Self-directed language learning using mobile technology in higher education

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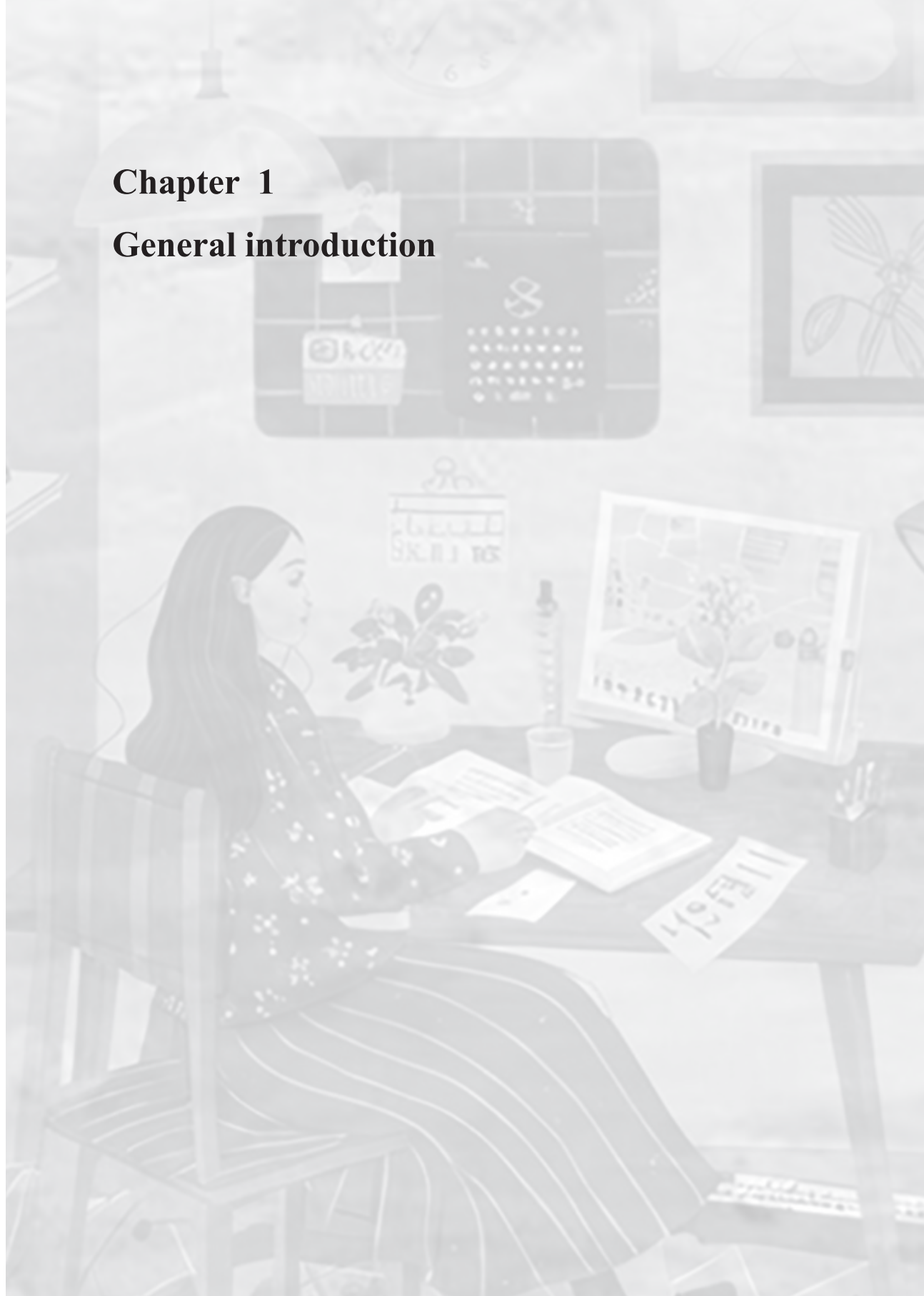
General introduction



1.1 Introduction

The phenomenon of globalization has profound implications for the acquisition of foreign language skills, particularly in academic and business spheres (Kramsch, 2014). In today's interconnected world, proficiency in foreign languages is crucial for students engaging in international courses, whether on campus or online, as well as for academics operating within an international context. Mastery of foreign languages serves as a vital tool, enabling smooth collaboration, the dissemination of knowledge, and the exchange of ideas across disciplines. In essence, it's not merely a skill set but a fundamental requirement for effective communication, cultural appreciation, and collaborative efforts in our globalized society. However, integrating foreign language learning into the core curriculum of specific disciplines within higher education remains limited. Additionally, in some regions, students lack sufficient exposure to foreign languages in classroom settings, hindering their language acquisition process (Richards, 2015; Trinder, 2017; Tsou et al., 2006). To address this gap, many students are turning to self-directed language learning via mobile technology (SDLLMT) as a means to enhance their language skills beyond formal instruction. SDLLMT empowers individuals to take charge of their language learning journey independently (Merriam & Bierema, 2013), utilizing mobile applications such as italki, Babbel, Duolingo, HelloTalk, Tandem, YouTube, and Google Translate to create personalized learning environments. While students may receive support from teachers or peers, the process is primarily student-driven and self-directed (Lai et al., 2022). This approach enables learners to tailor their learning experience according to their needs and preferences, fostering a more flexible and effective language acquisition process outside traditional classroom.

Nowadays, the number of mobile technologies is consistently on the rise, with nearly every student owning a mobile device. According to the Horizon Report 2019, 95% of undergraduate students possess a mobile device (Alexander et al., 2019). In China, the prevalence of mobile technology is similarly high, where almost every university student owns devices such as smartphones, iPads, or laptops. 97% students own smartphones and 3% own non-smart phones (Dai, 2015). The advent of mobile technologies has fundamentally transformed how individuals interact with and perceive their environments. For many students, these technologies have become their primary means of engaging with learning materials (Alexander et al., 2019, p. 21). When utilizing mobile applications, learners often report heightened comfort and increased connectivity with peers and resources throughout their learning journey (Morris et al., 2019). Furthermore, the

integration of mobile technologies in higher education has demonstrated positive effects on student motivation and engagement (Bai, 2019; Nikou & Economides, 2018a). In this dissertation, mobile technology is defined as mobile phone, tablets, laptop and possible applications on them.

Over the past few years, there has been a notable surge in research on the integration of mobile technology and language learning. For example, Ma (2017) conducted a multi-case study investigating how mobile technologies mediate the language learning experience of a group of university students in Hong Kong. Similarly, Wang et al. (2021) explored students' perceptions of Chinese Island (CI), an immersive 3D virtual environment designed to facilitate authentic language use and enhance the learning experience for Chinese language learners in Australia. Additionally, Lee and Xiong (2023) examined how the personalization of Mobile-Assisted Language Learning (MALL) apps influences users' perceptions of concerning social support in terms of information, emotional and appraisal support and trust, which in turn influence their continuance usage intention. Despite these advancements, the predominant focus of MALL research has traditionally been on teacher-initiated learning (e.g., Gao & Shen, 2021; Ghorbani & Golparvar, 2020; Lee et al., 2017; Tai, 2022), neglecting the exploration of student-initiated learning outside the classroom (An et al., 2020). However, it is essential to recognize that the integration of mobile learning does not yield consistent results across all educational settings. A recent meta-analysis study on mobile learning revealed a higher effect size in informal settings compared to formal settings (Sung et al., 2016). Additionally, Hsu (2013) argued that the adoption of a teacher-centered educational approach negatively impacts students' attitudes toward MALL. Given the effectiveness of informal out-of-class learning and the adverse effects of a teacher-centered approach, there is a pressing need for research dedicated to self-directed learning outside the classroom, which is initiated by students themselves.

1.2 Self-directed learning

Self-directed learning (SDL) is a foundational concept that underscores the learner's active role in assuming responsibility for their own educational journey. It empowers learners to devise tailored and adaptable learning strategies based on their existing knowledge and individual needs. By doing so, SDL not only enhances learning outcomes but also equips individuals with essential skills for lifelong learning and future civic engagement. As articulated by Knowles (1975), SDL transcends

traditional educational boundaries and can manifest in both formal and informal learning environments. Knowles (1975) delineates SDL as follows

"*a process in which individuals take the initiative, with or without the help from others, in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies, and evaluating learning outcomes*." (Knowles, 1975, p. 18)

Researchers offer varied perspectives on SDL, each emphasizing different dimensions and contexts. Candy (1991) conceptualizes SDL not only as an endpoint but also as an ongoing process, delineating four key dimensions: learner control, independent pursuit of learning, self-management in learning, and personal autonomy. Of these, personal autonomy emerges as a central objective in education across diverse settings and age groups. Self-management refers to learners' capacity and willingness to regulate their own learning activities, emphasizing the exercise of personal autonomy throughout the learning process. Learner control pertains to the degree of control individuals exert over various aspects of their instructional environment, while the independent pursuit of learning relates to learning endeavors undertaken outside formal educational settings (Loyens et al., 2008). Importantly, Candy's model acknowledges that learners' self-directedness may vary depending on the context in which learning occurs. Brockett and Hiemstra (1991) integrate both personal attribute and process perspectives in their Personal Responsibility Orientation Model. Their model highlighted the significance of the social context, particularly the physical environments where learning takes place. Garrison (1997) proposes an SDL model that aligns with perspectives presenting SDL as both a personal attribute and a dynamic learning process. According to Garrison, SDL involves three interrelated dimensions: self-management, self-monitoring, and motivation. In addition to recognizing SDL as both a personal attribute and a learning process, Song and Hill (2007) introduce a third dimension to their model by incorporating the online learning context. Their model emphasizes the exploration of how environmental factors influence SDL within the realm of online learning.

By synthesizing the existing literature, SDL can be comprehensively understood through three distinct perspectives: personal attributes, process, and context. Personal attributes involve learners' motivations and capabilities in taking responsibility for their own learning, encompassing resource utilization and the development of learning strategies (Garrison, 1997). The process aspect refers to the exercise of personal autonomy, specifically encompassing planning, monitoring, and

evaluating one's learning activities (Moore, 1972). The context perspective emphasizes environmental factors and their impact on the learner's degree of self-direction. The current project regards SDL as a process in which individuals take responsibility and initiative over their own learning process, including diagnosing the learning needs, designing the learning plan, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating their learning results, with or without others' help (Knowles, 1975; Merriam & Bierema, 2013). It's noteworthy that many researchers use the terms "self-directed learning" and "self-regulated learning" interchangeably (Loyens & Rikers, 2008). While their definitions share similarities and both entail active engagement and goal-directed behavior, the key difference lies in the degree of control learners exert, particularly at the onset of the learning process (Loyens & Rikers, 2008). In self-directed learning, learners initiate learning tasks, whereas in self-regulated learning, they may not necessarily do so.

1.3 Self-directed learning using mobile technology for Chinese university students

SDL competency is an essential goal in higher education for improving the quality of student learning and preparing students for the future. SDL has attracted much attention in various disciplines, including the field of English language learning and teaching. In China, before entering into higher education, students learn the English language just for the entrance examinations. When students enter university, they begin to pay attention to their language competencies (like speaking, listening, writing, reading and translating). And, it is widely acknowledged that solely classroom-based learning of languages is likely to be insufficient (Benson & Reinders, 2011) in that learning a language is a long and continuous process. Thus, just practicing the English language in classroom with teachers and classmates is not enough to improve their English language competency due to the teacher-oriented teaching style, limited language-teaching equipment and limited class time. In order to encourage effective language learning, it is necessary to expand the time and space limits of classroom, enabling the student to have contact with English language at different moments of their daily life (Zhang, 2015). SDL out of class can meet this requirement.

Previously, the main way for self-directed language learning is to go to library to borrow some books and practice with peers. But, with the advent of emerging technologies, every college student in China has its own mobile technology device such as mobile phone, iPad or laptop. 97% of students own smartphones and 3% own non-smart phones (Dai, 2015), which guarantees

students' access to mobile technology for SDL. In this dissertation, mobile technology is defined as mobile phone, tablets, laptop and possible applications on them. In the realm of foreign language learning, mobile technology, characterized by affordable internet access, greater memory and processing power, can not only provide self-directed learners boundless access to language learning materials, offer more strategies and support and more ways to evaluate learning outcome (such as using some self-testing applications) (Hsu & Lin, 2021; Kukulska-Hulme & Viberg, 2018), but can also improve learners learning interests, reduce their anxiety when learning and enable learners to design a personalized and adaptive learning plan according to everyone's current knowledge base (Klimova & Prazak, 2018; Yilmaz et al., 2018). Many students therefore try to improve their foreign language competencies outside the curriculum, in a self-directed way. As demonstrated before, SDLLMT refers to learners taking control of their language learning process independently outside the classroom with the assistance of mobile technology, and determining what and how to learn (Merriam & Bierema, 2013). Furthermore, research indicates that self-directed language learning with technology outside the classroom correlates with positive affective outcomes and language proficiency gains (Lai et al., 2015; Sundqvist & Wikström, 2015). However, students exhibit a wide range of self-directed technology usage patterns in terms of frequency, types of technologies utilized, and the manner in which technology is integrated into their learning (Lai & Gu, 2011). Given this diversity, there is a pressing need to delve into the specific nature of university students' self-directed English language learning behaviors with technology (Sumuer, 2018; Zhang, 2010). Such insights can aid educators and researchers in identifying potential avenues for supporting and enhancing students' use of technology for self-directed language learning.

1.4 Theoretical background

1.4.1 How do students self-direct their language learning process assisted by mobile technology?

Although research showed that many students have been conducting self-directed learning using mobile technology, it's important to recognize that simply adopting a learning approach or utilizing mobile technology does not guarantee successful learning outcomes (Vogel et al., 2009). How students navigate the learning process is crucial, as it not only influences the effectiveness of their learning experiences but also serves as the foundational and essential step in fostering learners' competence in self-direction (Tan & Koh, 2014). In essence, the manner in which students engage

with the learning process plays a pivotal role in determining the extent to which they can effectively leverage self-directed learning strategies and technologies to achieve their educational goals.

Many models have been proposed to understand self-directed learning. For example, Candy (1991) presented a Four-Dimensional Model, which encompassed personal autonomy, self-management, autodidaxy, and learner-control. Grow (1991) created his Staged Self-Directed Learning Model to outline a process that assisted learners in navigating the various aspects of the self-directed learning process. Brockett and Hiemstra (1991) proposed the Personal Responsibility Orientation Model and emphasized two orientations of self-directed learning: process and goal. Garrison's Three-Dimensional Model (1997) viewed self-directed learning as a learning process and personal attributes. In addition to a learning process and personal attributes, Song and Hill (2007) added a third perspective: the learning context, which represented the environmental factors' impact on self-directed learning. Hiemstra and Brockett (2012) updated the Personal Responsibility Orientation model to The Person Process Context (PPC) Model, which included teaching-learning process, personal characteristics and learning context. All these models presented above provided us with a comprehensive view of self-directed learning, yet few focused on the specific and detailed perspective of self-directed learning being seen as a learning process. Only Garrison (1997) further noted that the process of self-directed learning involved self-management, self-monitoring, and motivation. However, Song and Hill (2007) stated that Garrison (1997) still emphasized the level of learner autonomy rather than the self-instructional process. Building upon the definition of self-directed learning, therefore, this dissertation developed a model to understand the self-instructional process of self-directed learning, which involves learners initiating their language learning tasks and regulating the learning process. More explicit, it includes learning task initiation phase and Zimmerman's three-phase model of self-regulation (Zimmerman, 2000), which comprises forethought, performance, and self-reflection phases. With this model, we could gain full insight into the entire process of SDL from why learners start to how they achieve their goals.

1.4.2 How do students improve the learning effectiveness in the context of self-directed language learning using mobile technology?

In order to improve the learning effectiveness, the initial adoption and continuous adoption of self-directed learning using mobile technology were investigated.

Despite the fact that university students engage in self-directed learning with mobile technology, various obstacles discourage active participation in this learning process. Concerns such as a lack of confidence in English proficiency during online interactions, apprehension about receiving incorrect feedback, and a mismatch between social network connections and language learning partners contribute to hesitancy (Lai & Gu, 2011; Lai et al., 2018; Lai & Zheng, 2018). Moreover, significant variability exists among university students regarding the frequency and types of technology used, as well as the manner in which technology is utilized for self-directed language learning. To elucidate the reasons behind these variations and hesitations, and to encourage frequent use of mobile technology for learning, the Integrative Model of Behavior Prediction (IMBP; Fishbein & Ajzen, 2010) was employed as the theoretical framework. IMBP, derived from the Theory of Reasoned Action (TRA; Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (TPB; Ajzen, 1991), provides a parsimonious approach to investigating factors influencing a particular behavior in a given population (Admiraal et al., 2013). IMBP considers individual psychological processes and user-oriented factors, making it well-suited for exploring the use of mobile technology in self-directed learning, where behavior is determined by learners' choices. IMBP posits that attitudes, perceived norms, and self-efficacy predict intention to engage in a specific behavior, while intention, knowledge, skills, and facilitating conditions influence actual behavior. The application of the Integrative Model of Behavior Prediction (IMBP) in educational research has been previously validated by researchers such as Admiraal et al. (2013), Kreijns et al. (2013), Vermeulen et al. (2017), and Wang et al. (2019). However, all of them are conducted in teacher learning. In the current study, IMBP is applied to identify the determinants of university students' use of mobile technology in their self-directed learning process.

While acquiring initial users is a crucial milestone, retaining them and encouraging continued usage present significant challenges in the implementation of mobile learning (Yang et al., 2019). Addressing this concern, a conceptual model has been proposed to investigate learners' engagement, satisfaction, and persistence in self-directed language learning using mobile technology, taking into account both learner and teacher perspectives (Yang et al., 2019). By

exploring these dimensions, the model aims to provide insights that can inform self-directed learners, educators, and software developers on strategies to effectively enhance self-directed learning experiences with mobile technology.

1.5 The organization of the dissertation

This dissertation focused on self-directed language learning using mobile technology in higher education. It contains six chapters (see Figure 1.1). In order to understand this topic, **Chapter 2** firstly presented a selection of studies in order to provide an overview of empirical research into learning strategies that self-directed learners use with the support of mobile technology in language learning. Twenty studies were selected and systematically analyzed. The central research question in this study was what cognitive strategies, metacognitive strategies, affective strategies, and social strategies did students use during their self-directed language learning using mobile technology? The findings call for more studies exploring all self-regulatory stages in the process of self-directed learning using mobile technology and investigating the influence of learners and teachers on the process. For this reason, Chapter 3 to 5 were further proposed to fill in the research gaps.

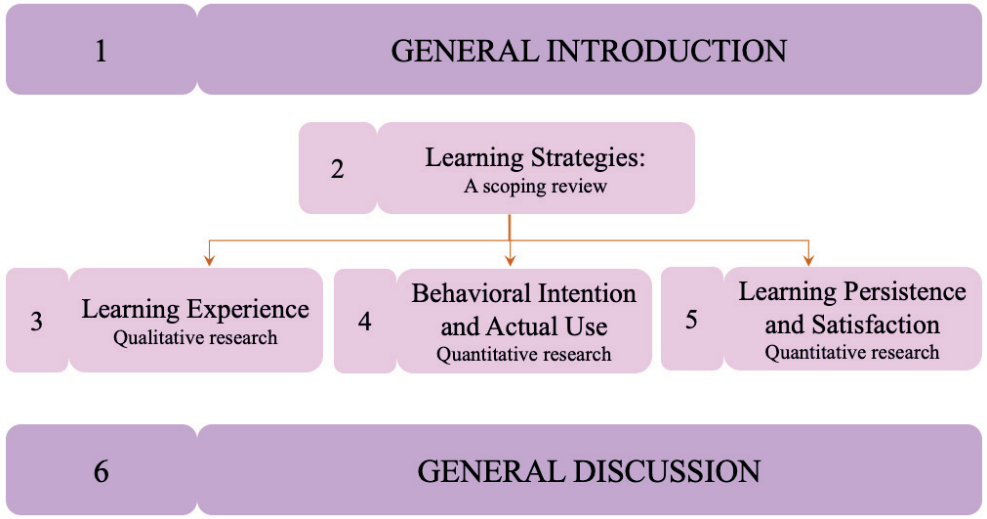


Figure 1.1 Overview of the dissertation.

In order to understand all self-regulatory stages in the process of self-directed learning using mobile technology, **Chapter 3** described a netnography study to gain insight into the learning experience of language learners in the context of self-directed learning using mobile technology. The research questions included (1) How do language learners initiate their learning in the context of self-directed learning using mobile technology? (2) What do language learners do in the forethought phase, performance phase and self-reflection phase in the context of self-directed learning using mobile technology? The netnography approach was employed to answer these question. 29 posts from an online platform for knowledge exchange were screened as the data. The coding of 29 answers was carried out based on a theory-driven framework.

From the perspective of self-directed learners, **Chapter 4** provided a research investigating the factors that influence university students' intention towards and actual use of mobile technology in self-directed language learning outside class. To answer the main research question, the following sub-questions were formulated: (1) To what extent do attitude, subjective norm and self-efficacy relate to university students' behavioral intention toward using mobile technology in self-directed learning? (2) To what extent do behavioral intention, facilitating conditions and self-regulation skills relate to university students' actual use of mobile technology in self-directed learning? (3) To what extent do self-regulation skills moderate the relationship between behavioral intention and actual use of mobile technology in self-directed learning? Survey data from 676 language learners in different disciplines from Chinese universities were collected and analyzed using Structural Equation Modeling approach.

In **Chapter 5**, we explored the factors that influenced foreign language learners' persistence and satisfaction towards self-directed language learning using mobile technology from the perspective of teachers and learners. The variable of teacher support provided recommendations and guidance about specific mobile applications, learning materials and learning tips, and encouragement in the learning process to improve students' learning experience. The learner-level variables showed learners' mobile-related knowledge, attitudes, skills, and competencies of learners in utilizing mobile technology effectively to achieve self-directed learning objectives (self-directed learning, mobile-learning self-efficacy, and optimism).

The research questions that guided this study were (1) Is there any difference in SDLLMT between students with high and low language proficiency? (2) How is learners' satisfaction

explained by teacher support, learners' mobile readiness and engagement in SDLLMT? (3) How is learners' persistence explained by teacher support, learners' mobile readiness and engagement in SDLLMT? (4) How do mobile readiness and engagement mediate the relationship between teacher support and both outcome variables of SDLLMT? Self-reported questionnaires from 446 language learners in different disciplines attending Chinese universities were collected. In order to answer these questions, an independent sample *t*-test, structural equation modeling and a mediation analysis were employed.

Chapter 6 offers a comprehensive overview of the research conducted in Chapters 2 to 5. It includes a summary of the key findings from the preceding chapters, a general discussion of the results, implications for practical application and future research directions, as well as an exploration of the limitations encountered in these studies.

Chapter 2

Learning Strategies in Self-directed Language Learning Using Mobile Technology in Higher Education: A Systematic Scoping Review

This chapter was published in an adapted form as:
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Abstract

Language learners in higher education increasingly use out-of-class self-directed learning facilitated by mobile technology. In order to make informed educational decisions, this study sets out to provide an overview of empirical research into learning strategies that self-directed learners use with the support of mobile technology in language learning. Twenty studies were selected and systematically analysed, revealing the cognitive, metacognitive, social and affective strategies that self-directed learners used in their language learning processes. Low-cognitive strategies appeared to be more commonly reported than high-cognitive strategies. The use of metacognitive strategies was more closely associated with the forethought phase and performance phase than with the self-reflection phase, yet only a few articles reported all three metacognitive phases. Three kinds of social strategies were examined, and only one affective strategy was reported. Finally, implications of these findings and directions for future research are provided for self-directed learners, practitioners and researchers to facilitate self-directed learning and future work.

Keywords

Self-directed language learning; Mobile-assisted learning; Learning strategies; Higher education; Review

2.1 Introduction

The globalisation of economies and societies has consequences regarding the need to learn foreign languages for international communication, especially for academic and business purposes (Kramsch, 2014). These foreign language competencies are specifically relevant for students who attend courses abroad, either on campus or online, and academics who choose to work in an international context. In higher education, however, there is not much space to learn foreign languages as part of the subject curriculum in a discipline, and in some countries students do not receive enough in-class language exposure to ensure their learning success (Richards, 2015; Trinder, 2017; Tsou et al., 2006). Many students therefore try to improve their foreign language competencies outside the curriculum, in a self-directed way. Students use, for example, mobile apps such as HelloTalk, Twitter, YouTube, et cetera, to create their own learning environment (Lai et al, 2022). They may receive support from teachers, but the process is student-initiated and self-directed (Lai et al, 2022). Self-directed learning broadly refers to the process in which individuals take responsibility and initiative over their own learning process, including diagnosing the learning needs, designing the learning plan, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating their learning results, with or without others' help (Knowles, 1975; Merriam & Bierema, 2013). Many researchers use self-directed learning interchangeably with self-regulated learning (Loyens & Rikers, 2008). Although their definitions are similar and both involve active engagement and goal-directed behaviour, the difference lies in the degree of control the learners have, specifically at the beginning of the learning process (Loyens & Rikers, 2008). In self-directed learning, learners are the initiators of the learning tasks, whereas in self-regulated learning, they are not. In order to support this kind of self-directed learning, students can use mobile technology to learn foreign languages (e.g., Lai & Gu, 2011; Zhang & Pérez-Paredes, 2019). Mobile technology, which is defined as mobile phone, tablets, laptop and possible applications on them, becomes popular due to its easy access to the abundant resources and convenient connection with others, so students utilise it to develop their language competence in the authentic environment and maintain their interests in learning. However, adopting any learning approach or mobile technology does not guarantee successful learning (Vogel, Kennedy, & Kwok, 2009). How students conduct the learning process also matters, which may benefit from further research on improving the effectiveness of such learning experiences.

To date, most reviews on self-directed learning are not about student-initiated learning, but on self-regulated learning instead (e.g., Dent, & Koenka, 2016; Jansen, Van Leeuwen, Janssen, Jak, & Kester, 2019). Given the significance of this kind of learning approach, research on student-initiated self-directed learning outside class deserves more attention. For this reason, we conducted a review of self-directed language learning using mobile technology beyond the classroom, which could inform self-directed learners, educators and software developers on how to effectively enhance self-directed learning with mobile technology.

2.2 Self-directed use of mobile technology in language learning

In order to increase the opportunities to expose to foreign languages, learners use mobile technology as an instrument to learn foreign languages in an out-of-class and self-directed way (Lai et al, 2022). The characteristics of mobile technology, such as portability, individuality, social connectivity, and context sensitivity, have been broadly incorporated in language learning (Chinnery, 2006). Concerning portability, learners can use mobile technology to convenient and continual access to language resources and practicing opportunities anytime and anywhere via applications such as Google or YouTube because mobile technologies are easily carried (Sung, Chang, & Yang, 2015). Supported by its feature of individuality, mobile technology enables learners to personalize and customize the learning process based on their own needs and interest. About social connectivity, learners use mobile apps such as Skype and HelloTalk to collaborate or share with other language learners and native speakers in the target language, either synchronously or asynchronously (Lan, Sung, & Chang, 2007). Regarding its context sensitivity, mobile technology allows learners to integrate language knowledge with real life and cultural context (Chen & Li, 2010). However, using mobile technology in learning does not guarantee successful learning (Vogel, Kennedy, & Kwok, 2009). Learners still need to employ appropriate strategies to support their language learning process.

A number of review studies regarding learning strategies in self-directed use of technology have been performed. Yet as mentioned above, most of these review studies are about self-regulated learning instead of self-directed learning missing the self-initiated element. In online learning setting, for example, Broadbent and Poon (2015) examined self-regulated strategies as correlates of academic outcomes in higher education through a review of 12 studies. They concluded that critical thinking, effort regulation, time management, metacognition, and peer

learning were all positively related to learning outcomes, whereas the relationships with organisation, elaboration, and rehearsal were the least empirically supported. In addition, Stevenson, Hartmeyer and Bentsen (2017) performed a meta-analysis of 17 studies to assess how concept mapping-based technologies (including computer software, mobile devices, web-based learning environment and electronic system) impacted self-regulated learning through various strategies. The findings showed computer software was useful for developing cognitive strategies, teachers could stimulate metacognitive strategies, and both mobile technologies and teachers could help to enhance motivation. In the field of e-learning, Garcia, Falkner and Vivian (2018) reviewed 19 articles to investigate whether learning self-regulated strategies could be supported by modern technologies in high school. The findings reported that self-evaluation and seeking information were the most researched categories, while seeking social assistance and environmental structuring was not examined in any study. Also, another review was conducted by Lee, Watson and Watson (2019) to analyse 21 empirical articles published from 2008 to 2016 regarding self-regulated learning in MOOCs. The results showed that self-regulated learning positively correlated with learning in MOOCs, and contextual, behavioural, metacognitive, and motivational regulation strategies were identified. And in 2020, Anthonysamy, Koo, and Hew (2020) reviewed 14 articles how self-regulated learning strategies in a blended learning environment was related to positive non-academic outcomes. The results showed that these strategies were positively related to non-academic outcomes. Motivational belief strategies, resource management, and metacognitive knowledge were investigated most, whereas cognitive engagement strategies were examined in only a few studies.

