utilize specific technical features of mobile devices as crucial tools for their autonomous language learning.

A further objective of the study was to investigate the features of AI-generated language applications mediating student agency. The subsequent section presents data from a questionnaire administered to the 159 students, including the 20 interview participants.

Features of AI-generated Applications Mediating EFL Students' Agency in Self-study of Language Skills

Table 4.

Features of AI-generated applications mediating EFL students' agency in self-study of language skills

Statement	Mean	SD
19. It is helpful for my self-study of English language skills when I can download the applications and use them on any mobile platform.	4.35	.703
20. Some applications are free totally or free for a period of time, which helps to maintain my self-study of English language skills on them applications.	4.34	.719
21. I find it useful for my continuous self-study of English language skills with applications that include such presentational elements as a user-friendly interface, timing, control options, and help options.	4.28	.695
22. The various types of activities provided by a language learning application help me practice to improve my English language skills.	4.19	.742
23. The multimodal features of an application, for example, animation, audio, colourful graphics, etc. motivate my self-study of English language skills.	4.21	.788
24. Language learning applications offer personalized recommendations by analyzing my learning progress to create adaptive learning paths for my self-study of the language skills.	4.03	.830
25. Language learning applications provide activities geared toward my learning needs, which helps me realize my strengths and weaknesses to improve my English language skills.	4.00	.763
26. Language learning applications provide specific feedback, which help me improve my English language skills.	3.84	.861
27. Language learning applications provide scores/grades for the tasks/exercises, which helps me know my level of English proficiency.	3.94	.723
28. Language learning applications function as teachers to instruct me step-by-step how to do my self-study of English language skills.	3.74	.875
29. Language learning applications give me badges/flags/applauses, etc. as well as other encouraging forms when I can do the language skills activities correctly, which motivates me to practice more on them.	3.65	1.006

30. Language learning applications do not criticize me when I give wrong answers, which makes me feel confident to continue with my self-study of English language skills.	3.36	1.150

The statement "It is helpful for my self-study of English language skills when I can download the applications and use them on any mobile platform" received the highest mean score (M = 4.35), indicating the importance of accessibility and offline storage for language learning applications. In addition, the students showed a strong preference for free or time-limited free applications (M = 4.34), highlighting their desire for cost-effective learning tools that support learner autonomy. While still demonstrating agreement, students' ratings were lower for applications that provide gamified encouragement like badges or applause (M = 3.65), and significantly lower for applications that avoid criticism for incorrect answers (M = 3.36). Notably, responses for these latter two statements showed greater variability, as indicated by SD values of 1.006 and 1.150, respectively.

During the interviews, the students described how their learning agency was mediated through their experiences with mobile applications. A prominent theme was the perception of applications as scaffolding tools that facilitated their learning progress. The students reported receiving automated feedback during English practice, which they viewed as instruction from more knowledgeable others. Thuy appreciated the specific listening tips provided by TalkEnglish and Daily Dictation. Ngoc highlighted the direct and clear error correction and useful feedback as motivating factors. Tuyet found ELSA helpful for improving pronunciation, and Grammarly for detailed grammar correction in writing. Huyen noted the scaffolding provided through real-life contextualized lessons, which aided in the appropriate use of language expressions.

Besides, the interviews revealed that personalized feedback and study history tracking were key aspects of learner agency, motivating their continued engagement. Diem noted that Minitest and Study4 provided progress tracking and feedback, aiding in identifying areas for improvement and maintaining effective learning strategies. Trang appreciated the use of diagrams to visualize progress and the exposure to trending reading topics in Duolingo. Similarly, Linh reported that Coursera and Udemy's feedback helped her assess her strengths and weaknesses, facilitating targeted improvement. Using another application, Nhu appreciated Elsa's speech evaluation feature, which provided encouraging feedback and logically structured, visually appealing lessons with suggested study times. Focussing on the writing skills on the language applications, Tram valued the feedback from virtual AI assistants, which offered suggestions for correct language use, writing evaluations, and language improvement strategies.