These reviews mentioned above were mainly about online courses, specific technologies, electronic tools or a blended learning environment, which were broader than mobile technology. Given the features of mobile technology in language learning claimed above, this study focused on just mobile technology. Additionally, although these reviews added understanding to the self-directed learning strategies using technology, they did not differentiate between teacher-initiated or student-initiated, nor in class or out of class learning. Considering the popularity of students-initiated exposure to foreign languages outside class and the significance of self-directed learning approach, it is essential to understand how students conduct their learning in a self-initiated and out-of-class way. Moreover, these above-mentioned strategies examined in previous review studies are not about foreign language learning. Specific strategies in foreign language learning need to be

investigated, which could be conducive to foreign language learners and provide practical guidance for future investigations. To fill in these gaps, this study gained an insight on the learning strategies that university students used in their out-of-class self-directed language learning process.

Previous research has indicated that strategies played a vital role in language learning process and success. In the current study, learning strategies refer to behaviours which could "help learners to comprehend" (O'Malley & Chamot, 1990), "make learning easier, faster, more enjoyable, more self-directed, more effective, and more transferable" (Oxford, 1990), "mediate their own learning" (Hall, 2001), and finally enhance their language proficiency and boost confidence when using the language (Rusnadi, 2017). Qingquan, Chatupote and Teo (2008) stated that research into learning strategies indicated that overall language performance was related to the level of strategy use. Effectively using learning strategies can improve learners' language competences and make them better learners (Hismanoglu, 2000). In the domain of language learning, O'Malley et al. (1985a) divided learning strategies into three categories based on the type or level of processing involved, namely cognitive, metacognitive and affective/social strategies, which is acknowledged to be the "full range of strategies" (O'Malley & Chamot, 1990, p. 44). Hsiao and Oxford (2002) proposed that the latter category should be further differentiated into social and affective strategies in order to increase the explanatory power of the original model. The final typology thus comprises the following four main components (O'Malley & Chamot, 1990):

1. Cognitive strategies mean mentally processing learning materials, such as *auditory representation, imagery, repetition, grouping, inferencing, translation, resourcing, deduction, summarising, recombination* and *note taking;*

2. Metacognitive strategies are associated with analysing planning, monitoring, and evaluating the learning process, such as *selective attention, advance organisers, directed attention, self-management* and *self-evaluation*;

3. Affective strategies involve managing the emotions, such as *self-encouragement, self-reinforcement* and *self-talk*, and

4. Social strategies concern interacting with people for the purpose of increasing the opportunities to practice foreign languages and get feedbacks, such as *cooperation* and *questioning for clarification.*

This scoping review gained an insight into students' learning strategies in self-directed language learning using mobile technology. We thus investigate four research questions:

- What cognitive strategies did students use during their self-directed language learning using mobile technology?
- What metacognitive strategies did students use during their self-directed language learning using mobile technology?
- What affective strategies did students use during their self-directed language learning using mobile technology?
- What social strategies did students use during their self-directed language learning using mobile technology?

2.3 Method

The guidelines employed in this scoping review study were the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) extension for Scoping Reviews (Tricco, Lillie, Zarin et al, 2018).

2.3.1 Data search

Utilising PRISMA (Moher et al., 2009) principles, this study began with an extensive search of the literature conducted using electronic searches and the snowballing method to retrieve relevant literature. The federated search service provided by the library of a research university in the Netherlands was used for the electronic search. It is a comprehensive database, whose sources include, amongst others, Web of Science, Taylor and Francis, Elsevier/ScienceDirect and EBSCOhost. Three sets of keywords were used: (1) self-directed-learning related keywords, including self-directed, SDL, self-regulated, SRL, "out of class", autonomous, informal, and ubiquitous; (2) technology-related keywords, including mobile and technology; and (3) foreign-language related keywords, including "language learning", "English learning", and "foreign language learning". When searching the electronic database, the three sets of keywords were combined. The search was conducted in February 2020, which served as the cut-off date for published articles. The articles had to be written in English and peer-reviewed. After collating all the relevant studies, the snowballing method was used to find more relevant work based on reference lists in the studies from the electronic search.

2.3.2 Data selection

On 10th February 2020 the initial search yielded 342 articles that were related to self-directed learning and mobile technology. The title and abstract of each identified study were firstly screened for eligibility. The studies without full text and the studies unrelated to student learning were excluded, and 170 studies remained for future analysis.

Studies were included if they met these criteria:

- Students should use mobile technology, including mobile devices (laptop, smartphone, tablet) and applications on these devices, to support their learning.
- The learning tasks should be initiated and managed by the participants themselves, with or without teacher support, in the learning process.
- The learning content should be foreign languages.
- Involving students in higher education.
- Including the information on learning activities.

Ten per cent of 170 articles were also read by a co-author based on the above-mentioned inclusion criteria. There was a discrepancy about one article. The two researchers held a discussion, and finally consensus was reached. Applying these inclusion criteria reduced our database to 20 studies, 13 from electronic searches and 7 from the snowballing method. This literature search and review procedure is illustrated in Figure 1. Regarding the method of data collection and analysis, among the 20 studies, 3 studies used quantitative method, 1 used qualitative method, 1 used action research, and 15 used mix methods (quantitative and qualitative method).

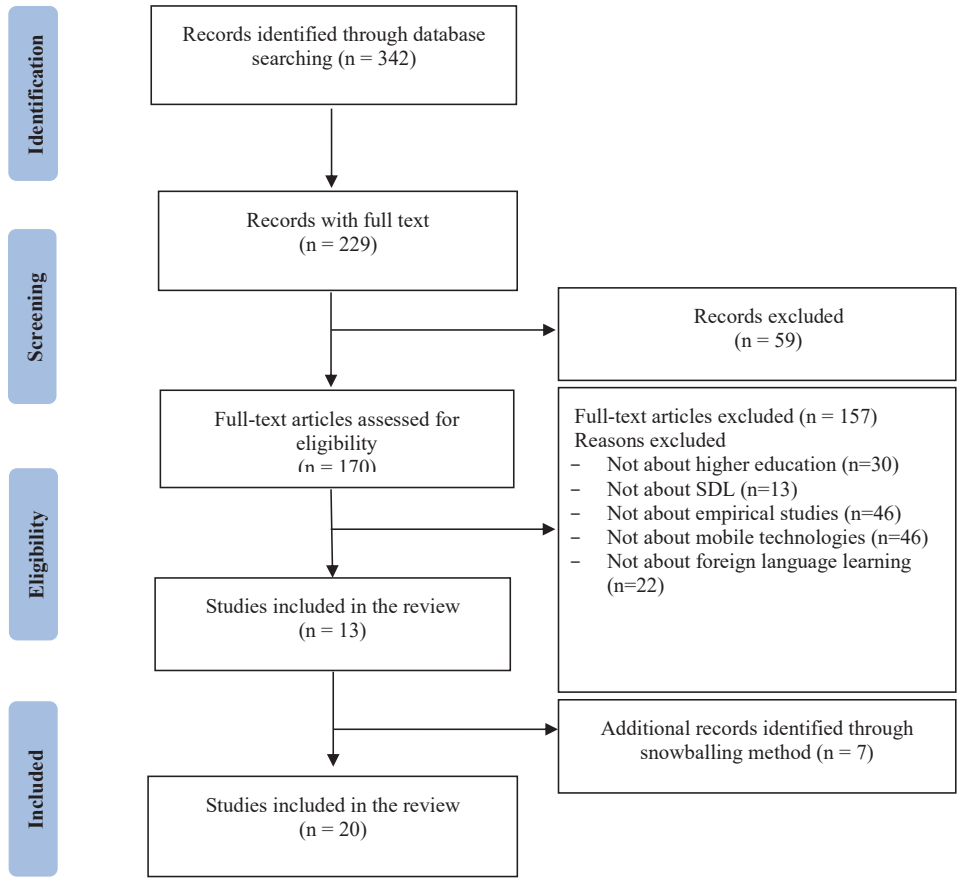


Figure. 2.1 Flow chart depicting the search and selection process.

2.3.3 Data extraction and analysis

Author name, publication year, participants' proficiency levels and learning activities were extracted from each study. Each article was checked to extract the learning activities from the results and conclusion sections. These texts were coded as learning strategies based on O'Malley's classification, namely, metacognitive, cognitive, affective and social strategies, and specific strategies are explained in the results section and Appendix B. For example, it was coded as *Contextualisation*, categorized in cognitive strategies, when participants learned new words and vocabulary in Facebook, as reported by Hamat, Abu and Hassan (2019). These coded texts were sorted and summarised (See Appendix C). To ensure all relevant information extracted, 20 articles

were double-checked by two researchers. When there were disagreements on the coding, theses were discussed among researchers until the consensus was reached.

For data analysis, Bloom's revised taxonomy is employed as the framework to measure cognitive strategies in order to determine the level of students' thinking (Anderson, Krathwohl, & Airasian, 2001; Crompton, Burke, & Lin, 2019). Anderson et al. (2001) categorized cognitive learning as six levels: 1) *remembering*, which refers to recalling and remembering basic facts and rules; 2) *understanding*, which means comprehending the meaning of information; 3) *applying*, which refers to executing knowledge, skills, or techniques in new situations; 4) *analysing*, which means breaking the information into its main parts; 5) *evaluating*, which means making judgments based on in-depth reflection; and 6) *creating*, which refers to creating new information. The six levels range from low-order, which requires less cognitive processing, to high-order, which requires deep learning and a greater degree of cognitive processing (Anderson et al., 2001). And, widely-accepted cyclical self-regulatory phases proposed by Zimmerman (2000, 2008) are selected as the framework to categorize metacognitive strategies so as to show how students regulate their learning process. The cyclical self-regulatory phases consist of *forethought, performance* and *self-reflection*. In the *forethought phase*, language learners can set learning goals, assess linguistic resources for language tasks, and plan how to reach these goals. In the *performance phase*, learners actually execute the task, monitor and regulate how they are progressing. Finally, in *self-reflection phase*, learners assess how they have performed the task (Zimmerman, 2000).

2.4 Results

2.4.1 Cognitive strategies

Cognitive strategies refer to processing the learning resources mentally or physically, or employing specific techniques in learning tasks, such as *deduction, imagery, auditory representation, resourcing, inferencing, translation, repetition, grouping, summarising, recombination*, and *note-taking* (O'Malley & Chamot, 1990). As mentioned above, cognitive learning is classified as six levels, including *remembering, understanding, applying, analysing, evaluating*, and *creating*, from low-order to high-order (Anderson et al., 2001). Based on the data extracted, we classified the specific strategies examined in the reviewed studies into one or two of the cognitive levels. The results are summarised in Table 2.1.

Table 2.1 Cognitive strategies in six cognitive process levels.

Author (Year)	Remembering	Understanding	Applying	Analysing	Evaluating	Creating
Alm (2015)	-	-	-	-	Resourcing	-
Celik et al. (2012)	-	Resourcing	-	-	-	-
García Botero et al. (2018)	Imagery; Auditory Representation; Recombination	-	Recombination	-	-	-
Hamat and Haan (2019)	Contextualisation	-	-	-	-	-
Lai (2019)	Imagery; Contextualisation; Note-Taking	Resourcing; Inferring	Deduction	-	-	-
Lai and Gu (2011)	-	Resourcing	-	-	-	-
Lai et al. (2017)	Imagery; Auditory Representation; Recombination; Grouping; Note-taking; Repetition	Resourcing; Auditory Representation	-	-	-	Resourcing
Lai and Zheng (2018)	Imagery; Recombination	Resourcing	-	-	Resourcing	-
Ma (2017)	Auditory Representation; Resourcing; Contextualisation, Repetition	Resourcing; Auditory Representation; Repetition; Translation	-	-	Resourcing	Resourcing
Sockett and Toffoli (2012)	Repetition; Auditory Representation; Contextualisation	Summarising; Auditory representation	-	-	-	-
Steel (2012)	Imagery;	-	-	-	-	-

	Contextualisation; Repetition; Auditory representation					
Trinder (2017)	Note-Taking	-	-	-	-	-
Wrigglesworth and Harvor (2018)	-	Resourcing;	-	-	-	-
Yao (2016)	-	Resourcing;	-	-	-	-
Zhang and Pérez-Paredes (2019)	Imagery; Auditory Representation	Auditory Representation	-	-	-	-
Zou and Yan (2014)	Repetition	Resourcing; Imagery	-	-	-	-

Note. "-" denotes no cognitive strategy identified here

Table 2.2 Number of reviewed articles involving in learning strategies in six cognitive categories.

Strategies	Remembering	Understanding	Applying	Analysing	Evaluating	Creating
Resourcing	1	9	-	-	3	2
Auditory representation	6	4	-	-	-	-
Imagery	6	1	-	-	-	-
Repetition	4	1	-	-	-	-
Contextualisation	5	-	-	-	-	-
Note taking	3	-	-	-	-	-
Recombination	3	-	1	-	-	-
Grouping	1	-	-	-	-	-
Inferring	-	1	-	-	-	-
Deduction	-	-	1	-	-	-
Summarising	-	1	-	-	-	-
Translation	-	1	-	-	-	-

Note. "-" denotes no article involving in the learning strategies here

At the *remembering* level, the lowest cognitive level, eight kinds of learning strategies were identified. *Imagery, auditory representation* and *contextualisation* were the most frequently identified in the reviewed articles, followed by *repetition, recombination, note-taking, resourcing* and *grouping*. *Imagery* means learners utilize visual images to recite and understand new language contents or mentally represent problems (O'Malley & Chamot, 1990). It was identified in six articles. Learners used it through vocabulary apps such as Duolingo and Baicizhan (García Botero, Questier, & Zhu, 2019; Steel, 2012; Zhang & Pérez-Paredes, 2019) and digital flashcards (Lai, 2019; Lai, Hu, & Lyu, 2018) for vocabulary and grammar learning. *Auditory representation* refers to playing the sound of words, phrases, or sentences in the back of one's mind so as to assist in comprehending and recalling (O'Malley & Chamot, 1990). This was also identified in six articles, and it was used to learn vocabulary with language learning apps (García Botero et al., 2018; Lai et al., 2017; Steel, 2012; Zhang & Pérez-Paredes, 2019), and practice pronunciation and speaking through musical videos and songs (Ma, 2017; Sockett & Toffoli, 2012). *Contextualisation* refers to "assisting comprehension or recall by placing a word or phrase in a meaningful language sequence or situational context" (O'Malley & Chamot, 1990, p.126). Five articles showed that leaners used this strategy to learn new words, technical terms and specific expressions on Facebook (Hamat & Abu Hassan, 2019), natural learning environments created on YouTube and Podcast (Lai, 2019; Ma, 2017), and virtual online communities (Sockett & Toffoli, 2012). *Repetition* means learners intentionally practice and rehearse the words or phrases repeatedly (O'Malley & Chamot, 1990). Four articles involved this strategy. For example, learners watched movies or series, listened to songs over and over again for improving speaking skills (Lai et al., 2018; Ma, 2017; Sockett & Toffoli, 2012), and reviewed previously learned words through dictionary apps (Steel, 2012; Zou & Yan, 2014). *Note-taking* means "writing down key words and concepts in abbreviated verbal, graphic, or numerical form" (O'Malley & Chamot, 1990, p.126). Three articles mentioned this strategy when interacting with vocabulary instruction on Facebook (Lai, 2019), listening to English songs (Lai et al., 2018) and watching films (Trinder, 2017), so as to better memorise new words and expressions. *Recombination* means combining known knowledge in a new way to formulate meaningful sentences or language expressions (O'Malley & Chamot, 1990). Three articles included using *recombination* for grammar learning through quizzes to combine known elements with the newly learned (García Botero et al., 2019; Lai et al., 2018; Lai & Zheng, 2018). *Grouping* means making classifications of words, phrases, or sentences based on their attributes or meaning,

and *resourcing* means understanding or reciting language elements by utilizing reference books, encyclopaedias, websites, dictionaries, etc. (O'Malley & Chamot, 1990). These two strategies were each only mentioned in one article. Lai et al. (Lai et al., 2018) showed that learners *grouped* the new words into customised lists saved in online dictionaries for vocabulary learning. Ma (2017) reported that learners knew and kept updated information regarding cultural practices and lifestyles by reading news from Yahoo US or UK (*Resourcing*).

Seven kinds of strategies were identified at the *understanding* level. *Resourcing* was the most commonly identified strategy, with nine articles mentioning it. Dictionaries, translating tools, search engines, and news were examined as the resourcing tools for learners to check word meaning, understand word usage and appreciate target culture (e.g., Celik, Arkin, & Sabriler, 2012; Wrigglesworth & Harvor, 2018; Yao, 2016). *Auditory representation* is used by learners to practice and improve listening skills via listening to BBC Radio (Zhang & Pérez-Paredes, 2019), television series (Sockett & Toffoli, 2012), English songs and articles (Ma, 2017) and podcasts (Lai et al., 2018). *Imagery, translation*, and *repetition* were identified in one article. Some learners used Youdao Dictionary app to learn foreign languages, which provides imaginative descriptions that include pictures to help understand terms and abstract words (*Imagery*) (Zou & Yan, 2014). *Translation* refers to the use of the native language as a basis to understand and/or produce the foreign language (O'Malley & Chamot, 1990). Ma (2017) reported that, learners first read English-version news on the BBC and then read Chinese-version news on Yahoo Hong Kong (*Translation*). They also read news repetitively and habitually to enhance their reading skills (*Repetition*) to improve reading skills. *Inferencing* and *summarising* were identified in one article. *Inferencing* is using the known information to infer the meaning of new elements, predict results, or complete the tasks (O'Malley & Chamot, 1990). Lai (2019) showed that learners used this strategy to guess word meanings and infer a film's meaning from character actions and facial expressions when listening to songs and watching movies. *Summarising* refers to summing up the gained information in a written or mental way (O'Malley & Chamot, 1990). Sockett and Toffoli (2012) reported that learners summarised the meanings, or at least the songs' subject, when listening.

Two kinds of strategies were identified at the *applying* level. One is *deduction*, which means applying rules to comprehend or create language output (O'Malley & Chamot, 1990). This was reported by Lai (2019), who showed that learners applied correct grammar in order to interact with friends on WhatsApp. Another is *recombination*, which learners employed to apply what they

learned in writing and listening exercises to construct new sentences in Duolingo (García Botero et al., 2019).

No strategies were identified at the *analysing* level, and *resourcing* was the only strategy examined at the *evaluating* and *creating* levels. Three articles identified *resourcing* strategy at the *evaluating* level. Two (Lai & Zheng, 2018; Ma, 2017) mentioned that learners used dictionary apps to ensure the correct collocations in essays, and another (Alm, 2015) described using the google search engine to test - through counting the number of hits - whether the words, phrases and sentences were accurate. In the *creating* level, Lai et al. (2018) and Ma (2017) indicated that some learners used dictionary apps to help write sentences or essays (*Resourcing*).

In summary, Table 2.1 shows that 16 out of 20 articles reported learners employing cognitive strategies, with more strategies at the *remembering* and *understanding* levels than at *applying, analysing, evaluating* and *creating* levels. This indicates that language learners mainly conduct more low-order learning strategies than high-order learning strategies. Table 2.2 indicates that there are 12 strategies identified in the cognitive learning processes. The strategies which are identified most are *resourcing* and *auditory representation*, which are low-level strategies.

2.4.2 Metacognitive strategies

Metacognitive strategies concern the learning process and include planning for learning goals, monitoring learning tasks, and evaluating learning outcomes, such as *self-monitoring, self-management, selective attention, advance organisers, directed attention*, and *self-evaluation* (O'Malley & Chamot, 1990). These metacognitive strategies are proved beneficial in learning success (Nückles et al., 2020). Their monitoring and controlling role in cognition means that metacognitive strategies are viewed as deep-processing and higher-order strategies (Martínez-Fernández, & Vermunt, 2015). The cyclical self-regulatory phases contain *forethought, performance* and *self-reflection phase* (Zimmerman, 2000), which is employed to categorize metacognitive strategies.

Four kinds of strategies were examined in the *forethought phase*: *resource management, organisational planning, environment management* and *advance organisation*. *Resource management* refers to seeking, arranging, or adjusting resources for learning. In the reviewed studies, this strategy was identified when learners were creating authentic learning opportunities (e.g., Celik et al., 2012; Lai, 2019; Lai & Gu, 2011; Zhang & Pérez-Paredes, 2019), preparing

learning resources such as making personalised vocabulary lists in order to learn new words and facilitate essay writing in later phases (Lai et al., 2018; Ma, 2017), acquiring more useful materials after subscribing to bloggers who teach foreign languages (Zou & Yan, 2014), and selecting the appropriate learning materials based on the better-known Q&A online forums, such as the Zhihu and Douban apps in China (Zhang & Pérez-Paredes, 2019). Learners also downloaded mobile apps in advance for language learning (Steel, 2012). *Organisational planning* means generating plans for language learning tasks (O'Malley & Chamot, 1990). For example, learners set up learning plans by themselves (Celik et al., 2012) or with the help of mobile apps (Ma, 2017; Steel, 2012; Zhang & Pérez-Paredes, 2019). *Environment management* is used to set up and arrange a learning environment to make learning easier. Some learners set up environments by changing the language settings of mobile devices or applications into the target language (Alm, 2015; Chen, 2013). O'Malley and Chamot (1990) define *advance organisation* as "previewing the main ideas and concepts of the material to be learned, often by skimming the text for the organising principle" (p.119). In the current review, however, *advance organisation* refers to previewing what will be learned. It was only mentioned in one article, which reported that participants used technology to taste the language to be learned, and generated a specific plan (Lai & Gu, 2011).

Eight kinds of strategies were found in the *performance phase*, the second phase of the cyclical self-regulatory phases, including *comprehension monitoring, production monitoring, time management, selective attention, directed attention, resource management, effort management*, and *problem identification*. *Monitoring* encompassed *comprehension monitoring* (checking whether learners understand) (Lai, 2019) and *production monitoring* (checking whether learners' language output is correct) (Lai et al., 2018; Lai & Zheng, 2018). *Time management* refers to adjusting the time spent on specific tasks in order to get better results, such as extending the study hours based on study pace (Celik et al., 2012; Lai & Gu, 2011). *Selective attention* means knowing how to focus on specific aspects of language learning before executing tasks (O'Malley & Chamot, 1990). Lai (2019) reported that learners paid particular attention to using correct grammar when they applied the grammar knowledge learnt to daily interaction with friends. Sockett and Toffoli (2012) also showed that learners paid much more attention to dialogue for the purpose of learning sentence structure when watching films. *Directed attention* means doing or setting something beforehand to remind learning tasks (O'Malley & Chamot, 1990). Learners sometimes reminded themselves to learn by keeping memory bars of vocabulary apps high (García Botero et al., 2019)

and displaying study reminder popups in the English Liulishuo app (Zhang & Pérez-Paredes, 2019). *Resource management* or *effort management* means adjusting learning resources or efforts needed in learning process. In the study by Celik et al. (2012), learners increased learning resources when they needed more, while Zhang and Pérez-Paredes (2019) showed learners made more efforts when they saw posts about the achievements of friends or classmates on vocabulary learning apps. *Problem identification* is identifying the problems which should be solved in tasks, or the parts that hinder understanding and completing tasks (O'Malley & Chamot, 1990), and was adopted to identify comprehension problems after repeatedly listening to English songs (Sockett & Toffoli, 2012).

The only learning strategy in the *self-reflection phase* is *self-evaluation*, which refers to "checking the outcomes of one's own language learning against a standard after it has been completed" (O'Malley & Chamot, 1990, p.119). Lai and Gu (2011) and Zhang and Pérez-Paredes (2019) showed that learners assessed their language proficiency through Facebook, email and language learning apps like Liulishuo to see if they understood things well. Lai and Zheng (2018), Ma (2017) and Steel (2012) reported that learners assessed how much they knew about vocabulary and grammar through testing apps or websites.

In summary, 13 out of 20 reviewed articles are associated with metacognitive strategies in self-directed language learning. Table 2.3 shows that the number of reviewed articles involving *forethought phase* is the most, followed by that in the *performance phase* and the *self-reflection phase*, and only two articles involve using metacognitive strategies in all three phases.

Table 2.3 Metacognitive strategies in the three phases.

Authors (year)	Forethought phase	Performance phase	Self-reflection phase
Alm (2015)	Environment management	-	-
Celik et al. (2012)	Resource management; Organisational planning;	Time management; Resource management	-
Chen (2013)	Environment management	-	-
García Botero et al. (2018)	-	Directed attention	-
Lai (2019)	Resource management	Selective attention; Comprehension monitoring	-
Lai and Gu (2011)	Resource management; Advance organisation	Time management	Self-evaluation
Lai et al. (2017)	Resource management;	Production monitoring	-
Lai and Zheng (2018)	-	Production monitoring	Self-evaluation
Ma (2017)	Resource management; Organisational planning	-	Self-evaluation
Sockett and Toffoli (2012)	-	Selective attention; Problem identification	-
Steel (2012)	Resource management; organisational planning	-	Self-evaluation
Zhang and Pérez-Paredes (2019)	Resource management; organisational planning	Directed attention; Effort management	Self-evaluation
Zou and Yan (2014)	Resource management	-	-

Note. "-" denotes no metacognitive strategy identified here.

From these reviewed studies, we found that self-directed learners manage different aspects of their own learning process, such as environment, resources, time and effort. O'Malley and Chamot (1990), however, only reported a general *self-management* strategy. In order to show how learners manage their learning process in more detail, we divided the *self-management* strategy into four subcategories, including *environment management, resource management, time management* and *effort management*.

2.4.3 Affective strategies

Similar to cognitive and metacognitive strategies, affective strategies have an essential role in language learning, especially in independent settings (Hurd, 2008). These are understood as managing the emotions that affect the learning involvement (O'Malley & Chamot, 1990). The use of these strategies assists learners in managing their feelings and attitude towards learning (Chou, 2004) to generate self-motivation and maintain interest and attention during a task, and finally to increase engagement and persistence and cultivate independent learning abilities (Fatemeh & Fereidoon, 2016). *Self-motivation, self-reinforcement, self-encouragement* and *self-talk* belong to this type of strategy (O'Malley & Chamot, 1990). Among the reviewed articles, only *self-motivation* strategy was identified, which refers to driving learners to keep going by reminding themselves of the benefits of self-directed learning or mastering new languages (O'Malley & Chamot, 1990). Two studies (Celik et al., 2012; Lai & Gu, 2011) mentioned that learners used technology to decrease boredom and increase the enjoyment of learning tasks, which effectively maintained their interest and enthusiasm in learning and motivated them to persevere and commit to their learning goals.

2.4.4 Social strategies

Social interaction is essential for language learning since it provides authentic social contexts for language use and practice (Derakhshan & Hasanabbasi, 2015). Not all social interactions have a positive effect foreign language acquisition, however (Mushtaq & Benraghda, 2018; Raut & Patil, 2016). Social strategies are needed in order to benefit from the possibilities that social interaction offers. These strategies include *cooperation* and *questioning for clarification* (O'Malley & Chamot, 1990), and *help-receiving*. *Cooperation* was the most frequently reported strategy, with 12 articles, which means learning with others to update information, check learning outcomes, or get feedback

on learning performance (O'Malley & Chamot, 1990). Learners used social media like WhatsApp, MSN, Facebook, MySpace, Skype, Twitter and WeChat to practice foreign language with friends, anonymous native speakers and classmates (Chen, 2013; Kuznetsova & Soomro, 2019; Lai, 2019; Wrigglesworth & Harvor, 2018; Yao, 2016), and to sometimes remind each other about the mistakes they were making (Lai, 2019). *Questioning for clarification* is also reported, which refers to "eliciting additional explanation, rephrasing, examples, or verification from a teacher or peer" (O'Malley & Chamot, 1990, p.120). Zou and Yan (2014) and Ma (2017) showed that participants adopted this strategy through discussion forums or social networking tools. *Help-receiving* is a strategy which involves other agents, such as teachers and friends, actively offering support to learners. Teachers, brothers, and friends were reported as providing help, including resource recommendation and strategy sharing in the self-directed language process (e.g., Lai, Yeung, & Hu, 2016; Yao, 2016).

Fourteen out of 20 of the reviewed articles reported social strategies used in the self-directed language learning process. Self-directed learners are also usually recommended useful learning materials and effective learning tips by teachers, peers or friends to enhance their learning. O'Malley and Chamot (1990), however, did not report a strategy about this. In order to explain this support from others, we add a new strategy, called *help-receiving*, to show this kind of activity.

2.5 Discussion

This review examined the learning strategies employed by university students in the self-directed language learning process using mobile technology. Only 20 articles were included in this review, as many other studies focused on teacher-initiated self-regulated learning. In order to make informed educational decisions about different aspects of language learning, this review has investigated the cognitive, metacognitive, affective and social strategies that learners use in their self-directed learning process. These strategies range from low-level cognitive processes, such as *remembering* and *understanding*, to processes at a high level of cognitive complexity, such as *planning, monitoring, reflecting, evaluating* and *creating*. It was clear from the literature review that the use of cognitive strategies was more commonly reported in relation to low-level cognitive processes, *remembering* and *understanding*, than in high-level cognitive processes, *applying, analysing, evaluating* and *creating*. The two most frequently used strategies, *resourcing* and *auditory representation*, are low-level cognitive strategies. Although these low-level strategies are

appropriate and work well when learning for a short-term purpose or when learning facts and details (Setiyadi, 2001), in order to improve overall language performance, they should be complemented with the use of high-order strategies throughout the learning process (Aharony, 2006; Setiyadi, 2001; Yot-Domínguez & Marcelo, 2017). Therefore, more research is necessary to examine the higher-order strategies. More of the reviewed articles examined the metacognitive strategies associated with the *forethought phase* and *performance phase* than those related to the *self-reflection phase*, and only a few articles reported on all three metacognitive phases. Only one affective strategy, *self-motivation*, was reported in two articles, and three kinds of social strategies were examined in the reviewed articles. Future studies are encouraged to focus on social and affective strategies as they are related to effective learning in language learning (Chamot, 2005; Zeynali, 2016).

2.5.1 Self-directed language learning and self-regulatory phases

Only two articles reported on all three self-regulatory phases. Zimmerman (2000) stated that self-regulation is cyclical, from the *forethought phase* to the *performance phase* to the *self-reflection phase*, and that the three phases are all essential for self-directed learners. The *forethought phase* helps learners strategically prepare for upcoming tasks, the *performance phase* is important as learners make adjustments to their learning promptly according to the feedback from monitoring and evaluating, and *self-reflection* influences the forethought processes of a learner's subsequent learning actions in fulfilling the self-regulatory cycle (Zimmerman, 2000, 2008). To our best knowledge, however, few empirical studies examined whether participating in all three phases would lead to better language performance. We thus encourage more empirical research on the impact of using a complete cycle of self-regulatory processes.

2.5.2 Affective strategies

This review study showed that affective strategies received little attention in research regarding self-directed language learning using mobile technology, since only two reviewed articles reported one similar strategy, *self-motivation*. One possible reason is that researchers may not pay much attention to affective strategies in the mobile environment because using mobile technology itself has played a highly motivating role in the process due to its appealing characteristics (Jones, Issroff, Scanlon, Clough, & Mcandrew, 2006). However, although using mobile technology can motivate

self-directed learners to learn, it is temporary, and learners are easily distracted, interrupted (Crescente & Lee, 2011; Kacetl & Klímová, 2019; Wolter & Rosenthal, 2000). There is thus still a need to investigate affective strategies as they can boost a learner's continuance motivation in the mobile learning environment and have a great effect on the success of language learning (Anderson, 1991). Addressing other emotional feelings is also crucial. Nasri, Yunus and Nazri (2015) revealed that some language learners wer susceptible to negative emotions like diffidence, anxiety and trauma. Affective strategies, such as *self-encouragement* and *self-reinforcement*, may assist them in managing these negative emotions, further achieving successful learning (Nasri et al., 2015). Researchers and self-directed learners are therefore recommended to focus more on affective strategies in the future as well (Vermunt, & Donche, 2017).

2.5.3 Limited knowledge about strategies for language learning

Several reviewed articles showed that learners had limited knowledge about strategy use (Lai et al., 2016; Zhang & Pérez-Paredes, 2019) and technology use (Chen, 2013; Lai & Gu, 2011; Lai & Zheng, 2018) in the self-directed learning process using mobile technology. Lai et al. (2016) and Zhang and Pérez-Paredes (2019) stated that learners had difficulties in locating and selecting useful, appropriate and trustworthy resources and effectively using them for language learning. Chen (2013) and Lai and Zheng (2018) showed that learners lacked the necessary knowledge and experience to utilize mobile devices for establishing social connections and authenticity. In order to address these issues, teachers are encouraged to facilitate and support learners in technology-enhanced language learning environments, which is in line with the review study by Zhou and Wei (2018). Lai (2015) reported that teachers could provide "affection support, capacity support and behavior support", which strengthens a learner's awareness of the usefulness of technological resources, improves their abilities to locate and utilize these resources for learning, and scaffolds them experimenting with resources in out-of-class learning. However, teachers saw themselves a minimal role as they overestimated students' abilities and worried about their limited knowledge to offer assistance (Lai et al., 2016). This finding therefore highlighted the significance of increasing teacher awareness that they can play various roles in enhancing student knowledge of, and skills in, using mobile technology in the out-of-class self-directed learning. There is also a call for more research on how to enable teachers to exert their influence on fostering students' self-directed learning using technology.

2.5.4 Importance of social interaction

Although this study did not focus on technology use, several reviewed studies (Lai & Gu, 2011; Lai et al., 2018; Lai & Zheng, 2018) showed that students seldom used technology for social interaction and were sceptical about it, because they were not confident about their proficiency levels during online interactions, were afraid of getting incorrect feedback, and lacked an overlap between online friends and possible language partners (Lai & Gu, 2011; Lai et al., 2018; Lai & Zheng, 2018). Nevertheless, social interaction is essential since self-directed language learning is seen as a social activity (Alvi & Gillies, 2015; Heil, Wu, Lee, & Schmidt, 2016). Mobile technology can also facilitate social interaction in the language learning process, as mobile technology offers language learners the possibility of sharing files, data or simple messages, and authentic opportunities to use what they have learned practically through cooperating and communicating with their peers, native speakers or teachers (Troussas, Virvou, & Alepis, 2014). These affordances are beneficial for long-term language practices, further motivating learning and enhancing language performance (Kukulska-Hulme & Viberg, 2018). In order to maximise the potential of mobile technology for social interaction in language learning, future studies are advised to systematically examine the factors that affect the use and effects of mobile technology for social interaction in learning, and explore effective educational interventions to promote the use of technology by self-directed learners for social interaction in self-directed language learning.

2.5.5 Limitations and future directions

Many reviewed studies lack information about the participants' proficiency levels. Only 11 out of 20 studies reported the proficiency levels of the participants. Most focused on beginners or intermediates, and only one focused on advanced students. From earlier research, we knew that students at different proficiency levels used strategies differently (Green & Oxford, 1995; Hong-Nam & Leavell, 2006; Park, 1997; Wharton, 2000). We thus recommend that future studies provide more information about participants' proficiency levels in their studies, as this information may enable researchers to do further research in related fields and offer more evidence to educators in order to plan efficient scaffolding for self-directed learners. More attention should also be paid to the less-explored learner populations to see whether there are more varieties in their strategy patterns and skills, and their targeted language areas (Steel, 2012).

2.5.6 Practical implications

The research findings reveal cognitive, metacognitive, social and affective strategies that self-directed learners use in their learning process. These findings have a number of implications for empowering self-directed learners, educators/teachers, and software agents.

It is recommended that self-directed learners prepare themselves before starting self-directed learning. Self-directed learning seems to be more appropriate for intermediate and advanced language learners than for beginners (Sakai & Takagi, 2009; Ünal, Çeliköz & Sari, 2017). Language learners can conduct self-directed learning only when they reach a basic proficiency level. Good language learners usually use a larger number and wider range of strategies in combination (Chamot, Barnhardt, El-Dinary, & Robbins, 1996; Nasri et al., 2015; Oxford, 1999). Some language learners, however, used just one or two types of strategies in their self-directed learning process (e.g., Trinder, 2017; Wrigglesworth & Harvor, 2018). In order to become better self-directed language learners, it is necessary for learners to reach a basic proficiency level and integrate more appropriate strategies into their learning processes, especially deep-level cognitive strategies and affective strategies.

From the perspective of language educators/teachers, guidance should be provided for learners in order to facilitate their autonomous learning effectively. Given the limited knowledge that self-directed learners have of strategy use and technology use, teachers could recommend a wide range of technological resources, share metacognitive and cognitive strategies for effective use of the resources, and encourage students to actively use technology to support their language learning (Zhang & Pérez-Paredes, 2019). In order to better advise and support self-directed learners, teachers should also be supported in raising their awareness of the multiple roles they could have, such as providing affective support, capacity support and behaviour support, and equipping themselves with the necessary knowledge and skills to foster the self-directed learning of students.

For software developers, more adaptive learning features should be incorporated into software applications to help formulate users' personalised learning experiences based on their learning styles, background and technological access, which could offer better learning experiences for self-directed learners. Our findings show that independent learners seldom participate in high-level cognitive processes and often could not get useful feedback when interacting with others. These issues may be addressed by software developers by incorporating adaptive features into software applications. Software applications with adaptive features could make "intelligent" decisions based

on users' performance (Heil et al., 2016), such as designing high cognitive activities if learners master the low-level skills, and providing correct and personalised feedback based on the mistakes that users make during social interactions. More work is needed to track the effectiveness of these adaptive features. Based on the empirical results, it may be appropriate to make suggestions about the software design outcome.

2.6 Concluding remarks

Along with the increasing necessity of self-directed learning using mobile technology, there is a need to understand the self-directed learning process. This systematic scoping review examined 20 empirical studies to determine the learning strategies that self-directed learners used in their learning process. The main conclusion of this review was that self-directed learners used cognitive, metacognitive, social and affective strategies in their learning process, ranging from the simplest to a high level of intentionality and cognitive complexity. More precisely, low-cognitive strategies appeared to be more commonly reported than high-cognitive strategies. The use of metacognitive strategies was more closely associated with the forethought phase and *performance phase* than with the *self-reflection phase*, yet only a few articles reported all three metacognitive phases. And, three kinds of social strategies were examined, and only one affective strategy was reported. We call for more studies to gain insight into affective strategies and high-order cognitive process in self-directed language learning. In order to further exploit self-directed language learning using mobile technology, future research is advised to focus on the support of other agents for self-directed learners and the relationships between the proficiency levels of self-directed language learners and their strategy use.

Chapter 3

A Netnography Study On Self-Directed Language Learning Using Mobile Technology

This chapter was submitted in an adapted form as:
Lai, Y., Saab, N., & Admiraal, W. A netnography study on self-directed language learning using mobile technology.

Abstract

The objective of the study is to describe the learning experience of language learners in the context of self-directed learning using mobile technology. The netnography research method was employed to collect data from an online platform for knowledge exchange, analyzing how learners learned English in the context of self-directed learning using mobile technology. The findings revealed that the process experienced by these language learners included four phases, namely learning task initiation, forethought, performance, and self-reflection phases. More specifically, motivation for English learning and self-directed learning were identified in the learning task initiation phase. How learners set goals, did strategic planning, and perceived this learning process was indicated in the forethought phase. The strategies learners used, and how they sought help, managed their emotions, and monitored their learning process were highlighted in the performance phase. In the self-reflection phase, learners used their final grades as a metric to self-evaluate their performance. Furthermore, they made suggestions, identified challenges, and summarized the disadvantages of self-directed learning, and the conditions for its success. Learners also expressed a sense of achievement and reported improved self-directed learning ability after the learning process.

Keywords: Self-directed learning, Mobile technology, Learning experience, Netnography study

3.1 Introduction

The growth and enhanced capabilities of mobile technologies have revolutionized education by providing access to a variety of educational information at any time and from any location, thereby creating a plethora of learning opportunities. In the realm of foreign language learning, it is apparent that language learners are informally absorbing foreign language using a range of online resources (Lee & Lee, 2021). Furthermore, due to the limited time allocated within the curriculum for foreign language practice and mastery (Kennedy & Levy, 2009; Liu et al., 2020), an ever-growing number of students are turning to self-directed learning outside the classroom, using mobile technology to immerse themselves in authentic language environments and thus enhance their language abilities, particularly in countries distant from native-speaking regions. Loyens and Rikers (2008) differentiated between self-directed learning and self-regulated learning, even though some researchers used both terms interchangeably. Both require learners to be actively engaged and goal-oriented, but the degree of learner control differs, particularly at the start of the learning process (Loyens & Rikers, 2008). Self-directed learners tend to initiate a learning task themselves, whereas self-regulated learners work on tasks assigned by their teacher. Mobile technology consists of portable digital devices including cell phones, wearables, smart speakers, iPads, laptops and other devices connected to the Internet. In this study, self-directed language learning using mobile technology occurs outside the classroom and involves learners initiating their language learning tasks and taking control of the whole learning process within the mobile-assisted learning context.

Prior research has explored students' perceptions, learning strategies, behavioral intention, adoption, satisfaction, persistence, and effectiveness of mobile technology in self-directed language learning (e.g., Lai et al., 2022a; 2022b; García Botero et al., 2019; Lai et al., 2018; Zhang & Perez-Paredes, 2019). However, very little research has been conducted on learners' experiences with self-directed learning using mobile technology. While some researchers, such as Lai et al. (2018) and García Botero et al. (2019), have explored experiences with self-directed learning using mobile technology, they mainly focused on the use of mobile technology, rather than the entire learning process of self-directed learning. Knowledge about how learners self-direct their learning process could be conducive to enhancing the effectiveness of the learning experiences. This study therefore aims to contribute to insights into how learners self-direct their learning process during different phases. Moreover, since this study focuses on foreign language learning as the content for

self-directed learning, it also examines how self-directed learning phases interacted with four language domains, namely, speaking, reading, writing, and listening. The objective of this study is twofold: 1) to present a comprehensive model of self-directed learning process using mobile technology, further providing a practical framework for learners seeking to pursue self-directed learning, and 2) to contribute to improving the effectiveness of self-directed learning, with implications for learners, educators, and IT practitioners.

3.2 Literature review

3.2.1 Self-directed learning in mobile-assisted language learning

The use of mobile technology to fully exploit the potential of self-directed language learning is beneficial as it can support the self-directed language learning process. Lee, Hong, and Ling (2002) and Shapley (2019) stated that self-directed learners tend to derive greater benefits from online learning when compared to those who are not self-directed. In the context of mobile-assisted language learning, self-directed learners can leverage mobile technology, such as various portable devices, to access diverse learning resources, employ all kinds of mobile apps, and engage in communication with native speakers from any location at any time. Such utilization of mobile technology can further improve the effectiveness and efficacy of self-directed learning processes. Nevertheless, research on self-directed learning in mobile-assisted language learning is relatively undeveloped (Kukulska-Hulme, 2016; Li & Bonk, 2023).

Previous studies on language learning have explored the learning experience in self-directed, informal, autonomous or out-of-class learning using various technologies (e.g. García Botero et al., 2019; Lai et al., 2018; Ma, 2017; Zhang & Pérez-Paredes, 2019). For example, Lai et al. (2018) examined the language learning experiences outside the classroom, and factors that influenced these experiences. The authors reported three types of technological experiences, namely instruction-oriented, entertainment and information-oriented, and socially oriented technological experience, all three of which were influenced differently by attitudinal and support factors. Zhang and Pérez-Paredes (2019) explored the use and motivations underlying language learners' choice of mobile English learning resources (MELR). The results revealed that the primary reason for using MELR was to prepare for exams, while expanding their English vocabulary was the learners' main aim. Interestingly, only a few learners were able to choose suitable MELR that aligned with their specific English learning needs, relying instead on recommendations from social media and

authoritative education experts. Of the various types of MELR, mobile dictionaries and vocabulary learning applications were favoured by the learners. The two key factors driving the selection and use of MELR were enjoyment and interactivity. García Botero et al. (2019) investigated how students perceived and used Duolingo as a mobile-assisted language learning tool via software tracking, questionnaires and interviews. Tracking data showed that students were more active during holidays and lacked time during course weeks. The results from questionnaires revealed that Duolingo was able to encourage this kind of learning through fun activities. Additionally, the interview findings reported a lack of self-management, self-monitoring and sustained motivation. All these studies focused on how learners used these technologies in informal, out-of-class, and self-directed learning. However, much less attention was paid to how learners performed in the self-directed learning process with the assistance of mobile technology. Only Ma (2017) described the personalized learning process of foreign language learners, although they mentioned only one or two learning activities in planning, goal setting, self-recording, and self-testing, which did not cover the entire process.

3.2.2 Models of self-directed learning process

Self-directed learning can be described as a process involving individuals taking the lead to identify their learning needs, establish learning objectives, select and implement proper strategies, and assess learning performance, with or without others' support (Knowles, 1975). Numerous attempts have been made to develop conceptual models aimed at elucidating the components of self-directed learning. Candy (1991) presented a Four-Dimensional Model, which encompassed personal autonomy, self-management, autodidacticism, and learner control. Grow (1991) created his Staged Self-Directed Learning Model to outline a process that assisted learners in navigating the various aspects of the self-directed learning process. Brockett and Hiemstra (1991) proposed the Personal Responsibility Orientation Model and emphasized two orientations of self-directed learning: process and goal. Garrison's Three-Dimensional Model (1997) viewed self-directed learning as a learning process and personal attributes. Song and Hill (2007) added a third perspective: the learning context, which represented the impact of environmental factors on self-directed learning. Hiemstra and Brockett (2012) updated the Personal Responsibility Orientation model to the Person Process Context (PPC) Model, which included the teaching-learning process, personal characteristics and learning context. All these models presented above provided us with a

comprehensive view of self-directed learning, yet few focused on the specific and detailed perspective of self-directed learning being seen as a learning process. Only Garrison (1997) further noted that the process of self-directed learning involved self-management, self-monitoring, and motivation. However, Song and Hill (2007) stated that Garrison (1997) still emphasized the level of learner autonomy over the self-instructional process. Comprehending the self-directed learning process is crucial as it not only enhances the effectiveness of learning experiences but also serves as an initial and indispensable step in cultivating learners' self-direction competence (Tan & Koh, 2014).

3.2.3 The components of self-directed learning process

As stated in section 1, the initiation of learning tasks marks the inception of self-directed learning for learners, which is regarded as a component of the self-directed learning process. Subsequently, self-regulation is another crucial and indispensable component (Jossberger et al., 2010; Saks & Leijen, 2014), which is closely intertwined with the quality of self-directed learning (Long, 2000). Taken together, the self-directed learning process involves learners initiating their language learning tasks and regulating the learning process. More explicitly, it includes the learning task initiation phase and Zimmerman's three-phase model of self-regulation (Zimmerman, 2000), which comprises forethought, performance, and self-reflection phases, as illustrated in Figure 3.1.

The self-directed learning process incorporates four key components:

- *Learning task initiation phase,* where learners initiate their own learning tasks;
- *Forethought phase,* in which learners analyze the learning tasks by setting goals and developing plans;
- *Performance phase,* involving using diverse strategies and processes during task engagement to achieve the goals set in the previous phase;
- *Self-reflection phase,* where learners assess and react to their behaviors and performance outcomes once they have completed the tasks based on their chosen goals, and determine the possible factors that led to their success or failure.

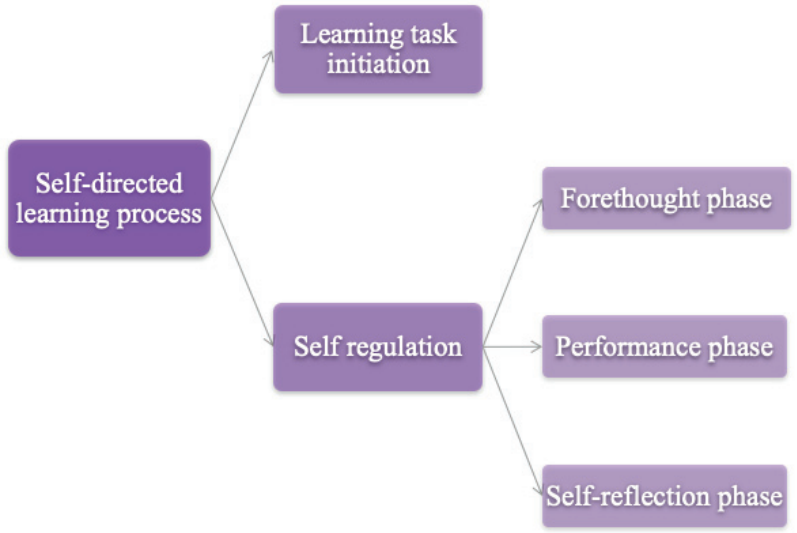


Figure 3.1. The components of self-directed learning.

3.2.4 This study

The current study aims to investigate the learning process of language learners in the context of self-directed learning using mobile technology outside the classroom by addressing the following research questions.

- How do language learners initiate their learning in the context of self-directed learning using mobile technology?
- What do language learners do in the forethought phase in the context of self-directed learning using mobile technology?
- What do language learners do in the performance phase in the context of self-directed learning using mobile technology?
- What do language learners do in the self-reflection phase in the context of self-directed learning using mobile technology?

3.3 Methodology

This study employed an ethnographic research method to analyze how Chinese learners learned English through the process of preparing for IELTS (International English Language Testing System) in the context of self-directed learning using mobile technology. Specifically, we used the netnography approach, which utilizes ethnographic research techniques in online communities. This approach offers a valuable opportunity to naturally capture users' perspectives since data within online communities are publicly accessible, granting users the freedom to openly express their opinions in online communities (Eaton & Pasquini, 2020; Kozinets, 2015; Qin et al., 2020).

3.3.1 Participants

The participants in this study are 29 self-directed learners who learned English on their own for the purpose of passing the IELTS. They could be undergraduates, postgraduates, or people who have entered the workplaces.

The International English Language Testing System (IELTS) is the most popular English language test for global immigration and higher education. It is recognized by governments, employees, educational institutions and other professional bodies around the globe. Four language skills, namely listening, speaking, reading and writing are evaluated during the test. IELTS is graded on a scale of 1-9, Band 9 indicating "expert user" and Band 0 "do not attempt the test".

3.3.2 Data source

This study selected Zhihu, a social question-and-answer online community, as the information source. It is a well-known knowledge-exchanging online platform in China, and has more than 2.2 billion users (Qin et al., 2020). Figure 3.2 shows the examples of the knowledge platforms and the online knowledge communities.

Figure 3.2. An example of the answer page on Zhihu.

The netnography process started with saving all online text posts related to preparing for IELTS in a self-directed way on Zhihu. We eventually screened nine questions:

"How should I prepare for IELTS in a self-directed way?" (https://www.zhihu.com/question/331225718/answer/2616048937),
"What should I do to prepare for IELTS in a self-directed way with a goal of 7?" (https://www.zhihu.com/question/39614041/answer/561085930),
"What should I do to prepare for IELTS in a self-directed way with a goal of 8?" (https://www.zhihu.com/question/48493199/answer/2260251654),
"Any experience or tips for beginners who are preparing for IELTS?" (https://www.zhihu.com/question/333937870/answer/2287971622),
"How should I prepare for IELTS?" (https://www.zhihu.com/question/19709258),
"Do you recommend preparing for IELTS in a self-directed way?" (https://www.zhihu.com/question/23246712/answer/2339625393),
"What is your learning process when preparing for IELTS in a directed way?" (https://www.zhihu.com/question/288558270/answer/1186061290),

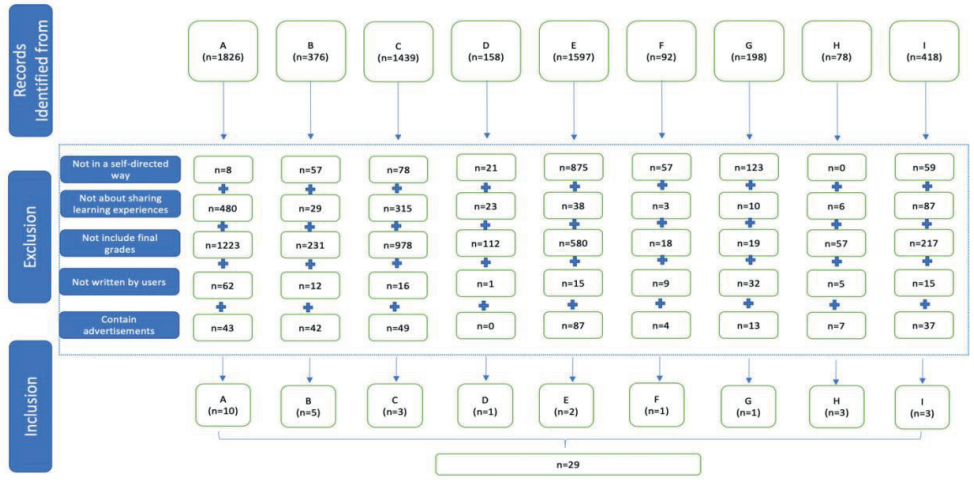
"How difficult is it for beginners to pass IELTS?"
(https://www.zhihu.com/question/37430159/answer/2225138511), and
"How should I prepare for IELTS within two or three months?"
(https://www.zhihu.com/question/29434069/answer/2260714991).

A total of 6,182 answers to these questions were identified. We only selected the entries with a final grade as this is an indication that students went through all the learning stages up to the examination. To include those answers which presented learners' learning process or experience about preparing for IELTS in a self-directed way, we further screened the answers based on the following criteria:

(1) These answers should be relevant to prepare for IELTS in a self-directed way.
(2) They should be written by users rather than educational institutions.
(3) They are about sharing learning experiences.
(4) They should not contain advertisements.

Finally, we arrived at 29 posts, indicating the participation of 29 individuals in the study. Furthermore, all 29 participants affirmed their utilization of mobile technology to varying degrees within their learning processes. Figure 3.3 and Table 3.1 present the exclusion reasons.

Figure 3.3 Flow chart depicting the search and selection process.



Note. A-I means the questions mentioned above.

A: "How should I prepare for IELTS in a self-directed way?"
B: "What should I do to prepare for IELTS in a self-directed way with a goal of 7?"
C: "What should I do to prepare for IELTS in a self-directed way with a goal of 8?"
D: "Any experience or tips for beginners who are preparing for IELTS?"
E: "How should I prepare for IELTS?"
F: "Do you recommend preparing for IELTS in a self-directed way?"
G: "What is your learning process when preparing for IELTS in a directed way?"
H: "How difficult is it for beginners to pass IELTS?"
I: "How should I prepare for IELTS within two or three months?"

Table 3.1 Reasons for exclusion.

Reasons	Number
Not in a self-directed way	1278
Not about sharing learning experiences	991
Did not include final grades	3435
Not written by users	167
Contained advertisements	282

3.3.3 Data analysis

The coding of 29 answers was carried out based on a theory-driven framework. The data analysis was conducted using ATLAS.ti 22, qualitative data analysis software. First, two researchers conducted initial coding of a small sample from the dataset based on our theoretical framework, and then developed a coding framework, as shown in Table 3.2. The first author subsequently coded the rest. To check the reliability, the second author was invited to code 20% of the dataset independently using the coding framework developed. If there was inconsistent coding, the two researchers double checked the original data until consensus was reached. The unit of analysis was a meaningful statement. Parts of the answers where no category was filled were left uncoded. These were not relevant to the learning process.

Table 3.2 The phases and activities of self-directed learning process.