The interviews also revealed that motivational features within applications significantly enhanced learner agency, encouraging sustained self-study. The students reported feeling motivated by application affordances, particularly features like applause, badges, bonus points,

certifications, recognitions, and cheering sounds. Nhu, for example, commented on the following feature of an application:

> The application's captivating visuals and videos, covering various topics, help me visualize new words. This is the primary reason I find studying with it more engaging than with a physical book. (Nhu, interview)

Xuan pointed out how the reminder from applications assisted her to be more self-engaged in learning.

> While scrolling through social media, notifications from the foreign language learning apps on my smartphone remind me it's time to study. Even with only 5-10 minutes of study daily, this consistent practice is forming a good habit, and the knowledge gained each day is gradually accumulating.

Trang also claimed that the friendly interface of the applications as well as easy and free access gave her more motivation to search for more knowledge. After learning with Cake, Duolingo, and Elsa, Phuong said that she spent more time to learn new words and language expressions suggested by the applications.

Another student, Anh, reported that the applications increased her interest in her self-study. She said,

> The application's eye-catching, easy-to-understand, and user-friendly interface boosts my interest in learning English. Mobile educational video platforms allow me to learn visually and at my own pace. I can watch lectures, tutorials, or demonstrations on various subjects, which enhances my understanding of complex topics through dynamic visuals and explanations.

The interview data indicate that applications motivate learners through virtual awards, bonus points, and prizes. Huyen reported being motivated by Duolingo's rewarding gamification, which included badges, points, and access to higher-level lessons. Oanh, also using Duolingo, appreciated its daily reminders, which helped her maintain consistent study habits. Nhu found the application's ranking feature, with streaks indicating completed tasks and progress, encouraging for daily self-study.

Learner agency was also evident in the development of study autonomy. For example, Quynh reported, "I have learned to be self-disciplined and trained myself to be able to study anytime, anywhere," attributing this to her time studying with the applications. Phương stated, "After using the application, I was able to self-assess my English levels and then make suitable study plans to improve my language skills." Diem commented on Cake,

> Cake has enhanced my learning autonomy thanks to its daily reminder. I review my lessons daily and have more knowledge from the suggested lessons from the application. I can master my self-study plan completely.

In the same vein, Anh stated, "These apps allowed me to create to-do lists, set reminders, and break down larger study tasks into manageable steps." Ly reported developing a consistent daily study habit with the applications and completing planned lessons. Similarly, Huyen found that her learning autonomy increased as she began setting her own self-study plans after a period of using the applications and their reminders. Thanh noted increased self-awareness in her study habits with the applications, with this autonomy extending to other areas of learning.

Overall, the questionnaire data from Table 4 "Features of AI-generated Applications Mediating EFL Students' Agency in Self-study of Language Skills" reveals a strong consensus among the students regarding the value of various online application features. The highest mean scores indicate that the students highly value applications that are easily downloadable and usable on any mobile platform (M=4.35, SD=.703) and those that are free totally or free for a period of time (M=4.34, SD=.719). Features related to a user-friendly interface, timing, control options, and help options also received high ratings (M=4.28, SD=.695). The multimodal features such as animation, audio, and colorful graphics (M=4.21, SD=.788) and personalized recommendations for adaptive learning paths (M=4.03, SD=.830) were also perceived as highly beneficial. Conversely, features like badges, flags, and applause (M=3.65, SD=1.006) and non-critical feedback (M=3.36, SD=1.150) received comparatively lower, though still positive, ratings. The interview data further enriches these quantitative findings by providing concrete examples of how these features motivate students and foster self-study. Anh reported that applications increased her interest due to their eye-catching, easy-to-understand, and easy-to-use interface and dynamic visuals and explanations. Students like Huyen and Quynh highlighted the motivational impact of gamification features (virtual awards, bonus points, badges), while Nhu appreciated ranking features. Beyond motivation, the interviews strongly point to the role of applications in cultivating learner autonomy. Quynh, Phuong, Diem, and Linh all described how features like self-assessment, daily reminders, and organized task lists helped them become more self-disciplined, self-assess, create suitable study plans, and master their self-study plans completely.