Topic	Components	Phases	Activities	Description
Self-directed learning process	Learning task initiation	Learning task initiation phase	Motivation for English learning	
			Motivation for self-directed learning	
	Self-regulation	Forethought phase	Goal setting	The process of learners setting specific objectives that they want to achieve.
			Strategic planning	Choosing an action plan.
			Task value	The importance of self-directed learning.
			Self-efficacy	The perception about the personal ability to perform a task.
		Performance phase	Task strategies	Learners' capability to employ learning strategies that can assist them to acquire the language.
			Help seeking	The act of asking for assistance when needed.
			Management	Planning the use of environment, resources, effort and time during the learning process.
			Interest incentives	The self-given reminders of goals that can help motivate and sustain learners.
			Self-consequences	To enhance their feelings of progress through self-reward.
			Self-recording	Making a record of the learning contents or behaviors for further analysis.
			Self-monitoring	Checking and correcting one's understanding or performance in the learning process.
		Self-reflection phase	Self-evaluation	Assessing learners' performance.
			Self-reaction	Learners' cognitive and emotional reactions to self-judgments.

3.4 Results

This section presents the analysis of data. The results relating to four learning phases is shown (and discussed) below, with special attention being paid to exploring the differences between the domains of listening, reading, writing and speaking.

3.4.1 Learning task initiation phase

Table 3.3 Codes in the learning task initiation phase and their summary.

Code	Summary
Motivation for English learning	• Study abroad • Professional development
Motivation for SDL	• Avoid paid training courses • Enjoy the sense of achievement after completing this self-directed learning

Learning task initiation involves *motivation for English learning* and *self-directed learning,* as shown in Table 3.3. Of the participants, nine studied the English language in preparation for studying abroad and one for professional development. Five conducted self-directed learning to avoid paid training courses and one for enjoying the sense of achievement after completing this self-directed learning.

3.4.2 Forethought phase

Table 3.4 Codes in the forethought phase and their summary.

Code	Sub-code	Summary
Goal setting	Target score	• Target scores • Smaller goals
Strategic planning	Understand the test	• Acquire the basic information about the test, useful learning tips, and the key parts of the test • Through the IELTS website, textbooks, online question-and-answer platforms (e.g., Zhihu), or online introductory videos
	Select appropriate learning resources	• Paper learning resources • Electronic learning resources • Vocabulary memorization apps was the most frequently noted category

	Make study plans	• The criteria of making plans:
		  ○ The amount of time available
		  ○ Their preferred learning styles, and
		  ○ Current level of English proficiency that was determined by their grades in previous English exams or a mock IELTS test
		• Search for study plans online
		• Use Excel app

Task value	Value of SDL	• Feasibility of self-directed learning as an effective means for IELTS preparation
Self-efficacy		Way of self-assessing self-efficacy: • A self-test • Prior self-learning experience

This phase includes *goal setting, strategic planning, task value* and *self-efficacy*, as illustrated in Table 3.4. Regarding *goal setting*, eight participants reported having target scores, with two of them also setting smaller goals. Moreover, participants 1 and 32 mentioned setting their goals according to their personal needs: "*Based on the English proficiency requirement of the master's*

program that I would like to apply for at the university abroad, I set my minimum goal with an overall band of 7 and a band of 6.5 in every section" (Participant 32).

In this study, participants developed *strategic plans* by gaining an *understanding of the test*, *selecting appropriate learning resources* and *making study plans*. Regarding *understanding the test*, participants acquired the basic information about the test, useful learning tips, and the key parts of the test via the IELTS website, textbooks, online question-and-answer platforms (e.g., Zhihu), or online introductory videos. Most participants reported that they focused on understanding the writing section of the test, while fewer of them emphasized the listening section.

Participants used both paper and electronic learning resources. One participant mentioned that they chose the paper resources because they found it difficult to study consistently for three hours on mobile devices without being distracted by games, messages, or movies. However, most participants used electronic tools, including online courses on platforms like YouTube and Bilibili, BBC radio, the Economist magazine, and online services that provided feedback for writing and speaking practice. Additionally, various mobile apps were utilized, including those for vocabulary-memorizing (e.g., Maimemo, Baicizhan), listening-practicing (e.g., Daily English Listening, EasyListen), speaking-practicing (e.g., IELTS Bro), IELTS-specific (e.g., Papa English), and social question-and-answer websites (e.g., Quora, Reddit). Of these, vocabulary memorization was the most frequently noted category, with four participants stating that these apps helped them memorize vocabulary using example sentences based on the forgetting curve.

Twenty-one participants *made study plans* for their IELTS preparation. These plans were based on the amount of time available, their preferred learning styles, and their current level of English proficiency that was determined by their grades in previous English exams or a mock IELTS test. For example, Participant 26 stated, "*I tend to be more focused in the morning, so I plan to practice listening skills every morning since it requires more attention*".

Besides, two mentioned they searched for study plans online. For example, participant 40 stated that they searched for the plans on Zhihu, looking for posts from individuals with similar English proficiency and target scores, and then tailored the plan to fit their own situation. One participant even used an Excel app to create a detailed study plan.

About *task value* of self-directed learning, thirteen participants acknowledged the feasibility of self-directed learning as an effective means for IELTS preparation.

Two participants assessed their self-learning ability through a self-test, which included such questions as "*Am I capable of focusing on studying for at least 3 hours every day?"* and *"What is my current level of English proficiency? Can I understand everyday English conversations?*" (Participant 3). Another participant referred to their prior self-learning experience to gauge their *self-efficacy*.

3.4.3 Performance phase

Table 3.5 Codes in the performance phase and their summary.

Code	Sub-code	Summary
Task strategies	Repetition	• Repeat exercises to maximize their learning outcomes • Go over what they have learned or summarized • Listen to the audio materials intensively • Read the materials intensively and recite new vocabulary repeatedly during reading practice • Analyze model essays one after another in writing • Record their own speaking and listen back
	Key word	• Underline the keywords in the questions before listening and reading to get them prepared, and then pay extra attention to these keywords during the listening and reading. • Keep the key words in mind in speaking practice.
	Note taking	• Take notes of the key information and the parts that caused confusion while listening to the materials.
	Grouping	• Group the parts where they were losing

		points in listening, reading and speaking practice. • Classify the new vocabulary
	Contextualization	• Guess the meaning in the context.
	Authentic context	• Extensively immerse themselves in the English TV series, movies, talk shows, books, vlogs in YouTube or Bilibili, and BBC news. • Alternate between watching videos with English subtitles, Chinese subtitles and no subtitles. • Engage in self-talk in English.
	Imitation	• Imitate the pronunciation and intonation after listening to or speaking along with language materials.
	Variety	• Use various expressions rather than consistently relying on the same ones.
	Translation	• Translate in writing and reading practice.
	Resourcing	• Use Google engine.
	Induction	• Conclude the rules for writing a good essay.
	Deduction	• Employ the rules or tips learned into their own essays.

	Selective attention	Give specific attention to:
		• In the listening domain:
		  ○ The point-losing parts
		  ○ The difficult sections, and
		  ○ Areas requiring extra attention
		• In the reading domain:
		  ○ The point-losing
		  ○ The difficult parts
		  ○ The titles, first and last sentences of every paragraph

		• In writing practice:
		  ○ Essay structure
		  ○ The use of liaison
		  ○ Nouns of locality
		• In speaking,
		  ○ Pronunciation
		  ○ Intonation
		  ○ Liaison

	Advance organization	• Preview the questions before engaging in the listening and reading activities.
	Organizational planning	• Generate a plan before writing an essay.
	Problem identification	• Identify their problems during learning, and then implement targeted training to address these issues
Help seeking	Teacher support	• Ask for listening tips, feedback
	Peer support	• Turn to high-scoring peers and English-majored friends for feedback • Established learning groups
	Internet support	• Search for learning tips and resources
	Native speakers' support	• Essays evaluation and coaching on speaking skills
	Parent support	• Monitor the learning progress
Management	Environment management	• Changing learning environment. • Setting the phone's system in English. • Extensively listening to English videos while walking and communing • Writing English blogs and posts on Quora
	Time management	• Allocate specific hours for four language domains • Set a minimum study time • Use spare time for learning
	Resource management	• Screen learning materials
	Plan adjustment	• Adjust their study plans by

		• Revising subplans that were not completed on time • Incorporating targeted training for weak areas that were identified during the learning process
Interest incentives	Self-motivation	• Make daily to-do-lists • Use learning platforms with high interactivity • Uninstall the recreational mobile apps • Employ the concentration apps
	Emotion adjustment	• Exercise • Meditation • Yoga • Socialize with friends • Watch movies
Self-consequences		• Buy a gift or went to see a movie as the reward after completing a major goal
Self-recording	Self-recording of new or good expressions	• Make records of new or useful vocabulary and expressions
	Self-recording of point-losing parts	Reasons for losing points in reading: • Inability to understand the article • Inability to find the answers even when understanding the article • Inability to understand the questions • Not knowing the correct answers even when the questions are understood
	Self-recording of useful learning tips	• Make recordings of useful learning tips
	Self-recording of oral practice audio recordings	• Make their own oral practice audio recordings using cell phone or specific apps
Self-monitoring	Production monitoring	• Look up listening materials • Compare with the reference answers in reading and listening practice

		• Compare their revised versions in writing • Self-correct their mistakes after listening to audio recordings or receiving feedback from others in speaking
	Comprehension monitoring	• Keep asking themselves questions while reading articles
	Other monitoring	• Track their grades

The *performance phase* consists of *task strategies, help-seeking, management, interest incentives, self-consequences, self-recording* and *self-monitoring*, as indicated in Table 3.5.

In this study, sixteen different task strategies emerged from the data, comprising twelve cognitive strategies and four metacognitive strategies. Their definitions are presented in Appendix B. Regarding cognitive strategies, *repetition* is mentioned most often. Generally, fourteen participants stated that they repeated exercises to maximize their learning outcomes, and seven went over what they had learned or summarized. Specifically, some participants listened to the audio materials intensively and even transcribed them during listening practice and read the materials intensively and recited new vocabulary repeatedly during reading practice. And some analyzed model essays one after another in writing and recorded their own speaking and listened back to identify areas for improvement in speaking practice. *Keyword* is frequently used in listening and reading practice. They underlined the keywords in the questions before listening and reading to better prepare themselves, and then paid extra attention to these keywords during the listening and reading, which could help them answer these questions quickly and accurately, further maximizing their scores within the limited time. Two participants noted that they just kept the keywords in mind in speaking practice, which allowed them to express their opinions fluently and coherently. *Note taking* is employed exclusively in their listening practice. Participants took notes of the key information and the parts that caused confusion while listening to the materials. *Grouping* means learners classify the words or expressions into different groups based on specific criteria (O'Malley & Chamot, 1990). Participants in this study grouped the parts where they were losing points in listening, reading and speaking practice. One also classified the new vocabulary. *Contextualization* means placing words or phrases in meaningful sentences or contexts to help

learners understand them (O'Malley & Chamot, 1990). Eight participants used this strategy in their learning process, especially in listening and reading practice. For example, Participant 16 stated, "*Even if there were some difficult sentences to understand in reading practice, I guessed the meaning in the context.*" Different from *contextualization*, *authentic context* describes learners extensively immersing themselves in the English TV series, movies, talk shows, books, vlogs in YouTube or Bilibili, and BBC news to become more familiar with the target language. Participant 7 noted that they alternated between watching videos with English subtitles, Chinese subtitles, and no subtitles to gradually improve their language proficiency. They also reported that they regularly engaged in self-talk in English to train themselves to think in the logic of the English language. In addition, eight participants used *imitation* as a strategy to refine their pronunciation and intonation after listening to or speaking along with language tools. Three participants mentioned the importance of using a *variety* of expressions rather than consistently relying on the same ones. *Translation* was employed by two participants in writing and reading practice. One participant used Google engine as a *resourcing* tool to learn new expressions. *Induction* and *deduction* were also touched on. For example, "*I concluded the rules for writing a good essay by analyzing at least three excellent essays*" (*Induction* _Participant 17), and "I *employed all the rules or tips learned in my own essays*" (*Deduction* _Participant 2).

Four metacognitive strategies are indicated as well. *Selective attention* was identified most. In the listening domain, participants gave specific attention to the point-losing parts, the difficult sections, and areas requiring extra attention. For instance, Participant 34 stated that he/she paid more attention to the names of people, places and roads since they need to be capitalized. Concerning the reading domain, in addition to the point-losing and difficult parts, participants kept an eye on the titles, and the first and last sentences of every paragraph before proceeding to the reading passage. Additionally, one mentioned performing targeted training on weak parts of reading where they had lost points multiple times. In writing practice, participants gave more consideration to essay structure, the use of liaison and nouns of locality. With respect to speaking, attention was given to pronunciation, intonation, and liaison. *Advance organization* was used in listening and reading practice where participants previewed the questions before engaging in the listening and reading activities. Participants also employed *organizational planning* in all four language domains. Participant 19 stated that they always generated a plan before writing an essay: "*I analyzed the writing task, and then created an outline. Then, I used the outline to guide me as I*

wrote the essay." Furthermore, two participants *identified their problems* during learning, and then implemented targeted training to address these issues.

Based on our data, participants *sought support* from teachers, peers, the internet, native speakers and parents. The internet was the most common source of help, with 19 participants using it to search for learning tips and resources. They accessed useful online learning tips for listening, online experience-sharing posts on Zhihu for reading, writing critique sites and online courses for writing, and useful mobile apps, online experience-sharing posts on Zhihu, online courses and coaching partners for speaking. 11 participants sought support from peers. They not only turned to high-scoring peers and English-majored friends for feedback on their writing and speaking, but also established learning groups to share listening and writing tips, critique each other's work, recommend useful resources, make plans and monitor each other's progress. 7 participants asked teachers for listening tips, feedback on their essays and pronunciation. Similarly, 7 participants sought support from native speakers for the evaluation of essays and coaching on speaking skills. Finally, 1 participant involved their parents in monitoring their learning progress.

Participants *managed their time* by allocating specific hours for four language domains, setting a minimum study time, and using spare time for learning. Participant 16 mentioned that they "*practiced listening and reading during the daytime and writing and speaking in the night time*". For *environment management*, one participant stated that changing the learning environment, such as studying in a different place, motivated them. Participants also emphasized the importance of having a non-distracting environment for reading, such as spending at least one hour free of distractions. Additionally, setting the phone's system to English, extensively listening to English videos while walking and communicating, and writing English blogs and posts on Quora made them immerse in the authentic environment. One participant also mentioned the need to *screen learning materials* to ensure their relevance and effectiveness. Moreover, seven participants made *adjustments to their study plans*, either by revising subplans that were not completed on time or by incorporating targeted training for weak areas that were identified during the learning process.

With regard to *interest incentives,* participants mentioned several methods that motivated them and kept them persistent and determined, including making daily to-do-lists, using learning platforms with high interactivity, which are easier to stick with, uninstalling the recreational mobile apps, and employing the concentration apps (e.g., Forest). Some also emphasized the significance of maintaining a positive mindset during the learning process, which can be achieved through

exercise, meditation, yoga, socializing with friends, and watching movies. In addition, only one (Participant 17) reported using the *self-consequences* in the process. They bought a gift or went to see a movie as a reward after completing a major goal.

This study identified four types of *self-recording*: new or useful vocabulary and expressions, point-losing parts, helpful learning tips, and orally practicing audio recordings. 25 participants made records of new or useful vocabulary and expressions across four language domains, and reviewed them repeatedly to expand their vocabulary, which in turn enabled them to understand IELTS contents better and avoid using simplistic expressions all the time in speaking and writing (participant 19), ultimately getting good grades in the real test. Besides, 20 participants recorded the point-losing parts for the purposes of knowing their weak points and targeted their studies. They also determined and categorized the reasons why they lost points. For example, Participant 16 stated, "*I found that the reasons why I lost points in reading could be grouped into four types: (1) inability to understand the article; (2) inability to find the answers even when I understand the article; (3) inability to understand the questions; and (4) not knowing the correct answers even when I understand the questions.*"

Nine participants made their own oral practice audio recordings using their cell phone or specific apps, only for the speaking domain. They listened back to these recordings to self-evaluate their answers and identify the words that they pronounced incorrectly. Based on these evaluations, they were able to make improvements in their speaking skills. Seven also mentioned that they made recordings of useful learning tips.

Production monitoring, comprehension monitoring and *other monitoring* were identified in this study. 17 participants engaged in production monitoring by looking up listening materials or comparing with the reference answers in reading and listening practice, comparing their revised versions in writing, and self-correcting their mistakes after listening to audio recordings or receiving feedback from others in speaking. One participant checked their comprehension by continually asking themselves questions while reading articles. Tracking their grades was another monitoring action to keep themselves informed of their current progress.

3.4.4 Self-reflection phase

Table 3.6 Codes in the self-reflection phase and their summary.

Code	Sub-code	Summary
Self-evaluation	Final grades	IELTS grades
Self-reaction	Suggestions	• Practice listening and speaking insistently • Summarize consciously • Use helpful mobile devices or apps
	Challenges	• Speaking, especially pronunciation and fluency • Maintaining a positive mood during the learning process
	Conditions for successful SDL	• Self-discipline and self-control • Effective learning methods • Emotional control • Planning and executing capabilities • The ability to access learning materials and information
	Disadvantages of SDL	• Time-consuming • Less feedback and materials • Easy to give up
	A sense of satisfaction	• Feeling a sense of satisfaction
	Improved SDL ability	• Improved self-directed learning ability

Self-evaluation and *self-reaction* were identified in the *self-reflection phase*, as outlined in Table 3.6. Participants used their final grades as a metric to *self-evaluate* their performance. Regarding *self-reaction,* learners made suggestions and concluded the difficult parts when reflecting on the whole learning process. The suggestions include being determined in practicing listening and speaking, summarizing consciously, and using helpful mobile devices or apps. They also mentioned that it is challenging to improve speaking, especially pronunciation and fluency. Additionally, maintaining a positive mood during the learning process proved to be a challenge for them. Besides, three participants reported feeling a sense of satisfaction, while one believes that

their self-directed learning ability had improved as a result of engaging in self-directed language learning. Furthermore, nine participants stated that successful self-directed learning requires self-discipline and self-control, effective learning methods, emotional control, planning and executing capabilities, and the ability to access learning materials and information. One participant pointed out the weaknesses of this learning approach, namely that it is time-consuming, there is less feedback and fewer materials, and it is easy to give up.

3.5 Discussion

This study examined learners' self-directed learning process in the context of mobile-assisted language learning through the netnography research method. The findings enriched our in-depth evidence-based insights into the self-directed learning process from four phases. In addition to the research findings presented above, there are certain noteworthy outcomes that deserve further elaboration.

3.5.1 The role of mobile technology in the self-directed learning process

This study showed mobile technology assisted self-directed learning in three self-regulatory phases. In the *forethought phase*, learners used mobile technology to access various authentic learning materials (e.g., YouTube videos, Quora), and record study plans. In the *performance phase*, they used specific mobile apps to memorize vocabulary, practice listening and speaking skills, seek help from others, record learning time or contents, and monitor their progress. They followed online courses to learn tips, and joined online peer groups to exchange experiences and gain encouragement. The results are partly in line with the findings of Müller and Faltin (2011) and Tabuenca and colleagues (2015) reporting that students used mobile tools to track or record time spent on self-regulated learning. However, our study did not find any mobile technology used in the self-evaluation or self-reflection phase. Müller and Faltin (2011) revealed the possibility of using mobile tools to compare performance in self-evaluation, and to report and visualize learning statistics in the *self-reflection phase.* Further research is needed to figure out the specific ways that mobile technology can effectively support learners in the self-evaluation or self-reflection phase.

Additionally, this study found that most learners used a combination of electronic learning resources as well as printed books to accomplish their learning goals, which aligns with the findings of Li and Bonk (2023) demonstrating that learners used traditional materials and open educational

resources in their self-directed language learning. Despite the affordances of mobile technology for self-directed learning discussed earlier, a participant in this study articulated their preference for printed books due to poor self-discipline. They found it challenging to resist distractions such as messaging, mobile games, or movies while utilizing mobile technology to support their learning process. This rationale highlights a contemporary challenge linked to maintaining focus and concentration amidst the ubiquity of digital diversions. It diverges significantly from Gregory's (2008) reasons for participants' preference for printed books. Gregory (2008) cited reasons such as awareness (never heard of e-books), preference for printed books (reliable and convenient), eyestrain (the negative effect of staring at the computer), no need of using e-books, and ease of access to printed books, which do not conform to the current digital and mobile era.

3.5.2 Interaction between self-directed learning phases and four language domains

This study examined how self-directed learning stages interacted with four language domains: speaking, reading, writing and listening. While most of the self-directed learning stages did not show significant differences across the four domains, two distinctions were identified. One pertained to *making study plans*. The study plans were developed based on the learners' current proficiency levels in four English language domains, as well as the time available and individual learning styles. Creating study plans for reading and listening is relatively straightforward, as their levels can be assessed by comparing individual responses to standardized ones. In contrast, devising plans for writing and speaking poses greater difficulty due to the more challenging nature of evaluating current proficiency levels in these skills. Another distinction emerged concerning *help-seeking*, with more learners seeking support for writing and speaking, contrasted with fewer seeking help for reading and listening. This discrepancy could stem from various factors. One possible explanation lies in the relatively higher degree of difficulty in writing and speaking practice, necessitating more external assistance in these areas. Another is that further assistance can be obtained by referring to model answers for reading and listening tasks. Conversely, finding analogous guidance for writing and speaking tasks is often less accessible, potentially contributing to the higher frequency of seeking external help in these domains.

3.5.3 Affective support and outcomes

Learners' affective states exert a great influence on their engagement (Shen, 2021), performance (Dewaele, 2022), and learning process (Kukulska-Hulme et al., 2023). In this study, affective aspects were mentioned in two phases, the *performance phase* and the *self-reflection phase*. In *the performance phase*, learners employed affective support to engage in the self-directed learning process, such as using highly interactive learning platforms and concentration apps. This finding is consistent with previous studies by Wu et al. (2022) and Kukulska-Hulme et al. (2023), which suggest the design of mobile technologies such as an interactive design could offer learners opportunities to express their feelings and thoughts, which might improve their motivation and learning performance (Chen et al., 2018; Delahunty, 2018). And, in the *self-reflection phase*, learners experienced a positive affective outcome characterized by a sense of achievement and fulfillment after successfully completing the self-directed learning process. This is congruent with the finding of Cohen and Magen-Nagar (2016), who demonstrated that students felt a high sense of achievement when following a massive open online course. In addition, maintaining a positive mindset is conducive to engaging in the self-directed learning process.

3.5.4 Help-seeking and self-efficacy

Learners solicited support from teachers, peers, internet, native speakers and parents. The Internet is the agent that learners turn to most frequently. This is because the internet is characterized by availability, ease of access, searching capability, and links to a huge volume of resources (Li Liew et al., 2000), and it can be accessed anytime and anyplace. Besides, Li and Bonk (2023) reported that learners drew support from tutors, interest-shared peer groups and open educational resources, which showed similar results to this study. In addition, this study found learners received help from parents as well.

Learners evaluated their self-efficacy by taking a self-test of their language proficiency or reflecting on the prior self-learning experience, which aligned with the finding of Littlejohn et al. (2016) showing self-efficacy in association with either the existing knowledge or previous learning experience in the self-regulated MOOCs. This implied that learning is facilitated when learners were able to connect new knowledge with their existing knowledge, which corresponds to the theory of knowledge construction (Anderson, 1982; Littlejohn et al., 2016).

3.6 Limitation and directions for future research

There are also a few limitations to be acknowledged in this study. Firstly, the sample was limited to participants who shared their grades in the posts, which may result in a bias towards those who achieved good grades as we found all of them achieved good grades in the exam. The reason for this can be that learners with good grades might be more inclined to share their experience compared to those with low grades. Future research could capture data from learners with varying levels of grades to gain a more comprehensive understanding of the self-directed learning process and to see whether learners with different levels of grades exhibit different self-directed learning processes. Besides, we did not investigate the relationship between a self-directed learning process and learning performance. Research has proved the significant relationships among forethought, performance, and self-reflection processes, and the predictive effect of these phases on performance in mathematics education (Callan & Cleary, 2019). Therefore, it also warrants attention to delve into this aspect in self-directed learning.

Although this study shed light on the affective aspects in self-directed language learning, this domain is still an "under-researched and under-theorized aspect of self-regulation" in mobile-assisted language learning (Kukulska-Hulme et al., 2023). Thus, given its significant influence on learning performance and engagement, we call for more studies to explore this field.

3.7 Conclusion and implications

This study proposed a framework for a self-directed learning process, which comprises *learning task initiation, forethought, performance,* and *self-reflection phases*. *Motivation for English learning* and *self-directed learning* were identified in the *learning task initiation phase*. The *forethought phase* included *goal setting, strategic planning, task value* and *self-efficacy*. Learners set their goals of target scores and small learning goals based on their needs, and made the strategic plans by understanding the test, selecting appropriate materials and making study plans. Some of them considered self-directed learning feasible for IELTS preparation, and they also perceived their self-learning ability through a self-test or referring to the prior self-learning experience. The *performance phase* consisted of *task strategies, help-seeking, management, interest incentives, self-consequences, self-recording* and *self-monitoring*. Twelve cognitive and four metacognitive strategies were presented. Learners solicited support from teachers, peers, internet, native speakers and parents, and managed the environment, resources, effort and time during the learning process.

Learners used some methods to motivate themselves and remain persistent. Additionally, they made recordings about their learning process and monitored the production and comprehension in the process. *Self-evaluation* and *self-reaction* were identified in the *self-reflection phase*. Participants evaluated their performance by using their final grades. And they made suggestions and concluded the difficult parts and successful self-directed learning requirements when reflecting on the whole learning process.

A number of implications can be drawn. Theoretically, this study proposed a framework for the self-directed language learning process, which comprised *learning task initiation, forethought, performance,* and *self-reflection phases*. It could help self-directed learners and other agents to inspect the learning process and identify areas of improvement, thus better optimizing the self-directed learning experience. Practically, self-directed learners could proactively seek help from teachers, peers, or friends when facing challenges, as identified by the participants in this study. These agents, in turn, are encouraged to render particular cognitive or emotional support to self-directed learners whenever possible. Furthermore, since the affective states of learners influence their motivation and persistence in self-directed learning (Shen, 2021; Dewaele, 2022), software developers should incorporate the affective monitoring and intervention features in language learning apps to assist learners in countering negative emotions and sustaining their motivation and engagement throughout the self-directed learning process.

Chapter 4

University Students' Use of Mobile Technology in Self-Directed Language Learning: Using the Integrative Model of Behavior Prediction

This chapter was published in an adapted form as:

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Abstract

Mobile technology offers great potential for university students' language learning. Numerous studies have been conducted on utilizing mobile technology in language learning classroom. However, using it in self-initiated and self-directed learning outside class remains to be explored. The present study employed the Integrative Model of Behavior Prediction to investigate the relationships between attitude, subjective norm, self-efficacy and behavioral intention, as well as the association between intention, facilitating conditions, self-regulation skills and actual use of mobile technology in self-directed language learning. This study also examined whether self-regulation skills moderated intention and actual use. Survey data from 676 language learners in different disciplines from Chinese universities were collected and analyzed using Structural Equation Modeling approach. The results showed that 37.1 percent of respondents indicated that they never used mobile technology for self-directed language learning. Of the other 425 respondents who did indicate that they used mobile technology for this purpose, the majority of them seemed to be extrinsically motivated. Learning activities regarding vocabulary acquisition and translation were far more reported than those in terms of listening, speaking, reading and writing. In addition, attitude and subjective norm significantly explained students' intention to use mobile technology, but self-efficacy did not have a direct effect on students' intention. Moreover, students' self-regulation skills and intention significantly predicted students' actual use of mobile technology. Through moderation analysis, the results indicated that the relationship between intention and actual behavior would be stronger with any increase in self-regulation skills. These findings are discussed and implications are formulated.

Keywords: Self-directed learning; Mobile technology; IMBP; Higher education

4.1 Introduction

It is widely acknowledged that learning a foreign language is often a difficult and time-consuming journey (Wang, Grant, & Grist, 2021). In higher education, however, there is not much space to learn foreign languages as part of the subject curriculum in a discipline, and in some countries students do not receive enough in-class language exposure to ensure their learning success (Liu, 2020; Richards, 2015; Trinder, 2017; Tsou et al., 2006). Thus, for the sake of increasing the opportunities for exposure to foreign languages, it is of great significance for students to devote their time on out-of-class and self-directed language learning as well. At the heart of out-of-class and self-directed language learning is the notion that learners take control of their own learning process by taking responsibility for and deciding what and how language knowledge is learned (Merriam & Bierema, 2013). Currently, many students have attempted to use mobile technology to learn foreign languages outside the curriculum, in a self-directed way, so as to improve their foreign language competencies. Students utilize mobile-accessible apps such as YouTube, Duolingo, Facebook, etc. to create their own learning environment. In this process, students may receive support (i.e., useful mobile apps or learning materials) from facilitators like teachers or maybe not, since the whole process is student-initiated.

Mobile technology has been widely used in language learning. It enables learners to access information anytime and anywhere (Hsu, & Lin, 2021), share their experiences and understanding, and collaborate with other learners or native speakers (Kukulska-Hulme, & Viberg, 2018), so as to improve their learning performance and interest. In higher education, this mobile assisted language learning is widespread. In Australia, for example, a virtual world, Chinese Island (CI), was introduced to effectively engage Chinese language learning students, facilitate their authentic language use, and enhance their learning experience (Wang, Grant, & Grist, 2021). In China, WeChat, a multi-purpose mobile app, was used to help students to develop their pronunciation learning by receiving feedback from automatic speech recognition (ASR) and/or peers (Dai, & Wu, 2021). Also, in Japan, video streaming services were employed in order to promote reading, vocabulary and listening comprehension in the foreign language learning (Dizon, 2021). All these applications are suited for mobile technology.

However, university students vary considerably in their out-of-class use of mobile technology (Lai & Gu, 2011; Nguyen, & Takashi, 2021; Stockwell, 2010; Zhang & Pérez-Paredes, 2019; Luo, 2019). Stockwell (2010), for example, examined 175 Japanese learners of English over a three-

year period and found that their usage of mobile phones for English vocabulary learning remained quite low when given the alternative of using desktop computers. Yet Lai and Gu (2011) revealed that Hong Kong students showed different levels of engagement with technology. Students not only employed a variety of technologies for language learning, but also used these technologies for different purposes, such as seeking opportunities for authentic language use, assessing their current level of language proficiency, motivating themselves to commit to the learning goals, obtaining cultural information, and broadening their social connections. In addition, Luo (2019) reported that Chinese students used different mobile apps, and 70% of the students used mobile technology for language learning less than 20 minutes. In the same country, Zhang and Pérez-Paredes (2019) showed that students were not regularly and actively involved in mobile English learning resources. Also, Nguyen and Takashi (2021) indicated that Vietnamese and Japanese learners rarely used mobile devices to study English outside the classroom, even though they would like to use mobile devices more often. Furthermore, as documented in the literature, a number of obstacles make students hesitate to engage in self-directed learning with mobile technology. For example, students are not always confident about their proficiency levels during online interactions, lack overlap between their social networking friends and language learning partners (Lai & Gu, 2011; Lai, Hu, & Lyu, 2018; Lai & Zheng, 2018), and are afraid of getting incorrect feedback (Lai & Gu, 2011). Due to the variety and hesitation in mobile technology use, an essential question emerges as to which factors drive or hinder university students' use of mobile technology for self-directed language learning outside the classroom. With the answer, the potential measures could be taken to enable students to utilize online resources on mobile technology to sharpen their language skills.

4.1.1 Mobile-assisted language learning

Previous empirical research has been carried out to examine students' acceptance and use of mobile-assisted language learning (MALL) and related factors. Kim and Lee (2016) examined how Korean students used MALL and investigated related factors that potentially affected MALL usage. Their findings revealed that content reliability, perceived enjoyment, perceived usefulness and perceived ease of use had significant effects on students' acceptance of MALL. García Botero, Questier, Cincinnato, He, and Zhu (2018) applied the modified version of the Unified Theory of Acceptance and Use of Technology to examine the factors affecting behavioral intentions and actual use of MALL. Results showed that performance expectancy, social influence, and

facilitating conditions influenced students' attitudes towards using MALL, and behavioral intention had an effect on actual MALL use. In 2020, Hoi (2020) used the same model to understand the acceptance and use of MALL by higher education learners in Vietnam. Results indicated that attitude and performance expectancy predicted learners' behavioral intention and their usage of MALL, and facilitating conditions had no direct effect on learners' MALL usage. In the same year, Sun and Gao (2020) investigated the relationships among intrinsic motivation, critical variables related to technology adoption, and students' behavioral intention in MALL. The authors reported that although intrinsic motivation did not have a direct influence on students' behavioral intention in MALL, it had a positive influence on students' behavioral intention through the two intervening variables, perceived usefulness and task technology fit. Despite these studies used various models to identify the determinants that affected MALL use, most of them did not differentiate specific educational contexts, such as teacher-initiated or student-initiated learning, and in-class or out-of-class learning.

Not all educational settings show similar results in mobile learning integration. A recent meta-analysis study on mobile learning in general found that mobile learning had a higher effect size in informal settings than in formal settings (Sung, Chang, & Liu, 2016). Moreover, Hsu (2013) stated that the teacher-centered educational approach was one of the factors that negatively affected students' attitude toward MALL. Given the effectiveness of informal out-of-class learning and the negative influence of teacher-centered approach, it is important to conduct research specifically on student-initiated self-directed learning outside class. In addition, the research samples in most studies are foreign language-majored learners, which makes conclusions difficultly generalize as - compared to other learners - these learners generally are better at language learning. Consequently, the current study includes students from humanities, social science, natural science and engineering and therefore describes a more general picture of self-directed language learning.

Considering this "less explored territory to date" (An, Wang, Li, Gan, & Li, 2021; Nguyen, & Takashi, 2021; Kukulska-Hulme, 2016: 138), insights into student-initiated and out-of-class MALL use will support students' practice of their self-directed MALL as well as help school managers and teachers to see to what degree students reach their goal and provide potential directions to further cultivate students with self-directed learning ability. In addition, several studies have investigated how different self-regulation skills related to learning behavior in an e-learning environment. Wang (2011), for example, showed that in an e-Learning environment with

Normal Web-based Test (N-WBT), students with a high level of self-regulated learning (SRL) had significantly better learning outcomes, whereas in an e-Learning environment with Peer-Driven Assessment Module of the Web-based Assessment and Test Analysis system (PDA-WATA) no significant difference was found between students with a low level and a high level of SRL in terms of learning effectiveness. In a study on computer-supported collaborative learning (CSCL), Lin, Huang, and Chuang (2015) reported that self-regulation positively influenced learning behavior, along with network centrality (i.e., social network position) in a CSCL environment. Lin, Szu, and Lai (2016) also found that students' learning behavior in different CSCL systems depended on their self-regulation levels. In a study on user-acceptance of computer-based assessment, Lin and Lai (2019) showed that students' behavioral intention significantly predicted their actual behavior for students with high self-regulation skills but not for students with low self-regulation skills. In a study on Massive Open Online Courses (MOOCs), additionally, Jansen, van Leeuwen, Janssen, Conijn & Kester (2020) revealed that the learners who complied with the SRL intervention were more engaged in SRL activities than the learners in the control group who did not receive any intervention. Moreover, self-directed learning with mobile technology is voluntary and therefore it requires students' self-discipline and self-regulation. Hence, in the present study, self-regulation skills are assumed to moderate the relationship between behavioral intention and actual use of using mobile technology in the self-directed learning process.

4.2 Theoretical Background

In order to explain university students' intention towards and use of mobile technology in self-directed language learning, we employed the Integrative Model of Behavior Prediction (IMBP; Fishbein & Ajzen, 2010) as the theoretical model in this study. IMBP evolved from the Theory of Reasoned Action (TRA; Fishbein & Ajzen, 1975) and Theory of Planned Behavior (TPB; Ajzen, 1991). It could be used to investigate the factors that determine a given behavior in any given population in a parsimonious way (Admiraal et al., 2013). IMBP is user-oriented and takes individual psychological processes into account. In this study, the actual behavior, using mobile technology in the self-directed learning process, is up to learners' own choices, which is well suited for this model. The IMBP posits that attitude, perceived norm, and self-efficacy predict intention to engage in particular behavior; intention as well as knowledge and skills and facilitating conditions predicts the actual behavior.

Some researchers have validated IMBP in the educational research (Admiraal et al., 2013; Kreijns, Van Acker, Vermeulen, & van Buuren, 2013; Vermeulen, Kreijns, Van Buuren, & Van Acker, 2017; Wang et al., 2019). However, all of them were conducted in teacher-directed learning. In the current study, IMBP is applied to identify the determinants of university students' use of mobile technology in their self-directed learning process. The proposed research model is indicated in Figure 4.1.

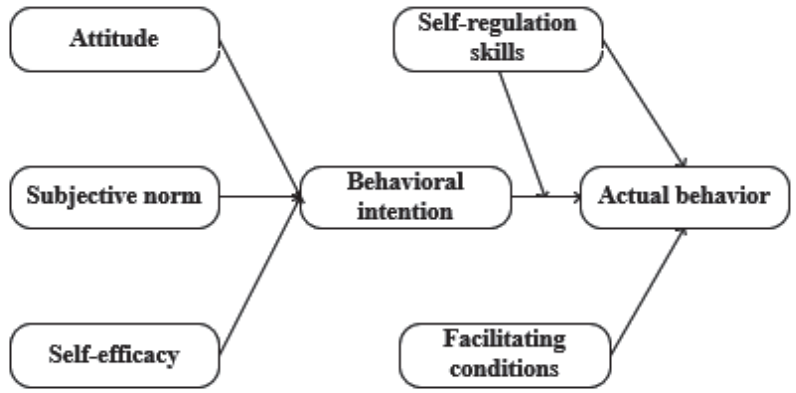


Fig. 4.1. The proposed research model of this study.

4.2.1 Attitude, subjective norm and self-efficacy

Attitude is defined as individuals' feelings about conducting a particular behavior (Ajzen, 1991). It was theorized and empirically proved to have a significant and positive effect on behavioral intention in general domains (Ajzen, 1991; Fred, 1989) and technology-based learning (Chen & Wu, 2020; Chu & Chen, 2016). In the present study, accordingly, it concerns university students' positive or negative perceptions towards using mobile technology when they learn English language in an out-of-class, self-directed way.

Subjective norm is viewed as an individual's perceptions of performing a specific behavior influenced by important persons (Fishbein & Ajzen, 2010). Previous empirical evidence has shown that subjective norm could explain students' intention to use mobile technology (Al-Adwan, Al-Madadha, & Zvirzdinaite, 2018; Cheon, Lee, Crooks, & Song, 2012). However, the study

conducted by Khechine, Raymond, and Augier (2020) indicated that social influence was not significantly related to behavioral intention in the context of social learning system use. Moreover, some researchers stated that the influence of social influence on technology adoption was complex and varied across contexts (Venkatesh, Morris, Davis, & Davis, 2003).

Self-efficacy denotes an individual's confidence in his or her capability to perform a behavior (Ajzen, 1991). Individuals who think that they are proficient in a certain action are inclined to have greater intention towards performing it. According to the studies carried out by Raza, Umer, Qazi, and Makhdoom (2018) and Mohammadi (2015), self-efficacy was found to have a direct effect on behavioral intention in mobile learning.

4.2.2 Behavioral intention, facilitating conditions, self-regulation skills and actual behavior

Behavioral intention refers to the strength of an individual's willingness to perform a particular behavior (Ajzen, 1991). In this study, it represents the degree to which university students are willing to adopt mobile technology to learn languages in an out-of-class, self-directed way. With regard to the relationship between intention to use and actual behavior, studies have shown mixed findings. Many studies reported a positive correlation between behavioral intention and actual behavior (e.g., García Botero et al., 2018; Hoi, 2020), whereas Chu and Chen (2016) revealed that intention only enhanced the time for using e-learning technology and not the frequency.

Facilitating conditions describe the perceived belief that using a new technology could get support from the environment (Taylor & Todd, 1995). This is understood in the mobile technology environment as organizational and technical assistance for students' use of mobile technology for self-directed learning, such as technical support and necessary resources and knowledge. Facilitating conditions have been found to significantly link with actual behavior (Salloum & Shaalan, 2018; Tarhini, Hone, & Liu, 2015).

Self-regulation skills are defined as the ability of individuals to actively regulate their own learning tasks or behaviors from metacognitive, motivational, and behavioral perspective (Zimmerman, 1989; Zimmerman & Schunk, 2001). Self-regulation is important for learners in online learning given its possibilities for self-directed learning (Leejoeiwara, 2013; Stephen, Rockinson-Szapkiw, & Dubay, 2020). Furthermore, as mentioned above, in e-learning environments, self-regulation influenced students' learning behaviors, and students with high self-

regulation skills were more likely to perform learning behaviors compared to those with low self-regulation skills (Lin et al., 2015; Lin & Lai, 2019; Lin et al., 2016).

Actual behavior refers to the actual adoption of mobile technology in self-directed language learning.

4.2.3 This study

As discussed above, the aim of this research is to investigate the factors that influence university students' intention towards and actual use of mobile technology in self-directed language learning outside class. The findings may support self-directed learners and teacher educators to enhance students' technology use for autonomous language learning.

More specifically, we address the following research questions:

(1) To what extent do attitude, subjective norm and self-efficacy relate to university students' behavioral intention toward using mobile technology in self-directed learning?
(2) To what extent do behavioral intention, facilitating conditions and self-regulation skills relate to university students' actual use of mobile technology in self-directed learning?
(3) To what extent do self-regulation skills moderate the relationship between behavioral intention and actual use of mobile technology in self-directed learning?

4.3 Method

4.3.1 Participants

Participants in this study were students from various disciplines in Chinese universities who learned English in a self-directed way. We selected the eligible students by the first item of the questionnaire ("Have you ever learned English language by yourself on your own choice?"). The study adopted a convenient sampling method to collect data with an online survey. In order to encourage participants to respond openly and honestly, the online survey used an anonymous link from Qualtrics. To recruit participants, a hyperlink was distributed via social media tools such as WeChat and QQ to students among many universities from the network of the first author. The hyperlink was also sent to university teachers educators to be included in their WeChat groups and QQ groups with university students. Completing the questionnaire took about 8-10 minutes. Students were informed about the aim of questionnaire and how their data would be used, and gave

their consent at the end of the questionnaire. Research clearance was obtained from the ethics committee of ICLON Research Ethics Committee.

The data collection period lasted from December 3rd to December 30th, 2020. A total of 676 returned the completed questionnaires. Among the 676 completed questionnaires, 425 (62.9%) indicated that they had the experience of self-studying English of their own volition, 5–20 times the number of parameters (i.e., variables and hypothesized relationships) to be estimated (Kline, 2005). The demographic data of the participants are shown in Table 4.1.

Table 4.1 Demographic statistics of participants (N=425).

Measures	Items	Frequency	Percentage (%)
Gender	Male	76	17.88
	Female	349	82.12
Age	<18	5	1.18
	18-25	374	88.00
	>25	46	10.82
Educational level	Undergraduate	215	50.59
	Postgraduate	210	49.41
Discipline	Social science and humanities	374	88.00
	Natural science	51	12.00
Location of university	Eastern China	167	39.29
	Middle China	149	35.06
	Western China	109	25.65
Level of university	Project 985	40	9.41
	Project 211	177	41.65
	Ordinary universities	208	48.94

Note. "Project 985" refers to the first-class universities in China. "Project 211" refers to the second-class universities in China. Ordinary universities refer to the universities which do not belong to "Project 985" or "Project 211".

4.3.2 Instruments

The questionnaire was divided into three parts. In Part 1, we collected demographic information (i.e., gender, age, current university location, educational level, and discipline), and asked a screening question whether students ever learned English language by themselves (as explained earlier in section 3.1) and, if they had done so, a multiple-selection question about the reasons why they chose to learn English by themselves. Part 2 involved the subscale related to self-regulation skills. Part 3 began with a multiple-selection question regarding the activities that students had participated in when using mobile technology to self-study English language in order to help them recall relevant learning experiences. This was followed by subscales pertaining to attitude, subjective norm, self-efficacy, facilitating conditions, behavioral intention and actual behavior (Table 4.2). All items had the statement "When self-studying English language" as the stem. All the items were scored on a 5-point Likert scale, ranging from strongly disagree to strongly agree, or never to always.

All the subscales were from previous related studies. The draft questionnaire was pilot tested with thirteen university students in China to collect feedback on the instrument. Based on their feedback, some items were modified, as demonstrated in Appendix E.

Table 4.2 Descriptions and sources of variables.

Variables	Abbr.	Descriptions	Items	Source
Actual behavior	AB	The dependent variable, frequency of mobile technology use for self-directed learning.	9	Lai, Wang, and Lei (2012)
Behavioral intention	BI	The degree to which language learners intend to continue using mobile technology in self-directed learning.	3	Moon and Kim (2001)
Attitude	ATT	Language learners' feelings about using mobile technology in self-directed learning.	4	Taylor and Todd (1995)
Self-efficacy	SE	Language learners' perceptions of their abilities to use mobile technology to support their self-directed learning.	3	Cheon et al. (2012)
Self-regulation skills	SRL	Language learners' perceived self-regulation skills to support using mobile technology in self-directed learning.	4	Lai and Gu (2011)
Facilitating conditions	FC	Students' perceived availability of support from the learning environment that facilitates technology adoption.	4	Nikou and Economides (2017)
Subjective norm	SN	The degree to which an individual perceives whether teachers and classmates believe he or she should use mobile technology in self-directed learning.	3	Cheon et al. (2012)

4.3.3 Data analysis

Structural equation modeling (SEM) with Mplus 8.3 (Muthén & Muthén, 2017) was employed in this study to analyze the data.

Firstly, the measurement model (also known as confirmatory factor analysis model) was estimated to describe how well the observed indicators measured the latent constructs. In this step, we obtained factor loadings, Cronbach's alpha, Composite Reliability (CR), Average Variance Extracted (AVE) (Fornell & Larcker, 1981), and inter-construct correlations to describe the reliability and validity of each construct.

Secondly, the structure model was performed to validate the strength of the relationships among the latent variables. The model fit was assessed by several key goodness-of-fit indices suggested (Hair, Black, Babin, Anderson, & Tatham, 2006; Kline, 2016). If the ratio of Chi-Square (χ^2) to its Degree of Freedom (χ^2/df) is smaller than 3, this is regarded as an acceptable fit (Schumacker & Lomax, 2012). The values of Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) greater than 0.90 exhibit a good fit for the structural model (Kline, 2005). Moreover, the values of Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA) less than 0.08 represent an acceptable model fit (Steiger, 2007).

Finally, the construct of self-regulation skills was tested as a moderator. Using the method of Baron and Kenny (1986), the moderating effect of self-regulation skills was tested in the relationships between behavioral intention and actual behavior.

4.4 Results

4.4.1 Descriptive statistics

Regarding the reasons why they learn English autonomously (see Table 4.3), over 50% of participants learned English in a self-directed way for passing language tests and getting better work or study opportunities in the future. In addition, in the option of "Others", two participants indicated that they conducted self-directed English learning because they wanted to improve their poor basic language ability.

Table 4.3 Reasons that students learned English language and the percentages.

Reasons	Frequency	Percentage
English language is my major, so I have to.	184	43.20
Passing English Language tests (IELTS, TOEFL, CET, TEM and so on).	309	72.70
Being good for getting better working or studying opportunities in the future.	233	54.80
Being interested in English language and culture.	207	48.70
Others	12	2.80

Regarding the activities that they participated in (see Table 4.4), most participants used mobile technology to learn vocabulary and translate, compared to practicing listening, speaking, reading, writing and other activities.

Table 4.3 Activities that students participated in.

Activities	Frequency	Percentage
Learn vocabulary (Like Baicizhan, Shanbei, etc.).	386	90.80
Translate (Like Youdao Dictionary, Baidu dictionary, etc.).	352	82.80
Practice listening (Like Shanbei Listening, Zhimi Listening, etc.).	287	67.50
Practice speaking (Like English Qupeiyin, English Liulishuo, etc.).	238	56.00
Practice reading (Like 21 Century News, etc.).	214	50.40
Practice writing (Grammarly, iwrite, etc.).	149	35.10
Other activities (Like TED, Wangyiyun, etc.).	241	56.70

4.4.2 Measurement model

The measurement model, which included six latent constructs, was validated by confirmatory factor analysis (CFA). All the constructs were evaluated by examining the reliabilities, convergent and discriminant validities.

Table 4.5 showed the results of the measurement model. All the item factor loadings ranged from 0.653 to 0.894. Facilitating conditions were deleted because only two item factor loadings were greater than 0.6, and it was not followed the three-indicator rule in SEM. The recommended cut-off levels for AVE, CR and Cronbach's alpha were 0.50, 0.70 and 0.70, respectively (Fornell & Larcker, 1981; Hair et al., 2006). In this study, the composite reliability (CR) of all constructs was larger than 0.70, indicating good reliabilities. All the Cronbach's values were larger than 0.70, indicating all constructs had appropriate internal consistency. Moreover, the average variance extracted (AVE) values were above 0.50, except for one construct (self-regulation skills). However, according to Fornell and Larcker (1981), the convergent validity of a construct is still adequate if AVE is less than 0.50, but composite reliability is higher than 0.60. Thus, the convergent validity of self-regulation skills was acceptable because the composite reliability was 0.763, although its AVE was 0.447.

Discriminant validity was found when the square root of the AVE of each construct was higher than its correlation coefficients with other constructs (Fornell & Larcker, 1981). In this study, as shown in Table 4.6, the square roots of the AVEs exceeded its correlation coefficients with other constructs, justifying discriminant validity.

Table 4.5 Reliability and convergent validity.

Construct	Items	Parameters of significant test				Item reliability	Composite reliability (CR)	Convergence validity (AVE)	Cronbach's alpha
		Estimate	S.E.	Est./S.E.	P-Value				
ATT	ATT1	0.765	0.027	28.752	***	0.585	0.872	0.632	0.874
	ATT2	0.846	0.017	48.737	***	0.716			
	ATT3	0.815	0.023	35.701	***	0.664			
	ATT4	0.749	0.027	28.235	***	0.561			
SE	SE1	0.827	0.024	34.064	***	0.684	0.849	0.654	0.844
	SE2	0.719	0.031	22.998	***	0.517			
	SE3	0.872	0.021	41.699	***	0.760			
SN	SN1	0.802	0.021	38.804	***	0.643	0.802	0.576	0.793
	SN2	0.681	0.037	18.531	***	0.464			
	SN3	0.788	0.024	32.217	***	0.621			
SRL	SRL1	0.661	0.042	15.672	***	0.437	0.763	0.447	0.760
	SRL2	0.653	0.041	15.812	***	0.426			
	SRL3	0.683	0.033	20.486	***	0.466			
	SRL4	0.676	0.035	19.245	***	0.457			
BI	BI1	0.832	0.024	34.488	***	0.692	0.881	0.712	0.874
	BI2	0.894	0.016	54.617	***	0.799			
	BI3	0.803	0.024	34.027	***	0.645			
AB	AB1	0.679	0.035	19.600	***	0.461	0.912	0.535	0.910
	AB2	0.790	0.022	35.465	***	0.624			
	AB3	0.756	0.025	30.324	***	0.572			
	AB4	0.682	0.034	20.205	***	0.465			
	AB5	0.734	0.025	28.997	***	0.539			
	AB6	0.654	0.032	20.680	***	0.428			
	AB7	0.788	0.023	33.784	***	0.621			
	AB8	0.717	0.026	27.942	***	0.514			
	AB9	0.769	0.026	30.091	***	0.591			

Note. ***$p < 0.001$.

Table 4.6 Discriminant validity.

Construct	AB	BI	ATT	SE	SN	SRL
AB	0.730					
BI	0.581	0.840				
ATT	0.496	0.748	0.795			
SE	0.394	0.486	0.571	0.808		
SN	0.446	0.683	0.741	0.580	0.759	
SRL	0.417	0.332	0.433	0.345	0.343	0.669

Note. Diagonal elements are the square root of the average variance extracted.

4.4.3 Structural model

All the constructs except facilitating conditions were further used in the structural model to examine their relationships. The fit indices of this model indicated good fit to the data, shown in Table 4.7.

The results, shown in Table 4.8 and Figure 4.2, demonstrated that the model explained 75.3% of the variance in behavioral intention and 54.2% of the variance in actual use of mobile technology. Table 8 also showed that attitude (β=0.731, $p < 0.001$) and subjective norm (β=0.217, $p < 0.05$) were positively related to behavioral intention. In addition, behavioral intention (β=0.562, $p < 0.001$) and self-regulation skills (β=0.282, $p < 0.001$) positively and significantly predicted actual behavior. No significant relationship was found between self-efficacy and behavioral intention.

Table 4.7 Model fit.

Index	Criteria	Research Model	Yes or No
MLχ^2	Smaller is better	846.778	-
df	Larger is better	288	-
χ^2/df	$1< \chi^2/df<3$	2.940	YES
CFI	>0.9	0.914	YES
TLI	>0.9	0.903	YES
RMSEA	<0.08	0.068	YES
SRMR	<0.08	0.047	YES

Note. ML=Maximum Likelihood.

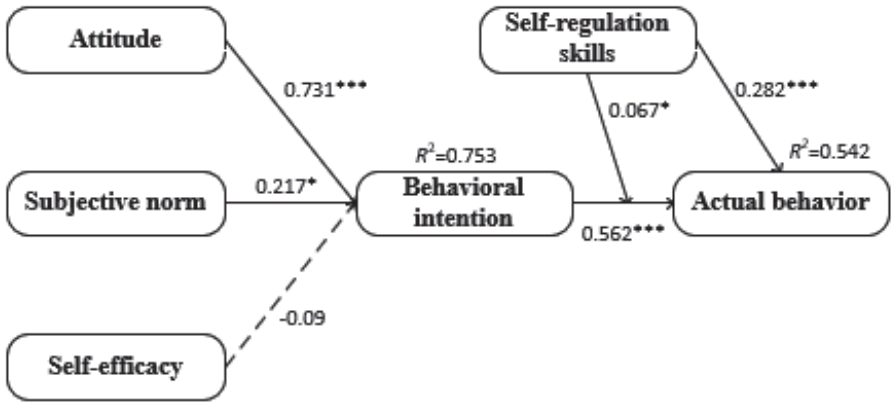


Fig. 4.2. Results of structural equation modeling.

4.4.4 Moderation analysis

The results in Table 4.8 showed that the interaction term (behavioral intention × self-regulation skills) ($\beta = 0.067$, $p < 0.05$) had a significant effect on usage behavior of mobile technology. Self-regulation skills significantly and positively moderated the relationship between behavioral intention and actual use of mobile technology in the self-directed learning process. This means the higher the students' self-regulation skills were, the stronger the relationship between students' intention and actual use of mobile technology.

Table 4.8 Path coefficients.

Path	Estimate	S.E.	Est./S.E.	P-Value
ATT→BI	0.731	0.129	5.667	***
SN→BI	0.217	0.126	1.715	*
SE→BI	-0.090	0.060	-1.513	-
BI→AB	0.562	0.054	10.436	***
SRL→AB	0.282	0.065	4.361	***
SRLBI→AB	0.067	0.032	-2.035	*

Note. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

4.5 Discussion

4.5.1 Learners' use and motivation

Of all respondents of the questionnaire, 37.1 percent indicated that they never used mobile technology for self-directed language learning. The reasons can be clustered into two types. First, regarding mobile technology, they do not perceive it as an effective tool to support them in out-of-class learning because they are distracted by the prompts of social media applications (Kacetl & Klímová, 2019; Wilmer, Sherman, & Chein, 2017). Second, they do not conduct self-directed learning because they probably do not see the value of this kind of learning or lack self-directed abilities to guide themselves for effective learning. Further research needs to examine students' motivation for self-directed language learning with mobile technology.

Although many university students had engaged in out-of-class self-directed language learning, the majority of them seemed to be extrinsically motivated. This is similar to the finding of Zhang and Pérez-Paredes (2019), indicating that passing exams and improving exam scores were the main reasons for using mobile resources, even for postgraduates. Cheng and Lee (2018) revealed that extrinsic motives were conducive to initiating students' interest in language learning, but detrimental to sustaining their interest. More importantly, external motivation for engaging in a behavior would possibly decrease their intrinsic motivation for this behavior (Deci, 1971; Harackiewicz, 1979). In other words, if students perceive that external incentives are the main cause of their actions, they may feel controlled and thus the intrinsic motivation may be undermined (Li, Sheldon, & Liu, 2015). Furthermore, considering the result of Cheng and Lee (2018) that self-directed learners often suffer from losing motivation and give up, extrinsically motivated self-directed learners are more likely to quit in the course of learning. On the contrary, if students perceive that their behavior is caused by their personal desires and interests, then they may tend to enjoy this behavior (See also Li, Sheldon, & Liu, 2015), and they are more persistent (Hart, 2012; Parker, 2003). Additionally, language learning is critically gradual and developmental, which means it is not learnt in day or two, but in years, and demands long-time persistence for competence acquisition (Fryer, 2019). Thus, in order to enable students to persist in self-directed learning and acquire language development successfully, it is critically important that their intrinsic motivation be cultivated.