Discussion

This study investigated the implementation of self-study among EFL students, utilizing AI-powered language learning applications on mobile devices, with a specific focus on how the features of these language learning applications mediate learner agency through the lens of SCT. The research sought to address a significant gap in the understanding of the MALL process, particularly regarding the dynamic interplay between learner agency and digital tools, as highlighted by Guo (2022), Kimsesiz (2023), Miangah and Nezarat (2012), and Trinh (2023). The findings of the study provide some insights into the ways EFL students in this specific

cultural and educational context utilize and perceive AI-powered language learning applications.

Firstly, regarding how EFL students implement self-study via AI-generated language learning applications, the findings resonate with the theoretical tenets of SCT and learner agency in language learning. The observed high engagement of the students with both smart and non-smart handhelds for self-study aligns directly with Vygotsky's (1978) concept of mediation, where tools (in this case, mobile devices) are not merely aids but fundamental instruments that facilitate learning and thinking processes. As Huong et al. (2024) explained, humans actively manipulate external tools, which significantly influence their mental operations. The consistent use of various mobile devices for self-study exemplifies this process of instrumental mediation in language acquisition. Furthermore, the varied engagement across different self-study activities, from utilizing diverse skills to seeking assistance from AI, clearly indicates that learners are exercising significant agency in selecting the most suitable methods and resources. This aligns with learner agency theory, as defined by authors like Swain (2009) and Pu (2020), who emphasize learners' proactive decision-making, autonomous choices, and self-regulation in their learning. Students like Huynh, Diem, and Ngoc explicitly articulated how they actively utilized mobile devices to manage their learning time efficiently, access diverse content, and practice various language skills. Their ability to adapt their learning strategies to their individual schedules and preferences, as highlighted by Engeström (1987) in the context of tool-mediated social practice, further underscores how these digital tools empower learners to take ownership of their educational journey. This reinforcement of the interconnectedness between individuals, mediating tools, and dynamic learning processes within a sociocultural context is also supported by Ünlüsoy et al. (2022) who recognized the influence of language learning through mediated interaction, and Engeström (1987), who saw digital tools as a means to transform cognition and practice.

Secondly, the findings on how the features of mobile devices assist language users in self-study shows alignment with the theoretical framework tool mediation in SCT. The high mean scores related to mobility, accessibility, and the exploitation of various technical potentials (e.g., sound, video, speech recognition) directly support the notion that MALL offers a flexible platform for self-study and empowers learners by granting them agency and ownership over their learning journey (Trinh, 2023). The qualitative insights from the interviews further underscore how the *features* and *functionalities* of mobile devices serve as mediating tools, providing affordances that promote learning and enhance their digital competence (Ünlüsoy, et al., 2022). While collaboration features were less utilized, the overall emphasis on individual accessibility and mobility for skill practice reinforces the core tenet that MALL empowers learners by granting them agency and ownership over their learning journey (Traxler, 2007). This demonstrates how learners actively engage with the specific capabilities of mobile tools to drive their self-directed language learning, embodying the principles of both self-study in MALL and tool mediation within a sociocultural lens (Huong & Bui, 2021; Lantolf et al., 2020).

Thirdly, the questionnaire and interview data reveal the mediation of the AI-generated application features in promoting EFL students'agency in language learning. The students' high evaluation of user-friendly, accessible, and multimodal application features directly underscores the mediating role of digital tools in language learning, as posited by Vygotsky (1978) and further elaborated by Huong and Bui (2021) and Ünlüsoy et al. (2022). The students' preference for applications with engaging interfaces and rich media demonstrates how specific features and functionalities of language learning applications serve as mediating tools that promote learning and enhance digital competence (Ünlüsoy et al., 2022). Furthermore, the qualitative data illustrates the cultivation of learner agency in language learning (Swain, 2009; Pu, 2020) through these tool features in personalizing and giving feedback as well as encouragement to their learning with the language applications. In the interviews, the students emphasized their ability to self-assess, manage their time, set reminders, and organize tasks. These responses reflect the core components of learner agency, including self-discipline, sustained motivation, and self-reflectiveness (Pu, 2020). The motivational features, such as gamification and visual content, as highlighted by some of the EFL students in the interviews, align with Guo's (2022) assertion that language learning applications create impact on learners' learning with encouraging forms via badges, applauses, and recognition, influencing their motivation. Overall, the data provides evidence that the application features, including user-friendliness, accessibility, and multi-modality, engaging interfaces and rich media act as mediating tools, fostering both sustained motivation and increased learner autonomy, thereby supporting the tenets of MALL within a sociocultural perspective (Larsen-Freeman, 2019; Guo, 2022; Yashima & Fukui, 2020).