In addition, learning activities regarding vocabulary acquisition and translation were far more reported than those targeting listening, speaking, reading and writing. This is in line with the

findings of Zhang and Pérez-Paredes (2019) and Steel (2012), who reported that Chinese and Australian language learners were heavily engaged in vocabulary acquisition. A possible explanation could be that Chinese learners believe that a large amount of vocabulary is the basis for effective speaking, listening, reading and writing (Zhang & Pérez-Paredes, 2019). Another possibility may be that in terms of targeted language areas of MALL applications, vocabulary teaching and learning have been the mainstay (Burston, 2014).

4.5.2 Factors related to behavioral intention

The primary purpose of this research is to understand the factors that affect university students' intention towards and actual use of mobile technology in their self-directed language learning process. Attitude towards mobile technology had the most predictive power on students' behavioral intention. This coincides with previous research conducted in Vietnam, showing that attitude toward mobile-assisted language learning was found to be the most powerful predictor of learners' behavioral intention (Hoi, 2020). Self-directed learning is learner-controlled and usually occurs out of class. Learners are responsible for selecting the appropriate learning tools (e.g., mobile technology) and learning materials to learn (Garrison, 1997). It makes sense that attitudes and beliefs greatly contribute to students' intention towards using mobile technology in self-directed learning process.

The relationship between subjective norm and behavioral intention was positive and significant as well, which aligns with the results of Unal and Uzun (2021) and Chang, Hajiyev, and Su (2017). However, Hartwick and Barki (1994) reported that the opinions of others played no significant role in voluntary settings, only in mandatory ones. Except for the moderating effect of contexts on the relationship between subjective norm and behavioral intention (Venkatesh et al., 2003), Srite (2006) proposed that different cultures also influenced the relationship between them. In individualistic cultures, for example, subjective norm had a weak effect on behavioral intention, whereas in collective cultures, like China, interaction between social members is an essential way of information transmission and people care more about their interpersonal relationships (Srite, 2006; Zhao, Wang, Li, Zhou, & Li, 2021). Although how to conduct self-directed learning completely depends on learners' own choices, in this collective environment they are still affected by teachers and peers in that they want to maintain good rapport with and receive support from them. If so, in

the subsequent learning process, self-directed learners will likely get help from teachers when necessary and study with their peers to motivate each other.

Unexpectedly, self-efficacy was not significantly related to behavioral intention, which contradicts previous studies that suggested a significant effect of self-efficacy on behavioral intention (Buabeng-Andoh, 2021; Park, 2009; Venkatesh & Davis, 1996). Cigdem and Ozturk (2016) asserted that as a result of widespread Internet access and technology across the educational settings, today' s learners are digital natives and they enter universities with abundant knowledge and experiences of mobile technology. This means that variance in self-efficacy might be limited, which may explain why self-efficacy did not predict behavioral intention to use mobile technology.

4.5.3 Factors related to actual use

The relationship between behavioral intention and actual behavior in using mobile technology was positive and significant. This outcome is also confirmed in previous studies (Hoi, 2020; Nie et al., 2020), which revealed that behavioral intention was significantly correlated with actual behavior. Self-regulation skills also predicted actual behavior, which accords with the finding of a previous study by Wang et al. (2019), who determined that rural teachers' professional knowledge and skills were significantly related to their behaviors of using the digital educational resources.

4.5.4 Moderation analysis of self-regulation skills

A significant finding lies in the significant and positive moderation effect of self-regulation skills on the relationship between intention and behavior. This signifies that the effect of behavioral intention on actual behavior would increase with an increase in self-regulation skills. In other words, students with higher self-regulation skills are more likely to transform their behavioral intention into actual behavior than those with lower self-regulation skills. Similarly, Lin and Lai (2019) revealed that behavioral intention significantly predicted computer-based assessment use behavior for high-self-regulation students but not for low-self-regulation students. Apparently, students with higher self-regulation skills have better abilities to regulate their behavior, cognition and motivation, all of which are conducive to engaging and persisting in learning (Nicol & Macfarlane-Dick, 2006).

4.6 Limitations and future research

This research has some limitations, although it has provided valuable contributions to the determinants that affect technology use in self-directed language learning outside class. Firstly, the data collection of this study was completed in a short period of time. Students' attitudes and behaviors are changing over time, along with the accumulation of new knowledge and experience. Longitudinal research may be designed to exploit these changing factors at different points and see whether other variables such as foreign language competence, prior experience and satisfaction with language learning using mobile technology affect students' continuance use of mobile technology. Secondly, previous studies have indicated differences between self-reported usage scales and technology-recorded scales (Straub, Limayem, & Karahanna-Evaristo, 1995). This study used self-perceived usage scales to obtain students' actual behavior, which might lead to bias due to subjectivity. Future research is encouraged to use technology-recorded data to analyze students' actual usage. Thirdly, all the participants were native Chinese-speaking English language learners. Future studies could also be conducted in other cultural contexts to examine the self-directed language learning with mobile technology and investigate the effect of foreign language proficiency and other environmental variables on self-directed technology use as well.

Furthermore, various categories of mobile apps for educational purposes have been put into use. Future research should focus on specific technology (e.g., social media) to determine how students utilize them in their self-directed learning outside class. Finally, future research can also examine how teachers can assist students in their self-directed language learning process.

4.7 Conclusion and implications

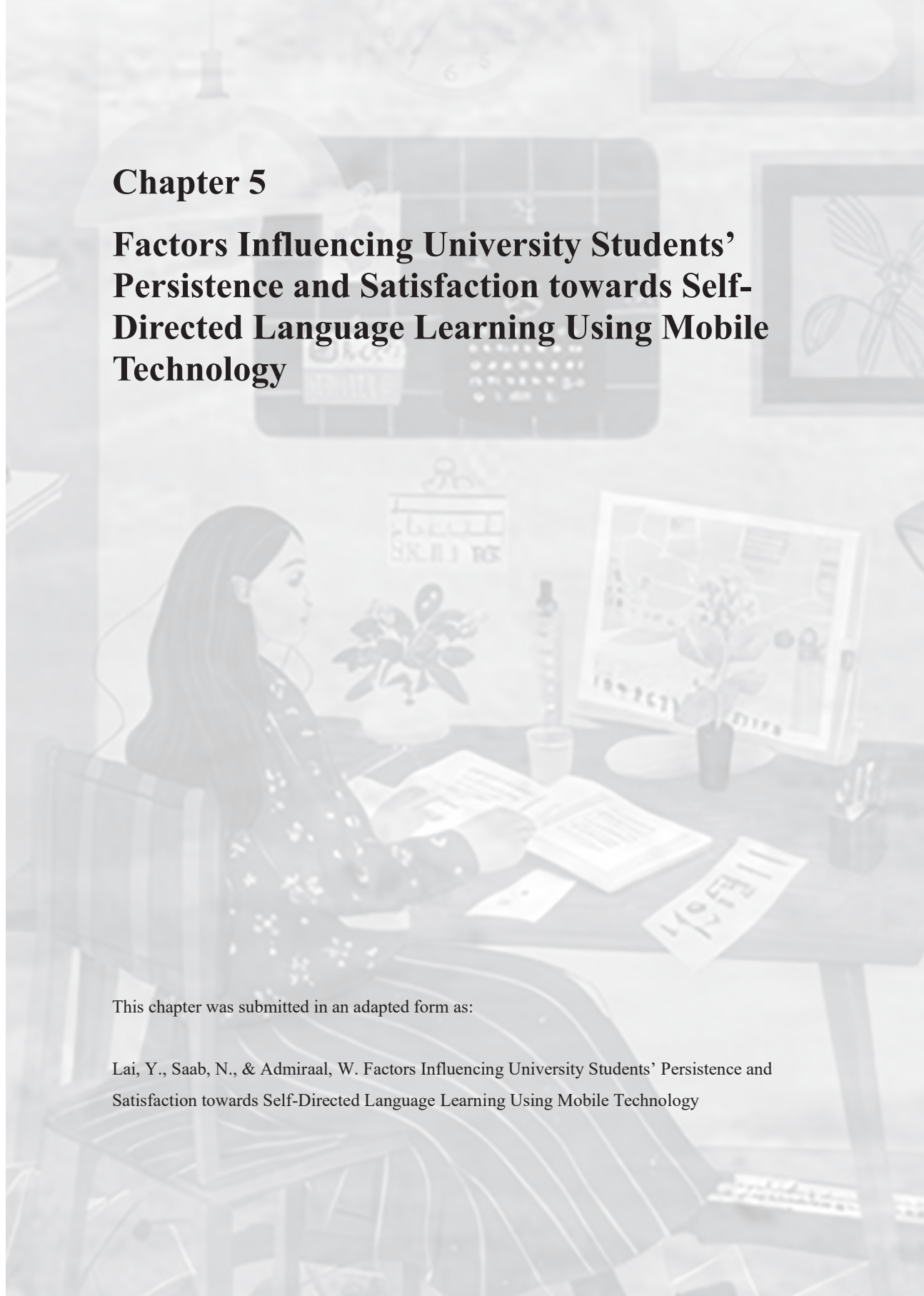
The main objective of this research was to explore the relationships between attitude, subjective norm, self-efficacy and intention, as well as the association between intention, facilitating conditions, self-regulation skills and actual use of mobile technology in self-directed language learning among university students. Additionally, it also aimed to answer the question whether self-regulation skills moderated intention and actual use of mobile technology. Attitude and subjective norm significantly explained students' intention to use mobile technology, but self-efficacy was not related to students' intention. Moreover, self-regulation skills and intention had positive relationships with students' actual use of mobile technology. Finally, self-regulation skills significantly moderated the relationship between behavioral intention and actual behavior.

The findings of this study make several contributions to this field. First of all, this study investigated the technology use of students from various disciplines in the self-directed informal context, a setting that has not been sufficiently studied so far (An, Wang, Li, Gan, & Li, 2021; Nguyen, & Takashi, 2021; Kukulska-Hulme, 2016, p.138). Secondly, the findings supported the use of IMBP model as an appropriate framework for examining the acceptance and use of mobile technology, which has not been extensively adopted in research on student learning. Although the relationship between self-efficacy and intention was not significant, a good explanatory effect of IMBP was suggested in the context of technology adoption. Thirdly, a nonsignificant relationship between self-efficacy and intention also further confirmed the results of Cigdem and Ozturk (2016), revealing the insignificant role of self-efficacy on students' behavioral intention in collective cultures. More empirical evidence is needed on this variable in technology adoption.

This research also provides practical implications to promote university students' use of mobile technology in self-directed language learning. Based on the positive effect of subjective norm, it is suggested that teachers discuss with students the role and importance of self-directed learning facilitated by mobile technologies. Software developers could emphasize the function of learning community to increase students' learning intention, further maintaining their learning interest. Additionally, based on the result of moderation analysis, students could improve their self-regulation skills before starting self-directed learning to foster their use of mobile technology in self-directed language learning out of class. Educational institutions also need to pay more attention on cultivating students' self-regulation skills to facilitate their self-directed, lifelong learning.

Chapter 5

Factors Influencing University Students' Persistence and Satisfaction towards Self-Directed Language Learning Using Mobile Technology



This chapter was submitted in an adapted form as:

Lai, Y., Saab, N., & Admiraal, W. Factors Influencing University Students' Persistence and Satisfaction towards Self-Directed Language Learning Using Mobile Technology

Abstract

Research on mobile-assisted language learning has mainly focused on teacher-initiated learning, instead of student-initiated learning outside of class. In self-directed language learning with mobile technology, students' satisfaction with and persistence in learning are conditional for making self-directed learning effective. This study examined how university learners' persistence and satisfaction towards self-directed language learning using mobile technology are predicted by mobile learning readiness, teacher support, and engagement. Survey data from 446 language learners in different disciplines attending Chinese universities were analyzed using structural equation modeling. Learners' satisfaction was found to be significantly and positively related to their mobile learning readiness, and persistence to both mobile readiness and engagement. Additionally, learners' mobile readiness was found to make a strongly significant contribution to engagement in self-directed learning using mobile technology. And teacher support was significantly and positively linked to learners' mobile readiness, yet negatively to learners' engagement. However, the finding showed an indirect and positive impact on learners' engagement with a mediating role for mobile readiness. A conceptual model of learners' persistence and satisfaction has been developed and tested based on previous studies on the self-directed informal context, a setting that has not been sufficiently studied so far. Considering the importance of learners' mobile readiness and the critical impact of teacher support in our context, further research should explore learners' characteristics and teacher support in mobile self-directed learning setting.

Keywords: Self-directed learning; Mobile technology; Language learning; Structural Equation Modeling; Persistence; Higher education

5.1 Introduction

The proliferation of mobile technologies has generated fresh prospects for language learning, ensuring its widespread availability, ease of access, and adaptability (Hafour, 2022; Hsu & Lin, 2022). Over the past few years, research on mobile assisted language learning has been on the rise. For example, Loewen et al. (2019) investigated university students' language learning experiences and results of learning Turkish on Duolingo in the United States. Wang et al. (2021), in Australia, probed students' perceptions about Chinese Island (CI), an immersive 3D virtual environment, to engage Chinese language learning students, facilitate their authentic language use, and enhance their learning experience. Van Lieshout and Cardoso (2022) examined the potential of Google Translate as a pedagogical tool to learn Dutch language phrases and associated pronunciation. To date, nevertheless, the majority of mobile-assisted language learning research has focused on teacher-initiated learning (e.g. Gao & Shen, 2021; Ghorbani & Golparvar, 2020; Lee et al., 2017; Tai, 2022), instead of student-initiated learning outside of class using mobile technology (An et al., 2020). In some nations, university students are not given enough time within language curriculum to practice and acquire foreign languages in class (Liu, 2020; Trinder, 2017). To tackle this issue, Lai et al. (2022a) and Pramesti (2020) suggested that students conduct self-directed and out-of-class language learning assisted by mobile technology to frequently expose themselves to authentic language environments, thereby further maximizing their language abilities. According to Loyens and Rikers (2008), self-directed learning is different from self-regulated learning although some researchers use both terms interchangeably. Both terms involve active engagement and goal-directed behavior of the students, but differ in the degree of control the learners have, particularly at the beginning of the learning process (Loyens & Rikers, 2008): self-directed learners are the initiators of a learning task, whereas self-regulated learners work on task that are set by the teacher. Mobile technology in this study refers to portable electronic devices such as smartphones, tablets, and laptops, as well as the software and applications designed to be used on them. These devices allow learners to access resources on-the-go and communicate with others. In this self-directed language learning using mobile technology (**SDLLMT**) context, learners are in charge of their own language learning with the assistance of mobile technology outside classroom, and they can determine what and how to learn (Merriam & Bierema, 2013). More explicitly, students make use of mobile applications such as Instagram, YouTube, Tandem, Google

Translate, as well as foreign language-specific apps like HelloTalk and Duolingo to set up a language learning environment.

SDLLMT is an under-researched field (An et al., 2020; Nguyen & Takashi, 2021). Yet several studies were found regarding students' perceptions on or experiences with using mobile technology in self-directed learning (Lai et al., 2018; García Botero et al., 2019), their learning strategies (Lai et al., 2022b), and behavioral intention and adoption of using mobile technology in self-directed language learning (Lai et al., 2022a; Lai, 2013; Lai & Zheng, 2018; Zhang & Perez-Paredes, 2021). However, research on intended outcomes, such as learners' satisfaction and persistence, has been limited up to now. Persistence is an important outcome variable as learning success in the online environment, and in online self-directed learning, in particular, depends on learners' perseverance of their learning activities (Joo et al., 2013). Satisfaction is an important affective outcome as well, as satisfied learners are more willing to try again and to persist in the long term (Ji et al., 2022). Despite the growing popularity of SDLLMT among students, the initial adoption of the type of learning does not assure successfully acquiring a new language (Yang et al., 2019). Learners need to preserve throughout the learning process since mastering languages takes years, not a couple of days (Fryer, 2019). Researchers noted, however, that even when surrounded by teachers' or institutional support, learners easily give up (Cheng & Lee, 2018); it might be much less the case if they rely on themselves to take complete control in self-directed learning with mobile technology. Yet a decrease in motivation or lack of useful materials could lead learners to give up this self-directed learning using mobile technology, without taking any responsibility and without consequences. For example, Luo (2019) investigated 325 Chinese university students about their mobile English learning. The results showed that 51% had always used mobile technology for language learning but most students did not use it consistently over a period, and 70% were unable to focus on the language tasks with mobile devices for more than 20 minutes at a time. For these reasons, this study aims to investigate the factors affecting learners' persistence and satisfaction when conducting SDLLMT. Consequently, the findings of this study might contribute to a better understanding of how to enhance learners' outcomes in SDLLMT. This study endeavors to provide guidance for self-directed learners and teachers to encourage learners' persistence in their SDLLMT. This study also explores the role of facilitators (teachers in this study) in self-directed learning outside class.

5.2 Literature review

5.2.1 Learners' persistence and satisfaction

Persistence, also known as continuance intention, has been regarded as a noteworthy indicator for quality evaluation in online learning (Joo et al., 2013), and an important variable for keeping students committed to the process of SDLLMT, as there is no teacher involved. Learners' satisfaction relates to learners' overall perceptions of their own experience when using mobile technology in their self-directed language learning (Rabin et al., 2019). It affects their motivation, which is an important psychological factor affecting student learning (Ji et al., 2022). Henderikx et al. (2017) and Reich (2014) have claimed that success in open learning contexts should be evaluated by learner-centered measures such as learner satisfaction.

Previous studies have examined factors influencing university students' satisfaction and persistence in online context. In mobile language learning, however, research that investigated satisfaction and persistence are mostly related to self-regulated language learning instead of self-directed language learning (Karaoğlan Yılmaz, 2021, Yang et al., 2019, and Huang & Yu, 2019). Only Wang et al. (2022) investigated *student-initiated* learning behavior in a mobile language context. They examined the relationship between continuance intention and perceived usefulness and the mediation effects of flow and integrative motivation. Continuance intention presents the repeated usage of language learning apps in the learning process. Flow refers to the optimal experience that one has while using language learning apps, which includes three dimensions: concentration, control and enjoy. Integrative motivation means learning language due to desire or interest to understand the target culture and perceived usefulness indicates to what extent a user thinks technologies can enhance the performance. The result of correlation analysis indicated that the four variables were significantly and positively related to each other. Regression analysis showed that flow and integrative motivation played mediating roles in the relationship between continuance intention and perceived usefulness. Yet, this study did not address teacher support and students' mobile learning readiness.

Students' mobile learning readiness and teacher support are both important factors that can influence self-directed learning outside class. Since self-directed learning using mobile technology outside class is completely initiated and controlled by the learners themselves, the learners have more autonomy. Higher learning autonomy implies that learners themselves can exert greater influence on the learning process (Kuo et al., 2021). One of the learner characteristics that affects

success in mobile learning could be mobile learning readiness (Lin et al., 2016). Besides, in spite of the dominant role of learners in this context, they could also seek and receive teacher help to support their language learning (Lai et al., 2022a). Lai (2015) stated that teachers play a significant role in influencing students' self-directed learning, and they can shape the quality and quantity of students' technology use outside the classroom. In addition to teacher support and mobile readiness, learners' engagement was included in this study. Learners' engagement is associated with high persistence rate and learning success (Pursel et al., 2016). Thus, it is necessary to include learners' engagement, their mobile readiness and teacher support in this study to understand learners' SDLLMT.

5.2.2 Learners' engagement

Engagement in SDLLMT refers to the ongoing time, effort, and energy that learners put into this form of independent learning to achieve their goals (Kuo et al., 2021). Student engagement has been conceptualized and operationalized as a multidimensional construct which can be broken down into behavioral, emotional, and cognitive engagement. Behavioral engagement means students participating in a language learning activity (Fredricks et al., 2004). Emotional engagement refers to students' affective reactions toward their learning experience (Kuo et al., 2021). These emotional feelings include enthusiasm, enjoyment, interest, fun, boredom, and feelings of depression (Deng et al., 2020). Cognitive engagement means that learners put effort into understanding and mastering the language knowledge and skills (Skinner et al., 2008). Ji et al. (2022) called for studies to explain how the different dimensions of language learners' engagement are associated with satisfaction in an online language learning environment. This study was timely, therefore, as it aimed to fill this gap by investigating learner engagement as a multidimensional construct.

Researchers have reported that learner engagement influences persistence and satisfaction in online learning (Gray & DiLoreto, 2016; Jung & Lee, 2018; Shin & Sok, 2023). Shin and Sok (2023) showed a positive and significant relationship between engagement and satisfaction and perceived learning in an online second language learning environment. And, Jung and Lee (2018) revealed that engagement not only had a direct effect on learning persistence, but mediated between the presence of a teacher and learning persistence in K-MOOCs. Based on these, we

assume learners' engagement is linked to persistence and satisfaction and plays a mediating role in the process of their SDLLMT.

5.2.3 Mobile learning readiness

Mobile learning is slightly different from online learning and e-learning, being characterized by mobility and situated learning. For this reason, Lin et al. (2016) warned us not to adopt existing e-learning/online learning readiness scales in mobile learning studies. The present study therefore employed a mobile learning readiness scale, instead of the widely-used online/e-learning readiness scales. Mobile learning readiness is defined as "an individual's propensity to use mobile technology to execute formal and informal learning activities" (Lin et al., 2016). More specifically, in our context, mobile readiness implies learners' mobile-related knowledge, attitudes, skills, and competencies of learners in utilizing mobile technology effectively to achieve self-directed learning objectives. According to Lin et al. (2016), mobile readiness is a three-dimensional construct, including self-directed learning, mobile-learning self-efficacy, and optimism. Self-directed learning is a personality trait where learners are self-motivated and responsible for their own learning process. M-learning self-efficacy defines learners' self-perceived capability to master the functions of mobile technology and systems and to learn well using the mobile technology. Optimism reflects learners' perceptions of the advantages of mobile technology (Lin et al., 2016). By incorporating all these perceptions and skills, learners are able to actively create and execute their learning plans (Lin & Hsieh, 2001).

Previous studies have found e-learning readiness to be associated with engagement, satisfaction, and persistence in online learning (Chen et al., 2013; Ji et al., 2022; Prasetya et al., 2021; Zou et al., 2022; Kim et al., 2019; Kumar, 2021). Since mobile learning originates from e-learning and online learning (Ozuorcun & Tabak, 2012), it is very plausible that mobile readiness, like online readiness, would have a similar influence on engagement, satisfaction, and persistence (Lin et al., 2016).

5.2.4 Teacher support

According to Garrison and Cleveland-Innes (2005), interactions between teachers and learners influence learner satisfaction and achievement more strongly than interactions between learners in online learning. Similarly, in the context of mobile-assisted self-directed language learning,

teachers are considered to play a critical role (Lai, 2015; Lai et al., 2022b). They are expected to provide recommendations and guidance about specific mobile applications, learning materials and learning tips, and encouragement in the learning process to improve students' learning experience, further leading to effective learning (e.g., García Botero et al., 2019; Hoi & Mu, 2021). Unfortunately, research has found that teachers tend to perceive themselves as having a limited influence on students' autonomous learning outside the classroom (Chan, 2003; Toffoli & Sockett, 2015). Thus, teachers' roles should be considered and empirically examined in the discussion of learners' autonomous learning behaviors outside the classroom (See also Lai, 2015).

Previous research has reported the relationship between the teacher's role and engagement, satisfaction and persistence in various educational contexts (Caskurlu et al., 2020; Hart, 2012; Joo et al., 2013). However, mixed results were found in the relationship between teacher support and engagement in online learning. Jung and Lee (2018) revealed a positive relationship between teaching presence and learning engagement in MOOCs. Yet, Han et al. (2021) found a negative relationship between emotional engagement and teacher support and indicated that Chinese EFL learners who perceived more teacher support were less likely to enjoy online learning. Xu et al. (2020) suggested that teacher facilitation had a positive impact on students' behavioral and cognitive engagement, but no influence on emotional engagement in WeChat-based online semi-synchronous discussions. In addition, Lai et al. (2016) revealed various aspects in which students expected their teachers to help them improve their knowledge and skills in autonomous language learning with technology outside the classroom. These aspects included metacognitive tips (e.g., how to locate, select and use learning materials) to improve students' self-directed learning ability, teachers' in-class technology use to make students familiar with mobile technology and more confident about their own capability to use the technology by themselves, and teachers' encouragement to enhance students' perceived advantages from using mobile technology. Based on these results, we could say that teachers' support could be conducive to students' self-directed learning, self-efficacy, and optimism, which are the three components of mobile readiness. Hence, we assumed that teacher support is related to mobile readiness as well as satisfaction and persistence.

5.2.5 Language proficiency

The significance of learners' language proficiency in online language learning has been underscored by Chen et al. (2022) and Chung and Ahn (2022). Chen et al. (2022), for example, examined the impact of English proficiency on junior high school students' English learning attitude, motivation and effectiveness in augmented-reality-enhanced contextualized learning. They showed that English proficiency significantly influenced knowledge comprehension. Students with higher English proficiency levels exhibited a more positive attitude towards putting effort into language learning, regulated learning, English, and foreign language learning, but less learning anxiety. They also displayed more motivation in terms of self-efficacy, proactive learning and learning value.

5.2.6 This study

This study aimed to examine how language learners' persistence and satisfaction were explained by mobile readiness (self-directed learning, optimism, and mobile self-efficacy), teacher support, and engagement in SDLLMT. It also sought to investigate whether differences in SDLLMT existed between students with high and low language proficiencies. The findings may provide implications to enhance the engagement, satisfaction, and persistence of self-directed learners, thereby facilitating more effective and successful autonomous language learning with technology.

Based on the literature review, the following model was proposed as the framework that guided this study (Figure 5.1).

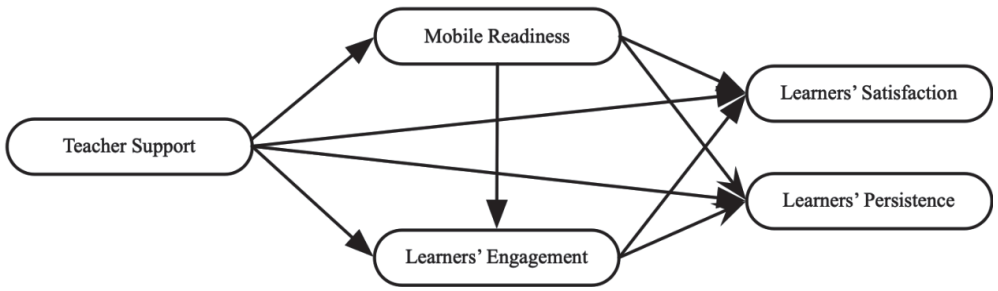


Figure 5.1 The conceptual model.

The study addressed the following research questions:

- Is there any difference in SDLLMT between students with high and low language proficiency?
- How is learners' satisfaction explained by teacher support, learners' mobile readiness and engagement in SDLLMT?
- How is learners' persistence explained by teacher support, learners' mobile readiness and engagement in SDLLMT?
- How do mobile readiness and engagement mediate the relationship between teacher support and both outcome variables of SDLLMT?

5.3 Method

5.3.1 Participants and procedure

In this study, a multidisciplinary sample of volunteers consisted of 446 self-directed English learners from Chinese universities. They were screened based on their response to the first item in the survey ("Do you have any experience learning English by yourself?"). Convenience sampling method was employed to gather data. An anonymous link to the online survey powered by Qualtrics was created to encourage participants to share their preferences. The link was disseminated through social media channels to reach the largest audience possible, targeting students from multiple universities within the primary author's network. Furthermore, the hyperlink was also shared with university teachers to be sent out to their students. To motivate self-directed learners to complete the survey, we introduced a limited lucky draw as a reward and highlighted the voluntary and enjoyable nature of the survey. We informed participants the purpose of the survey and how their data is used, and asked for their consent in the beginning of the survey. Completing the survey took participants around 5-10 minutes. Research clearance was obtained from the ethics committee of ICLON Research Ethics Committee.

The data were collected from August to November 2021. A total of 446 respondents visited the questionnaire website and 352 successfully completed the questionnaire (completion rate was 78.9%). Among the completed questionnaires, there were 28 respondents who stated that they had no experience of self-directed English learning; that left a total of 324 observations making up the study. The demographic information is shown in Table 5.1.

Table 5.1 Frequency and percentage of participants by gender, education, and major.

Demographic factors	*n*	%
Gender		
Male	156	48.15
Female	168	51.85
Education		
Undergraduate	248	76.54
Postgraduate	76	23.46
Major		
Language	108	33.33
Non-language	216	66.67
English Language proficiency		
Low level	121	37.35
High level	203	62.65

Note. Regarding language proficiency, students who had only passed College English Test 4 were coded as low level, while those who had passed College English Test 6, Test for English Major 4, or Test for English Major 8 were coded as high level.

5.3.2 Instruments

All the instruments used in this study came from existing validated scales. The questionnaire includes the following variables, namely satisfaction and persistence towards SDLLMT adapted from Lin and Wang (2012), engagement adapted from Deng et al. (2020), teacher support adapted from Hoi and Mu (2021), mobile readiness (i.e., optimism, self-efficacy, and self-directed learning) adapted from Lin et al. (2016), and demographic characteristics of the students (gender, English exams passed, discipline, educational level). A 5-point Likert scale was used to measure the items, with "1" representing "strongly disagree" and "5" indicating "totally agree". To define the context-specific feature, the items were stemmed from the contextual statement "When self-studying English language…" (See Supplementary Material). Since the instruments are in English, all the items were translated into Chinese by the first author, and then translated back by other bilingual teachers to ensure the semantic accuracy and equivalence. To ensure content validity, the questionnaire was sent to two academic professors for internal review and ten university students

for pilot test. Based on their feedback and suggestions, we modified the wordings to prevent semantic bias.

5.3.3 Data analysis

Four stages of analyses were performed. Firstly, an independent sample *t*-test was used to examine whether students with high and low language proficiency differed in their mobile readiness, engagement, satisfaction, persistence, and the teacher support they received in SDLLMT. The results showed the two groups had no statistical difference on learners' mobile readiness (t = -0.531, p > 0.05), engagement (t = -1.273, p > 0.05), satisfaction (t = -0.857, p > 0.05), persistence (t = -1.224, p > 0.05), and teacher support they received (t = -1.131, p > 0.05). Therefore, language proficiency was not included in further analyses.

Secondly, based on the proposed model, we adopted structural equation modeling to test these relationships. The measurement model was estimated with confirmatory factor analysis to evaluate the extent to which the observed items gauged the latent constructs. Composite reliability (CR), Cronbach's alpha, and average variance extracted (AVE) were used to test the model's reliability and convergent validity. To determine discriminant validity, the heterotrait-monotrait (HTMT) ratio of correlations method, a new criterion, was employed. Specifically, the HTMT is calculated from the average of the heterotrait-hetero method correlations relative to the average of the monotrait-hetero method correlations (Tang et al., 2021). The elements of HTMT are given by the equation below.

$$HTMT_{ij} = \frac{\frac{1}{K_i K_j}\sum_{g=1}^{K_i}\sum_{h=1}^{K_j} r_{ig,jh}}{\left(\frac{2}{K_i(K_i-1)}\cdot\sum_{g=1}^{K_i-1}\sum_{h=g+1}^{K_i} r_{ig,ih^*}\frac{2}{K_j(K_j-1)}\cdot\sum_{g=1}^{K_j-1}\sum_{h=g+1}^{K_j} r_{jg,jh}\right)^{\frac{1}{2}}}$$

and denote the number of items of construct and , respectively.

Thirdly, the structural model was performed to estimate the relationships among latent constructs. Chi-square to degrees of freedom (<3), Tucker-Lewis index (>0.9), root mean square error of approximation (<0.8), comparative fit index (>0.9) and standardized root mean square residual (<0.8) were used to determine the model fitness. Fourthly, we performed a mediation analysis using a bias-corrected bootstrapping of 5,000 samples (Preacher & Hayes, 2008).

5.4 Results

5.4.1 Measurement validation

Table 5.2 summarizes the information on reliability and convergent validity. All the items ranged from 0.643 to 0.857, which are above the recommended threshold value of 0.5 (Fornell & Larcker, 1981). Internal consistency reliability was estimated by CR and Cronbach's Alpha. The recommended threshold of these two indicators is 0.7 (Hair et al., 2006). Based on Table 1, all the constructs exceeded 0.7, suggesting good internal consistency. The AVE values of all constructs were greater than 0.5 (from 0.50 to 0.69), indicating the satisfactory convergent validity of the constructs (Fornell & Larcker, 1981). Concerning discriminant validity, the HTMT value between two factors should ideally be below 0.85 (Kline, 2015), but can go up to 0.90 if the constructs are conceptually similar (Yusoff et al., 2020). The HTMT values of three subconstructs of engagement did not exactly meet the suggested criteria. In order to address the problem of low discriminant validity among the three subconstructs, we combined these subconstructs into one overall measure, and only three items were left (two from cognitive engagement and one from emotional engagement). Hence, all the HTMT values were below 0.85, which met the suggested criteria of discriminant validity as illustrated in Table 5.3.

Table 5.2 Instrument validity and reliability.

Construct	Sub construct	Number of items	Factor loading	CR	AVE	Cronbach's α
Teacher support (TS)		6	0.66-0.84***	0.89	0.58	0.89
Persistence (LP)		3	0.81-0.85***	0.87	0.69	0.87
Satisfaction (LS)		5	0.68-0.78***	0.86	0.55	0.86
Engagement (LE)		3	0.71-0.78***	0.78	0.55	0.78
Mobile learning readiness (MR)	Self-directed learning (SDL)	4	0.68-0.83***	0.83	0.55	0.83
	Self-efficacy (SE)	7	0.71-0.86***	0.93	0.66	0.93
	Optimism (OP)	3	0.64-0.77***	0.75	0.50	0.74

Note. *p<.05, **p<.01, ***p<.001.

Table 5.3 Heterotrait-Monotrait (HTMT) between study constructs.

Constructs	TS	LP	LS	LE	SDL	SE	OP
TS							
LP	0.476						
LS	0.556	0.725					
LE	0.427	0.822	0.727				
SDL	0.626	0.529	0.721	0.612			
SE	0.429	0.724	0.573	0.696	0.476		
OP	0.482	0.686	0.765	0.704	0.704	0.672	

To avoid multicollinearity, common method bias was assessed using Harman single factor analysis, because inflating correlations between variables is a potential threat (MacKenzie & Podsakoff, 2012). Podsakoff et al. (2003) suggested that if the proportion of a single factor explaining the total variance is below 50%, common method bias does not exist. Our results show that the highest variance for a single factor was 38.3%, which indicates that common method bias was not a concern in the current study.

5.4.2 Test of the structural model

We analyzed the structural model fit using maximum likelihood estimation. As illustrated in Table 5.4, the structural model indicated a good fit with the collected data, meeting the criteria suggested by Kline (2015). The proportions of explained variance were 38.5% for mobile readiness, 76.9% for engagement, 74.3% for satisfaction, and 74.9% for persistence. Figure 5.2 shows the relationships between variables.

Teacher support (β = .621, p < .001) had a significant effect on mobile readiness. Mobile readiness (β = .992, p < .001) and teacher support (β = -.211, p < .01) were significantly associated with engagement in SDLLMT. Mobile readiness (β = .994, p < .001) was directly related to satisfaction. Mobile readiness (β = .574, p < .01) and engagement (β = .344, p < .05) had a direct relationship with persistence in SDLLMT.

Table 5.4 Model fit statistics.

	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR
Structural model	879.221	422	2.08	0.926	0.918	0.058	0.062
Criteria (Browne & Cudeck, 1993; Kim, 2016)			<3	>0.9	>0.9	<0.08	<0.08

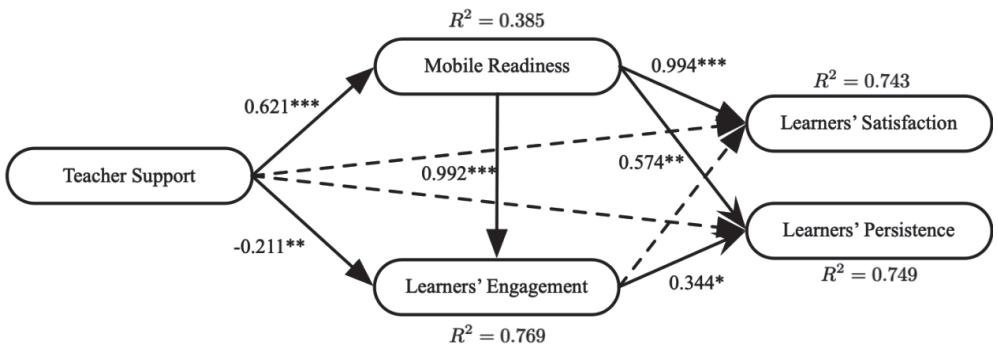


Figure 5.2 Results.

5.4.3 Mediation analysis

To examine the mediating effect, we verified the statistical significance of the indirect effect by conducting bias-corrected bootstrapping of 5,000 samples. Bootstrapping has been widely used to test whether a mediating variable carries the significant influence of an independent variable onto a dependent variable (Preacher & Hayes, 2008). A mediation relation was found in this study. The effect of teacher support on engagement was significantly mediated by mobile readiness (β = .616, p < .001, 95%CI [0.407; 0.896]). The other mediation effects were not significant.

5.5 Discussion

This study examined the influence of mobile readiness and teacher support on learners' persistence, satisfaction, and engagement in SDLLMT. Teacher support was significantly and positively associated with learners' mobile readiness, but negatively with learners' engagement. Mobile readiness made a significant and positive contribution to learners' engagement, satisfaction, and persistence. Learners' engagement was significantly and positively related to persistence. Additionally, mobile readiness mediated the link between teacher support and engagement. These main findings are discussed below.

5.5.1 Relationship between teacher support, learners' mobile readiness, and engagement

Teacher support was significantly and positively linked to learners' mobile readiness. The significant and positive relationship between the two variables provides empirical evidence that teachers can help students improve their self-directed learning skills, enhance their perceived capability of using mobile technology, and their perception of the advantages of mobile technology. Several studies (e.g., Hoi & Mu, 2021; Lai, 2015) support the idea that affective support from teachers can influence learners' perception of the advantages of technology in language learning. Yet, little empirical research has been done on teacher influence on self-directed learning skills and perceived capability of using mobile technology.

Learners' mobile readiness was found to make a strong contribution to engagement in SDLLMT, backing up the finding of Kim et al. (2019) indicating a positive and significant relationship between digital readiness and engagement in e-learning environment. Since self-directed learning using mobile technology outside class is completely up to the learners (Lai et al., 2022b), they have absolute learning autonomy. This means that learners' characteristics will exert great influence on their engagement (Kuo et al., 2021). It is a reasonable assumption that learners who are well-prepared for this mobile learning are more likely to be engaged in the learning process. More specifically, learners with higher mobile learning readiness, including stronger self-directed learning skills, positive perceptions about affordances of mobile technology in self-directed language learning, and greater confidence in using it, tend to remain engaged throughout the learning process.

Teacher support was significantly yet negatively related to learners' engagement, but it showed an indirect and positive impact on learners' engagement with a mediating role for mobile readiness. Despite the mixed findings of the direct relationship between teacher support and learners' engagement reported in the literature review, we could explain the negative relationship between teacher support and engagement, as students in student-initiated and -controlled learning environments might be more likely to enjoy the feeling of fully controlling their own learning process and might be unhappy with a lot of teacher involvement. More importantly, in China, the teacher is still quite important for learners, even in this self-directed and out-of-class context. Direct teacher involvement might put mental or emotional pressure on self-directed learners, further decreasing their engagement in the learning process. The mediating role of mobile readiness might be understood as learners receiving more teacher support had higher mobile

readiness, which in turn led them to be more engaged in SDLLMT. Although many self-directed learners might prefer not to have teacher support in SDLLMT, quite a few of them might not be well enough prepared to proceed successfully on their own. They still need teachers to lead them in the self-directed learning journey. For example, teachers could inform them about the affordances and possibilities of mobile technology in language learning (optimism towards mobile technology), and give them metacognitive tips on how to learn by themselves (self-directed learning skills) and how to effectively utilize technology (self-efficacy of using mobile technology) (Carson & Mynard, 2012; Gray et al., 2010), eventually enhancing their mobile readiness. Equipped with increased mobile readiness, students could possibly engage in this learning process more because they would feel a sense of achievement (Tsay & Brady, 2010).

5.5.2 Factors related to learners' satisfaction and persistence

Mobile readiness significantly and positively predicted learners' satisfaction and persistence, echoing the claims of Ji et al. (2022), Kumar (2021), Wei and Chou (2020), and Chen et al. (2013) demonstrating a positive relationship between online readiness/technology readiness and students' satisfaction and continuance intention in online learning. Regarding satisfaction, it can be inferred from our findings that learners are likely to feel more satisfied if they are better prepared when they start SDLLMT (i.e., greater self-directed learning skills, more optimistic perception of the advantages of and their ability to use mobile technology). Other researchers have shown partially significant relations between mobile readiness and persistence. Chen et al. (2013) found that technology readiness exerted a positive influence on users' persistence with mobile services. Yet, Leung and Chen (2019) reported that innovation, one of the drivers of technology readiness, was a significant predictor of continuance intention, whereas optimism, another driver, was not. Given the unclear relation between mobile readiness and persistence and lack of research into mobile readiness, further research should pay attention to this aspect.

Teacher support was not found to significantly influence either learners' satisfaction or persistence in SDLLMT, which contradicts findings of previous studies (e.g., Caskurlu et al., 2020; Yang et al., 2016), which revealed significant and positive relationships between teaching presence and students' satisfaction and persistence in online courses. In learner-initiated and -directed learning environments, as claimed above, learners might enjoy the feeling of fully controlling their own learning process and feel unease and unhappiness with a great deal of teacher involvement.

Meanwhile, because of the emotional pressure from Chinese teachers with high authority (Guo & Xu, 2021), learners may be not willing to directly ask for teachers' help and guidance. Hence, future studies need to figure out the in-depth relationships among these variables in the context of self-directed learning.

Learners' engagement was not related to satisfaction but had a direct effect on persistence. The non-significant relationship between engagement and satisfaction is surprising since other studies have found learners' engagement could predict satisfaction (Fisher et al., 2021; Rajabalee & Santally, 2020). As mentioned earlier in Section 4.1, we initially used three dimensions of learners' engagement, but eventually combined these subconstructs into one overall measure. More importantly, Lane et al. (2021) and Gao et al. (2020) both proved that cognitive engagement failed to explain learners' satisfaction in blended learning. Specifically, Gao et al. (2020) indicated that students were satisfied only when they were emotionally and fully engaged as emotional engagement had a positive impact on satisfaction, but cognitive engagement does not. Lane et al. (2021) also showed that emotional engagement was the most frequent predictor of student satisfaction in all four courses they studied, namely Human Geography, Math, Chemistry, and Computing Science, and cognitive engagement only explained satisfaction in the computing science course. We therefore assume that the non-significant relationship between engagement and satisfaction that we found could be caused by two items of cognitive engagement. More research is needed to examine the relations between subdimensions of engagement and satisfaction, and to further uncover explanations for these relationships through interview analysis. In addition, the significant relation between engagement and persistence found in this study coincides with the findings of Jung and Lee (2018), which indicated the direct and positive effect of learning engagement on persistence in MOOCs.

5.6 Limitation and future research

Some shortcomings of the current study should be mentioned here. Firstly, this study was based on learners' self-reported scales of engagement, satisfaction, and persistence. Future research could use recorded data to track learners' engagement and persistence, and recorded comments and reviews to extract learners' emotional perception through sentiment analysis techniques as indicators of satisfaction. Learning analytics could be used to explain learners' behavior based on large amounts of learning data. Additionally, qualitative methods can be also employed to examine

students' learning process and performance in further research. In this way, additional information can be collected about the factors that are related to efforts students put in language learning with mobile technology. This additional information might provide more specific implications how to improve students' learning. Secondly, along with learners' ever-changing mobile readiness and persistence usage, the cross-sectional nature of this study did not allow conclusions about students' development in persistence and satisfaction over time. A longitudinal design could be encouraged in subsequent studies. Thirdly, language proficiency level was based on English examinations that Chinese students have passed. However, these examinations may not accurately classify students with low-level or high-level language proficiency, because only language-major students are required to take Tests for English Major 4 and 8. More rigorous measures of language proficiency should be encouraged to investigate whether language proficiency levels affect students' SDLLMT. Fourthly, due to little empirical research on teacher influence on self-directed learning skills and perceived capability of using mobile technology, we call for more empirical studies to further strengthen the findings of our study. Finally, the paper includes teachers' and learners' perspectives in the process, but not the technology perspective. Technological features such as system quality, information quality, and service quality have been found to have significant influences on the learning process and success (Al-Fraihat et al., 2020). It would be worthwhile exploiting this gap by integrating these variables into the model to yield a better understanding of SDLLMT.

5.7 Conclusion

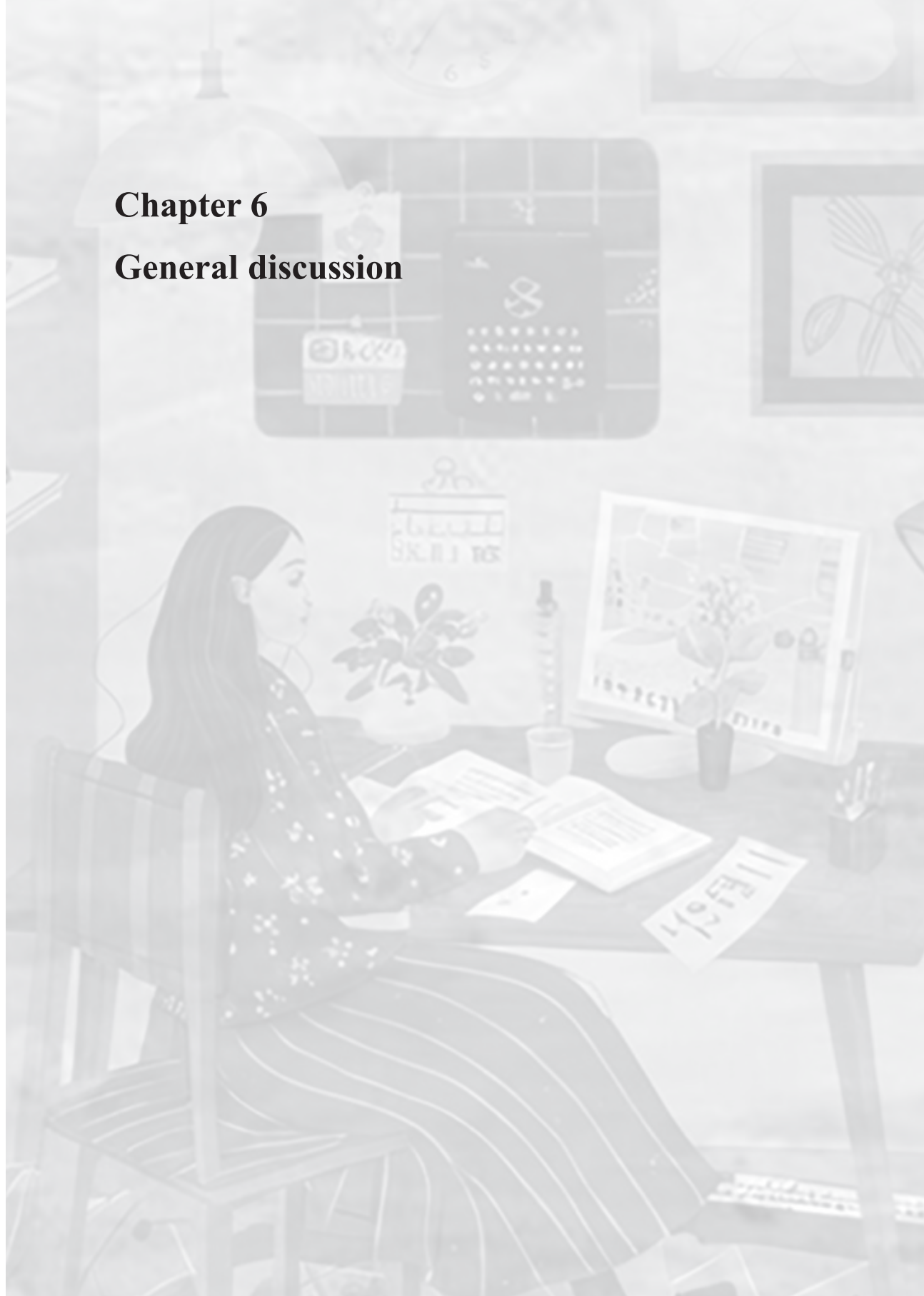
This study identified the impact of learners' mobile readiness, teacher support, and engagement on learners' satisfaction and persistence. Teacher support was found to be significantly and positively related to learners' mobile readiness, but negatively to learners' engagement. Mobile readiness made a significant and positive contribution to learners' engagement, satisfaction, and persistence. Learners' engagement was also significantly and positively related to persistence. Furthermore, mobile readiness mediated the link between teacher support and engagement, and the association between teacher support and satisfaction.

A unique contribution of the present research is that it was one of the first attempts to identify the determinants of persistence and satisfaction from the perspectives of language learners in SDLLMT. As self-directed, informal language learning remains a relatively under-researched area

in the field of MALL (Kukulska-Hulme, 2016, p.138), this study expanded the existing body of literature by putting forth and verifying a conceptual model of learners' persistence and satisfaction building upon antecedent studies. The comprehensive model offers a better understanding of the mechanism of how learners' mobile readiness and teacher support relate to learners' satisfaction and persistence outside classroom. Secondly, although readiness has been extensively investigated over the years in the field of online learning and e-learning, empirical studies have rarely introduced it as a construct in mobile learning and the post-acceptance phase (Leung & Chen, 2019). Due to the distinctions between mobile readiness and online learning/e-learning readiness as explained in section 2, this empirical study firstly encompassed and confirmed mobile readiness as a construct in the context of mobile learning and self-directed learning to open a discussion about future learning initiatives.

In practical terms, considering the importance of learners' mobile readiness and the critical impact of teacher support on it in informal learning, teachers may influence learners' self-directed learning skills and their perception of the advantages and their own capability of using mobile technology in self-directed language learning. More precisely, teachers could foster learners' self-directed learning skills by offering them opportunities to gradually direct their own learning processes (Francom, 2010). Teachers might also help learners understand the advantages of mobile technology by designing mobile-based activities to emphasize the positive functions of mobile technology in the foreign language class and then encouraging them to extend this to out-of-class and self-directed learning. Furthermore, teachers can enhance learners' capability in using mobile technology by offering students technical guidance, recommendations on useful online language resources and explicit demonstration of how to use those resources effectively (Hoi & Mu, 2021; Morris & Rohs, 2021). The direct and indirect effect of mobile readiness highlights its crucial role in mobile learning. Self-directed learners should attach great significance to their own mobile readiness. Based on our results, learners with higher self-directed learning skills and those who perceive the advantages of mobile technology and feel confident in using it tend to feel satisfied and persist in the process of SDLLMT, resulting in effective and successful learning.

Chapter 6
General discussion



6.1 Introduction

The dissertation aimed to contribute to theoretical and practical knowledge of self-directed language learning using mobile technology outside the classroom in higher education. The research aims of the dissertation were twofold. First, it was aimed at increasing our understanding of the learning experience of learners' self-directed learning process while preparing for IELTS (International English Language Testing System). Second, it was aimed at suggesting implications for improving the effectiveness of self-directed learning, with implications for learners, educators, and IT practitioners. Four studies were performed focused on (1) an overview of the learning strategies that learners used in their self-directed learning assisted by mobile technology (Chapter 2); (2) self-directed learners' learning process while preparing for the IELTS on their own (Chapter 3); (3) language learners' behavioral intention towards and actual use of mobile technology in self-directed learning (Chapter 4); and (4) language learners' engagement, satisfaction, and persistence in the context of informal, self-directed language learning using mobile technology (Chapter 5). In sum, the conclusions of the four studies will inform self-directed learners, educators, and software developers on how to effectively enhance self-directed learning with mobile technology.

In this final chapter of this dissertation, the main findings of each chapter are summarized first, followed by a discussion of the general findings. Next, the limitations and directions for future research will be provided. Finally, implications for the practice of self-directed learning are discussed to further promote self-directed learning using mobile technology, which can enhance the learning process and thereby achieve lifelong learning.

6.2 Main findings per chapter

Chapter 2. A Systematic Scoping Review of Learning Strategies in Self-directed Language Learning Using Mobile Technology in Higher Education.

In Chapter 2, a systematic scoping review was performed to examine the learning strategies that self-directed learners use with the support of mobile technology in language learning. The research questions that guide this scoping review were (1) What cognitive strategies did students use during their self-directed language learning using mobile technology?; (2) What metacognitive strategies did students use during their self-directed language learning using mobile technology?; (3) What affective strategies did students use during their self-directed language learning using mobile technology?; and (4) What social strategies did students use during their self-directed language learning using mobile technology?

Regarding the first research question, Bloom's revised taxonomy was employed as the framework to measure cognitive strategies to determine the level of students' thinking (Anderson et al., 2001; Crompton et al., 2019). Appendix B shows the definition of each strategy. At the *remembering* level, the lowest cognitive level, eight kinds of learning strategies were identified. *Imagery, auditory representation and contextualization* were the most frequently identified in the reviewed articles, followed by *repetition, recombination, note-taking, resourcing* and *grouping*. Seven kinds of strategies were identified at the *understanding* level, including *resourcing, auditory representation, imagery, translation, repetition, inferencing* and *summarizing*. *Deduction* and *recombination* were identified at the *applying* level. No strategies were identified at the *analyzing* level, and *resourcing* was the only strategy examined at the *evaluating* and *creating* levels. In summary, 16 out of 20 articles reported learners employing cognitive strategies, with more strategies at the *remembering* and *understanding* levels than at *applying, analysing, evaluating* and *creating* levels. This indicates that language learners mainly conduct more low-order learning strategies than high-order learning strategies. Moreover, there were 12 strategies identified in the cognitive learning processes. Table 6.1 shows that the strategies that were identified most are *resourcing* and *auditory representation*, which are low-level strategies.

With regard to the second research question, the widely-accepted cyclical self-regulatory phases proposed by Zimmerman (2000, 2008) were selected as the framework to categorize metacognitive strategies to show how students regulate their learning process. Four kinds of strategies were examined in the *forethought phase*: *resource management, organisational planning, environment management* and *advance organisation*. Eight kinds of strategies were found in the *performance phase*, the second phase of the cyclical self-regulatory phases, including *comprehension monitoring, production monitoring, time management, selective attention, directed attention, resource management, effort management*, and *problem identification*. *Monitoring* encompassed *comprehension monitoring* (checking whether learners understand) (Lai, 2019) and *production monitoring* (checking whether learners' language output is correct) (Lai et al., 2018; Lai & Zheng, 2018). The only learning strategy in the *self-reflection phase* was *self-evaluation*. In summary, 13 out of 20 reviewed articles were associated with metacognitive strategies in self-directed language learning. Table 6.2 shows the number of reviewed articles involving *forethought*

phase was the most, followed by that in the *performance phase* and the *self-reflection phase*, and only two articles involve using metacognitive strategies in all three phases.

Concerning third and fourth research questions, three kinds of affective strategies were examined including *self-motivation, self-reinforcement, self-encouragement* and *self-talk*. Social strategies reported include *cooperation* and *questioning for clarification* (O'Malley & Chamot, 1990), and *help-receiving*. 14 out of 20 of the reviewed articles reported social strategies used in the self-directed language learning process.

Table 6.1 Number of reviewed articles involving in learning strategies in six cognitive categories.

Strategies	Remembering	Understanding	Applying	Analysing	Evaluating	Creating
Resourcing	1	9	-	-	3	2
Auditory representation	6	4	-	-	-	-
Imagery	6	1	-	-	-	-
Repetition	4	1	-	-	-	-
Contextualisation	5	-	-	-	-	-
Note taking	3	-	-	-	-	-
Recombination	3	-	1	-	-	-
Grouping	1	-	-	-	-	-
Inferring	-	1	-	-	-	-
Deduction	-	-	1	-	-	-
Summarising	-	1	-	-	-	-
Translation	-	1	-	-	-	-

Note. "-" denotes no article involving in the learning strategies here.

Table 6.2 Number of reviewed articles involving in metacognitive strategies in the three phases.