The study's findings reveal a distinction between learner autonomy and the more encompassing concept of learner agency, particularly within the context of MALL. While learner autonomy is recognized as the capacity for decision-making, autonomous choices, and self-regulation in learning (Gao, 2021; Traxler, 2007), the research emphasizes how AI-powered applications actively mediate learner agency. This means that rather than merely supporting independent learning, these tools, echoing Vygotsky's (1978) concept of mediation and Engeström's (1987) activity theory, become instrumental in empowering students to take purposeful action. For instance, the observed high engagement of students with mobile devices for self-study in the study illustrates how learners actively manipulate external tools, influencing their mental operations and enabling them to exercise significant agency in selecting the most suitable methods and resources for self-study of the language skills. This goes beyond simply being able to learn independently; it highlights the proactive will and power of learners (Ünlüsoy et al., 2022; Traxler, 2007) to shape their learning journey by making use of the flexible and interactive features of MALL applications, thereby demonstrating ownership and active participation in their educational process (Huong & Bui, 2021; Lantolf et al., 2020; Guo, 2022).

In summary, by examining the features of these applications through the lens of SCT, the study provides a deeper understanding of how cultural tools shape learners' self-study strategies and their sense of agency. Specifically, it extends Guo's (2022) work on the interplay between learner agency and digital tools by focusing on AI-powered applications, which introduces new

dimensions of personalization and adaptivity. The study also builds upon the findings of Miangah and Nezarat (2012) and Kimsesiz (2023) by exploring the specific mechanisms through which mobile learning environments, particularly those enhanced by AI, influence learner agency and self-directed learning. The findings of this study have significant implications for language educators and developers of AI-powered learning tools, particularly within the EFL context.

Conclusion

In conclusion, this study contributes to our understanding of the complex relationship between technology, learner agency, and language learning within an EFL context. By examining the use of AI-powered applications by EFL students through the lens of SCT, the study obtain insights into how to create more effective and empowering learning environments that promote learner agency and facilitate language acquisition, while addressing the concerns and gaps identified by Guo (2022), Kimsesiz (2023), Miangah and Nezarat (2012), and Trinh (2023).

From the study's findings, various implications can be drawn. First, for language learning application design, the findings suggest a need to move beyond mere content delivery to prioritize features that foster active learner engagement and control. Applications should be designed to offer diverse learning pathways, flexible resource selection, and adaptive challenges that encourage learners to exercise significant agency in selecting the most suitable methods and resources. This includes robust feedback mechanisms and tools that enable personalization and self-monitoring. Second, regarding self-study with language applications, the research underscores that effective self-study is not solely about access to materials but about how learners actively manipulate mobile devices and AI-generated learning applications to achieve their goals. This implies that self-study training should focus on developing metacognitive strategies and critical digital literacy, teaching learners how to make use of AI features to manage their learning time efficiently, access diverse contents, and practice various language skills. Third, for language pedagogy, teachers should guide students to strategically interact with MALL tools. This involves integrating AI applications into classroom activities, fostering collaborative learning where students share their digital self-study experiences, and explicitly teaching how to harness AI for skill development. Finally, at the policy level, institutions and educational bodies must recognize the profound impact of MALL on learner agency by supporting the integration of AI-powered applications, including providing necessary infrastructure, ensuring equitable access, and developing guidelines for responsible and effective tool use.

Limitations of this study should be acknowledged. Those include the potential technological problems encountered by the participants during the time the study took place but were not reported and their reflections in the interviews done after their learning experiences may not reveal the complete pictures of their self-study. Besides, the study employed the convenience sampling, which could be prone to bias due to its non-random selection process, affecting the the generalizability of findings. Future research could explore the long-term impact of AI-

powered applications on language proficiency and learner agency, as well as conduct comparative studies across different cultural and educational settings. Examining the role of teacher intervention and guidance in conjunction with AI-powered applications would also be a fruitful avenue for future investigations.

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Biodata

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