Strategies	Forethought phase	Performance phase	Self-reflection phase
Advance organisation	1	-	-
Selective attention	-	1	-
Directed attention	-	2	-
Organisational planning	4	-	-
Problem identification	-	1	-
Production monitoring	-	2	-
Comprehension monitoring	-	1	-
Environment management	2	1	-
Time management	-	2	-
Effort management	-	1	-
Resourcing management	8	1	-
Self-evaluation	-	-	5

Chapter 3. A netnography study on self-directed language learning experience using mobile technology

Chapter 3 was a qualitative study, exploring the learning experience of language learners in the context of self-directed learning using mobile technology. Four research questions were formulated: (1) How do language learners initiate their learning in the context of self-directed learning using mobile technology?; (2) What do language learners do in the forethought phase in the context of self-directed learning using mobile technology?; (3) What do language learners do in the performance phase in the context of self-directed learning using mobile technology?; and (4) What do language learners do in the self-reflection phase in the context of self-directed learning using mobile technology? The netnography approach was used to guide the data collection and analysis. The netnography process started with saving all online text posts related to preparing for IELTS in a self-directed way on Zhihu, an online platform for knowledge exchange.

The results showed how learners performed in four self-directed learning phases, which include learning task initiation, forethought phase, performance phase, and self-reflection phase, as indicated in table 6.3. *Learning task initiation* involves *motivation for English learning* and *self-directed learning.* Motivation for English language included studying abroad and professional development and motivation for self-directed learning included avoiding paid training courses and enjoying the sense of achievement after completing this self-directed learning. Forethought phase included *goal setting, strategic planning, task value* and *self-efficacy*. Regarding *goal setting*, eight participants reported having target scores, with two of them also setting smaller goals. Moreover, participants 1 and 32 mentioned setting their goals according to their personal needs. Participants developed *strategic plans* by gaining an *understanding of the test*, *selecting appropriate learning resources* and *making study plans*. About *task value* of self-directed learning, thirteen participants acknowledged the feasibility of self-directed learning as an effective means for IELTS preparation. Another participant referred to their prior self-learning experience to gauge their *self-efficacy*. The *performance phase* consists of *task strategies, help seeking, management, interest incentives, self-consequences, self-recording* and *self-monitoring*. In this study, sixteen different task strategies emerged from the data, comprising twelve cognitive strategies and four metacognitive strategies. Based on our data, participants *sought support* from teachers, peers, internet, native speakers and parents. The Internet was the most common source of help, with 19 participants using it to search for learning tips and resources. Participants *managed their time* by allocating specific hours for

four language domains, setting a minimum study time, and using spare time for learning. For the *environment management*, one participant stated that changing the learning environment, such as studying in a different place, made them motivating. One participant also mentioned the need to *screen learning materials* to ensure their relevance and effectiveness. With regard to *interest incentives*, participants mentioned several methods to make them motivated and persistent, including making daily to-do-lists, using learning platforms with high interactivity, which is easier to stick with, uninstalling the recreational mobile apps, and employing the concentration apps (e.g., Forest). In addition, only one (Participant 17) reported they used the *self-consequences* in the process. They bought a gift or went to see a movie as a reward after completing a major goal. This study identified four types of *self-recording*: new or useful vocabulary and expressions, point-losing parts, helpful learning tips, and orally practicing audio recordings. Production monitoring, comprehension monitoring and other monitoring were identified in this study. Moreover, *self-evaluation* and *self-reaction* were identified in *self-reflection phase.* Participants used their final grades as a metric to *self-evaluate* their performance. Regarding *self-reaction,* learners made suggestions and concluded the difficult parts when reflecting on the whole learning process.

Table 6.3 Codes in self-directed learning phases and their summary.

Phases	Code	Sub-code	Summary
Learning task initiation phase	Motivation for English learning		• Study abroad • Professional development
	Motivation for self-directed learning		• Avoid paid training courses • Enjoy the sense of achievement after completing this self-directed learning
Forethought phase	Goal setting	Target score	• Target scores • Smaller goals
	Strategic planning	Understand the test	• Acquire the basic information about the test, useful learning tips, and the key parts of the test • Through the IELTS website, textbooks, online question-and-answer platforms (e.g., Zhihu), or online introductory videos
		Select appropriate learning resources	• Paper learning resources • Electronic learning resources • Vocabulary memorization apps was the most frequently noted category
		Make study plans	• The criteria of making plans: o The amount of time available o Their preferred learning styles, and o Current level of English proficiency that was determined by their grades in previous English exams or a mock IELTS test

			• Search for study plans online • Use Excel app
	Task value	Value of SDL	• Feasibility of self-directed learning as an effective means for IELTS preparation
	Self-efficacy		• Way of self-assessing self-efficacy: • A self-test • Prior self-learning experience
Performance phase	Task strategies	Repetition	• Repeat exercises to maximize their learning outcomes • Go over what they have learned or summarized • Listen to the audio materials intensively • Read the materials intensively and recite new vocabulary repeatedly during reading practice • Analyze model essays one after another in writing • Record their own speaking and listen back
		Key word	• Underline the keywords in the questions before listening and reading to get them prepared, and then pay extra attention to these keywords during the listening and reading. • Keep the key words in mind in speaking practice
		Note taking	• Take notes of the key information and the parts that caused confusion while listening to the materials.
		Grouping	• Group the parts where they were losing points in listening, reading and speaking practice. • Classify the new vocabulary

		Contextualization	• Guess the meaning in the context
		Authentic context	• Extensively immerse themselves in the English TV series, movies, talk shows, books, vlogs in YouTube or Bilibili, and BBC news. • Alternate between watching videos with English subtitles, Chinese subtitles and no subtitles. • Engage in self-talk in English
		Imitation	• Imitate the pronunciation and intonation after listening to or speaking along with language materials.
		Variety	• Use various expressions rather than consistently relying on the same ones
		Translation	• Translate in writing and reading practice
		Resourcing	• Use Google engine
		Induction	• Conclude the rules for writing a good essay
		Deduction	• Employ the rules or tips learned into their own essays

		Selective attention	Give specific attention to:
			• In the listening domain:
			  ○ The point-losing parts
			  ○ The difficult sections, and
			  ○ Areas requiring extra attention
			• In the reading domain:
			  ○ The point-losing
			  ○ The difficult parts

			○ The titles, first and last sentences of every paragraph • In writing practice: ○ Essay structure ○ The use of liaison ○ Nouns of locality • In speaking, ○ Pronunciation ○ Intonation ○ Liaison
		Advance organization	• Preview the questions before engaging in the listening and reading activities
		Organizational planning	• Generate a plan before writing an essay
		Problem identification	• Identify their problems during learning, and then implement targeted training to address these issues
	Help seeking	Teacher support	• Ask for listening tips, feedback
		Peer support	• Turn to high-scoring peers and English-majored friends for feedback • Established learning groups
		Internet support	• Search for learning tips and resources
		Native speakers' support	• Essays evaluation and coaching on speaking skills
		Parent support	• Monitor the learning progress
	Management	Environment management	• Changing learning environment. • Setting the phone's system in English.

			• Extensively listening to English videos while walking and communing, and • Writing English blogs and posts on Quora
		Time management	• Allocate specific hours for four language domains • Set a minimum study time, and • Use spare time for learning
		Resource management	• Screen learning materials
		Plan adjustment	• Adjust their study plans by • Revising subplans that were not completed on time • Incorporating targeted training for weak areas that were identified during the learning process
	Interest incentives	Self-motivation	• Make daily to-do-lists • Use learning platforms with high interactivity • Uninstall the recreational mobile apps, and • Employ the concentration apps
		Emotion adjustment	• Exercise • Meditation • Yoga • Socialize with friends, and • Watch movies
	Self-consequences		• Buy a gift or went to see a movie as the reward after completing a major goal

	Self-recording	Self-recording of new or good expressions	• Make records of new or useful vocabulary and expressions
		Self-recording of point-losing parts	• Reasons for losing points in reading: • Inability to understand the article • Inability to find the answers even when understanding the article • Inability to understand the questions; and • Not knowing the correct answers even when the questions are understood
		Self-recording of useful learning tips	• Make recordings of useful learning tips
		Self-recording of oral practice audio recordings	• Make their own oral practice audio recordings using cell phone or specific apps
	Self-monitoring	Production monitoring	• Look up listening materials • Compare with the reference answers in reading and listening practice • Compare their revised versions in writing, and • Self-correct their mistakes after listening to audio recordings or receiving feedback from others in speaking
		Comprehension monitoring	• Keep asking themselves questions while reading articles
		Other monitoring	• Track their grades
Self-reflection phase	Self-evaluation	Final grades	• IELTS grades
	Self-reaction	Suggestions	• Practice listening and speaking insistently

			• Summarize consciously, and • Use helpful mobile devices or apps
		Challenges	• Speaking, especially pronunciation and fluency • Maintaining a positive mood during the learning process
		Conditions for successful SDL	• Self-discipline and self-control • Effective learning methods • Emotional control • Planning and executing capabilities • The ability to access learning materials and information
		Disadvantages of SDL	• Time-consuming • Less feedback and materials • Easy to give up
		A sense of satisfaction	• Feeling a sense of satisfaction
		Improved SDL ability	• Improved self-directed learning ability

Chapter 4. Factors influencing university students' use of mobile technology in self-directed language learning.

The objective of Chapter 4 was to investigate which factors drive or hinder university students' use of mobile technology for self-directed language learning outside the classroom. The Integrative Model of Behavior Prediction (IMBP; Fishbein & Ajzen, 2010) was employed as the theoretical model. A survey was developed to collect data about demographic information, a screening question, self-regulation skills, the activities that students had participated in when using mobile technology to self-study English language, and attitude, subjective norm, self-efficacy, facilitating conditions, behavioral intention, and actual behavior. A total of 676 students completed the questionnaire. Structural equation modeling (SEM) with Mplus 8.3 (Muthén & Muthén, 2017) was employed in this study to analyze the data. Three research questions guided this study, including (1) To what extent do attitude, subjective norm, and self-efficacy relate to university students' behavioral intention toward using mobile technology in self-directed learning?; (2) To what extent do behavioral intention, facilitating conditions and self-regulation skills relate to university students' actual use of mobile technology in self-directed learning?; and (3) To what extent do self-regulation skills moderate the relationship between behavioral intention and actual use of mobile technology in self-directed learning?

The descriptive statistics indicated that over 50% of participants learned English in a self-directed way to pass language tests and get better work or study opportunities in the future. Another two participants reported that they conducted self-directed English learning because they wanted to improve their poor basic language ability. Regarding the activities that they participated in, most participants used mobile technology to learn vocabulary and translate, compared to practicing listening, speaking, reading, writing and other activities. Furthermore, students' attitude and subjective norm were positively related to their behavioral intention. Behavioral intention and self-regulation skills positively and significantly predicted their actual behavior. No significant relationship was found between self-efficacy and behavioral intention. In addition, Self-regulation skills significantly and positively moderated the relationship between behavioral intention and the actual use of mobile technology in the self-directed learning process. This means the higher the students' self-regulation skills were, the stronger the relationship between students' intention and actual use of mobile technology.

Chapter 5. Factors influencing university students' persistence and satisfaction towards self-directed language learning using mobile technology.

Chapter 5 was also a quantitative study, which examined the factors affecting learners' persistence and satisfaction when conducting self-directed language learning using mobile technology (SDLLMT). It also sought to investigate whether differences in SDLLMT existed between students with high and low language proficiencies. A total of 446 respondents visited the questionnaire website and 352 successfully completed the questionnaire. Four stages of analyses were performed, including an independent sample *t*-test, The measurement model, the structural model, and a mediation analysis. The research questions that guided this study were (1) Is there any difference in SDLLMT between students with high and low language proficiency?; (2) How is learners' satisfaction explained by teacher support, learners' mobile readiness and engagement in SDLLMT?; (3) How is learners' persistence explained by teacher support, learners' mobile readiness and engagement in SDLLMT?; and (4) How do mobile readiness and engagement mediate the relationship between teacher support and both outcome variables of SDLLMT?

In terms of the first research question, the findings showed that students with high and low language proficiency did not show a statistical difference in learners' mobile readiness, engagement, satisfaction, persistence, and teacher support they received. For the second and third research questions, teacher support had a significant effect on mobile readiness. Mobile readiness and teacher support were significantly associated with engagement in SDLLMT. Mobile readiness was directly related to satisfaction. Mobile readiness and engagement had a direct relationship with persistence in SDLLMT. Concerning the third research question, only one mediation relation was found in this study. The effect of teacher support on engagement was significantly mediated by mobile readiness.

6.3 Enhancing learners' learning experience and effectiveness in the context of self-directed language learning using mobile technology

The studies outlined in this dissertation aimed to enhance our comprehension of informal and self-directed learning with mobile technology in the subject of foreign language in higher education. In this section, we elaborate and discuss how learners navigate their self-directed learning process with the aid of mobile technology and how to enhance the effectiveness of this learning approach in higher education settings.

6.3.1 Learning experience in self-directed language learning using mobile technology

The imperative of delving into the intricacies of students' learning experiences is paramount. It provides insights into factors that influence students' motivation, engagement and performance. By incorporating elements that resonate with students' interests, preferences, and learning styles, educators can create more engaging and interactive learning environments. Moreover, every student has unique learning needs and preferences (Starks & Reich, 2023). Understanding how students learn helps educators not only tailor teaching methods, curriculum design, and classroom environments to enhance learning outcomes (Kumar et al., 2023), but also personalize instruction to meet individual students' requirements, strengths, and weaknesses. This approach fosters a more inclusive and supportive learning environment where all students can thrive. The studies described in Chapter 2 and 3 increased our insights into students' learning experience in the context of self-directed learning using mobile technology by investigating the learning strategies that learners used and what they did in the self-directed learning process. This section focuses on learners' self-directed learning phases, and affective and social perspectives.

6.3.1.1 Self-directed learning phases

This part reveales learners' self-directed learning phases, and their interaction with mobile technology usage and language domains. Based on the results of Chapter 2, few empirical studies examined all self-regulatory phases. For this reason, Chapter 3 aimed to investigate the learning experience from the perspective of self-regulatory phases. Self-directed learning is a learning process that emphasizes individuals as autonomous, independent, and responsible managers of their own learning. As stated in Chapter 3, the initiation of learning tasks signifies the beginning of self-directed learning for learners and can be, considered an integral part of the self-directed learning process. Additionally, reflecting on Knowles's (1975) conceptualization of self-directed learning as "the process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (p. 18), Jossberger et al . (2010), Saks and Leijen (2014) and Lai et al. (2023) regarded self-regulation as an essential part of self-directed learning. Moreover, the quality of self-directed learning is closely linked to the process of self-regulation (Long, 2000). For these reasons, the self-directed

learning process involves learners initiating their language learning tasks and regulating the learning process. Therefore, Chapter 3 explored learners' learning experience from the learning task initiation phase and Zimmerman's three-phase model of self-regulation (Zimmerman, 2000), namely forethought, performance, and self-reflection phases.

Mobile technology enables learning through its accessibility, offering resources like apps and online courses accessible anytime, anywhere. Its interactivity, including quizzes and games, fosters engagement and skill reinforcement. Personalization tailors learning experiences based on individual goals and proficiency levels. Synchronization across devices ensures seamless learning progression, while social features facilitate interaction with peers and native speakers. In essence, mobile technology empowers learners by providing diverse, interactive, and personalized language learning experiences, regardless of time or location. Despite the affordances of mobile technology in learning, little research focuses on how it was used in the self-directed learning process. For this reason, Chapter 3 investigated how mobile technology assisted self-directed learning phases. The findings showed that mobile technology was involved in two self-regulatory phases, but not in the self-reflection phase. This partly echoes the results from Yang et al. (2023) claiming that technology has been used in the performance phase instead of the forethought and self-reflection phases. Given the potential of mobile technology in the entire self-directed learning phases, future research is recommended to explore the feasibility and application of employing mobile tools for self-evaluation and the self-reflection phase, and also pay attention to examining self-directed learners' outcomes, not just their behavior.

Chapter 3 also explored the interaction between self-directed learning stages and four language domains: speaking, reading, writing, and listening. While most self-directed learning stages did not exhibit significant differences across these domains, two notable distinctions emerged. Firstly, in the aspect of creating study plans, it was observed that devising plans for reading and listening was relatively straightforward, as their proficiency levels could be evaluated by comparing individual responses to standardized benchmarks. Conversely, crafting plans for writing and speaking presented greater challenges due to the more complex nature of assessing proficiency levels in these skills. Secondly, a difference was noted in help-seeking behaviors, with more learners seeking support for writing and speaking compared to fewer seeking help for reading and listening. The possible explanation for this discrepancy could be the relatively higher degree of difficulty in writing and speaking practice. Therefore, self-directed learners could devote more

time and effort to preparing for the writing and speaking practices, such as trying to acquire high-quality learning information and resources on the two domains. Moreover, external assistance is particularly needed in writing and speaking parts.

6.3.1.2 Affective aspects

The affective aspect is crucial in self-directed learning as it includes learners' emotions, and motivation, significantly influencing their engagement and success (Dewaele, 2022; Kukulska-Hulme et al., 2023; Shen, 2021). Emotional well-being enhances cognitive functioning and information retention. Motivation, both intrinsic and extrinsic, drives learners to initiate and sustain their learning efforts. Recognizing and addressing the affective aspect ensures learners maintain enthusiasm, confidence, and a sense of ownership over their learning journey, leading to more meaningful and sustainable outcomes. However, Viberg et al. (2023) stated that few research focused on the affective part of self-regulation in mobile-assisted language learning. Moreover, Chapter 2 showed that affective strategies received little attention in research regarding self-directed language learning using mobile technology. Considering the significance of affective aspects in self-directed learning, therefore, more research is called to explore this field. Even though using mobile technology is widely acknowledged as a means to motivate students to learn (e.g., Poçan et al., 2023), it is temporary, and learners are easily giving up due to distraction and interruption by the recreational apps on it such as mobile apps, boredom, lack of useful materials (Crescente & Lee, 2011; Kacetl & Klímová, 2019; Wolter & Rosenthal, 2000). To solve this issue, Chapter 5 investigated how to improve learners' persistence and satisfaction from the perspectives of self-directed learners and teachers. The findings suggested that learners should be equipped with mobile learning readiness when conducting self-directed learning, and support from teachers as facilitators is extremely important. However, how to better utilize mobile technology and avoid its negative influence on the educational purposes is not covered by this dissertation. Thus, this direction also deserves attention.

6.3.1.3 Social interaction

Social interaction is crucial as self-directed language learning is viewed as a social endeavor (Alvi & Gillies, 2015; Heil et al., 2016). Moreover, mobile technology can play a pivotal role in facilitating social interaction within the language learning process. It provides learners with the

ability to share files, data, or simple messages, as well as authentic opportunities to practically apply what they have learned by collaborating and communicating with peers, native speakers, or instructors (Troussas et al., 2014). These capabilities support sustained language practice, thereby fostering motivation and enhancing language proficiency over time (Kukulska-Hulme & Viberg, 2018). The findings of Chapter 2 revealed that students rarely utilized technology for social interaction and harbored skepticism towards it. This skepticism stemmed from their lack of confidence in their proficiency levels during online interactions, fear of receiving inaccurate feedback, and absence of overlap between online acquaintances and potential language partners (Lai & Gu, 2011; Lai et al., 2018; Lai & Zheng, 2018). However, Chapter 3 demonstrated that learners actively sought assistance from various sources, including teachers, peers, the internet, native speakers, and parents. Among these, the internet emerged as the primary resource learners turned to. As online learning resources continue to proliferate across different formats and platforms, however, self-directed learners face a significant challenge in discerning the quality of these materials. The accessibility of such resources for free further complicates the task of evaluating their reliability and effectiveness (Hafiz et al., 2024). As a result, self-directed learners need to be meticulous in choosing materials that match their unique learning styles and preferences to ensure optimal learning outcomes.

6.3.2 Factors influencing university students' learning effectiveness in self-directed language learning using mobile technology

While numerous university students presently employ mobile technology to bolster their self-directed learning beyond the classroom, there exists significant variability in their utilization of mobile technology outside of class (Nguyen & Takashi, 2021; Zhang & Pérez-Paredes, 2019; Luo, 2019), and learners often tend to abandon the process prematurely (Cheng & Lee, 2018). To address this problem, the dissertation has conducted two quantitative studies to uncover the underlying factors. In Chapter 4 survey data from 676 language learners was gathered and employed the Integrative Model of Behavior Prediction (IMBP; Fishbein & Ajzen, 2010) as the theoretical model to examine the drivers and obstacles influencing university students' utilization of mobile technology for self-directed language learning outside the classroom. Furthermore, Chapter 5 explored the factors affecting learners' engagement, satisfaction, and persistence, examining perspectives from both self-directed learners and teachers.

The most influential factor on students' behavioral intention and actual use was their attitude towards mobile technology. Self-directed learning, which is typically learner-controlled and takes place outside of the classroom, entails learners taking responsibility for selecting suitable learning tools (such as mobile technology) and materials (Garrison, 1997). Therefore, it is logical to infer that attitudes and beliefs play a significant role in shaping students' intentions to utilize mobile technology for the self-directed learning process. The relationship between subjective norm and behavioral intention was found to be positive and significant. However, Hartwick and Barki (1994) noted that others' opinions are not significant in voluntary settings, only in mandatory ones, which aligns with the more general claim that the context moderates the relationship between subjective norm and behavioral intention (Venkatesh et al., 2003). Additionally, Srite (2006) suggested that different cultures influence this relationship as well. In individualistic cultures, subjective norm has a weak effect on behavioral intention, whereas in collective cultures like China, social interaction is vital for information transmission, and people prioritize interpersonal relationships (Srite, 2006; Zhao et al., 2021). Although self-directed learning relies on learners' choices, in collective environments, learners are still influenced by teachers, peers and other significant agents to maintain good relationships and receive support. Consequently, self-directed learners may seek assistance from teachers when needed and study with peers to motivate each other during the learning process. Unexpectedly, self-efficacy was not found to be significantly related to behavioral intention, contradicting previous studies that have suggested a significant effect of self-efficacy on behavior intention (Buabeng-Andoh, 2021; Park, 2009; Venkatesh & Davis, 1996). Cigdem and Ozturk (2016) explain this phenomenon, suggesting that due to the pervasive use of the Internet and technology in educational settings, today's learners are digital natives who enter universities with extensive knowledge and experience with mobile technology. Furthermore, the relationship between behavioral intention and actual behaviors of using mobile technology was found to be positive and significant. Additionally, self-regulation skills were predictive of actual behavior. A significant finding emerges from the notable and positive moderation effect of self-regulation skills on the relationship between intention and behavior. This indicates that the impact of behavioral intention on actual behavior strengthens with an increase in self-regulation skills. Put simply, students possessing higher self-regulation skills are more inclined to translate their behavioral intentions into actual behaviors compared to those with lower self-regulation skills. Evidently, students with superior self-regulation skills exhibit better abilities

to regulate their behavior, cognition, and motivation, all of which contribute to enhanced engagement and persistence in learning (Nicol & Macfarlane-Dick, 2006).

The initial adoption of the type of learning does not assure successfully acquiring a new language (Yang et al., 2019). Learners must persist throughout the learning journey, as mastering languages is a long-term endeavor that takes years, not just a few days (Fryer, 2019). According to the results in Chapter 5, learners' mobile readiness was discovered to strongly contribute to engagement in SDLLMT. Given that self-directed learning outside the classroom via mobile technology is entirely driven by learners (Lai et al., 2022b), they possess complete autonomy over their learning. Consequently, learners' characteristics exert considerable influence on their engagement (Kuo et al., 2021). It is reasonable to assume that learners who are well-prepared for mobile learning are more likely to actively engage in the learning process. Furthermore, teacher support exhibited a significant yet negative relationship with learners' engagement. However, it demonstrated an indirect and positive impact on engagement, with mobile readiness mediating this relationship. The negative association between teacher support and engagement can be interpreted as students in environments characterized by student-initiated and controlled learning being more inclined to relish the feeling of having full control over their learning process, possibly feeling discontented with excessive teacher involvement. Importantly, in the context of China, teachers remain highly significant for learners, even within self-directed and out-of-class settings. Direct teacher involvement may impose mental or emotional pressure on self-directed learners, subsequently diminishing their engagement in the learning process. The mediating role of mobile readiness can be comprehended as follows: learners who received greater teacher support tended to have higher levels of mobile readiness, consequently leading to increased engagement in SDLLMT. While many self-directed learners may prefer minimal teacher support in SDLLMT, some may not feel adequately prepared to navigate the learning process independently. In such cases, they still rely on teachers to guide them through their self-directed learning journey. Besides, mobile readiness significantly and positively predicted learners' satisfaction and persistence. Some researchers have highlighted partially significant relationships between mobile readiness and persistence. For instance, Chen et al. (2013) showed that technology readiness positively influenced users' persistence with mobile services. Conversely, Leung and Chen (2019) reported different findings, noting that while innovation -one of the drivers of technology readiness- significantly predicted continuance intention, optimism -another driver- did not. Due to the

ambiguous nature of the relationship between mobile readiness and persistence, coupled with the limited research in this area, future studies must delve deeper into this aspect. Moreover, teacher support was not found to significantly influence either learners' satisfaction or persistence in SDLLMT, contradicting findings from previous studies (e.g., Caskurlu et al., 2020; Yang et al., 2016) that revealed significant and positive relationships between teaching presence and students' satisfaction and persistence in online courses. In learner-initiated and -directed learning environments, as mentioned earlier, learners might prefer having full control over their learning process and may feel discomfort and dissatisfaction with excessive teacher involvement. Additionally, due to the emotional pressure exerted by Chinese teachers with high authority (Guo & Xu, 2021), learners may be hesitant to directly seek help and guidance from teachers. Therefore, future studies should aim to elucidate the intricate relationships among these variables in the context of self-directed learning.

Furthermore, learners' engagement was not found to be related to satisfaction but had a direct effect on persistence. The absence of a significant relationship between engagement and satisfaction is unexpected, considering that other studies have indicated that learners' engagement could predict satisfaction (Fisher et al., 2021; Rajabalee & Santally, 2020). As mentioned earlier in Chapter 5, we initially utilized three dimensions of learners' engagement (cognitive, emotional and behavioral engagement) but ultimately combined these subconstructs into one overall measure. Importantly, Lane et al. (2021) and Gao et al. (2020) both demonstrated that cognitive engagement failed to explain learners' satisfaction in blended learning contexts. Specifically, Gao et al. (2020) suggested that students were satisfied only when they were emotionally and fully engaged, as emotional engagement positively impacted satisfaction, while cognitive engagement did not. Lane et al. (2021) also found that emotional engagement was the primary predictor of student satisfaction across various courses, with cognitive engagement only explaining satisfaction in the computing science course. Thus, we hypothesize that the non-significant relationship between engagement and satisfaction observed in our study may be due to the inclusion of cognitive engagement items. Further research is warranted to examine the relationships between subdimensions of engagement and satisfaction and to explore explanations for these relationships through interview analysis.

6.4 Limitation and directions for future research

This dissertation provides insights into learners' learning experience in self-directed language learning using mobile technology, and the factors influencing their actual use and persistence in using mobile technology. When interpreting the results of this dissertation, some limitations need to be acknowledged.

The first limitation relates to data that was collected, which restricts the findings of the studies in the dissertation. In the studies presented in Chapter 4 and 5, self-reported questionnaires were used to collect the data about learners' perceptions, actual usage, and persistence, which might lead to bias due to subjectivity. In order to acquire more specific implications on how to improve students' learning, multiple methods of data sources could be introduced. For example, recorded data to track learners' actual usage, engagement, and persistence can be included, and recorded comments and reviews to extract learners' emotional perceptions through sentiment analysis techniques can be used as indicators of satisfaction. Additionally, qualitative methods can also be employed to gain deep knowledge about learners' perceptions. Moreover, along with learners' ever-changing attitudes, behavior, mobile readiness, and persistence usage, the cross-sectional nature of this study did not allow conclusions about students' development in actual usage, persistence, and satisfaction over time. Longitudinal research may be designed to exploit these changing factors at different points and see whether other variables such as prior experience affect students' continuance use of mobile technology.

The second limitation relates to the lack of insights into learning outcomes. Although the dissertation involves students' learning experience, perception, actual use, and learning satisfaction and persistence, no study was included to investigate their learning outcomes. It would be beneficial to not only examine the relationship between the factors that we have included in the dissertation and learning outcomes,. Therefore, it also warrants attention to delve into this aspect in self-directed learning.

Thirdly, the conclusions drawn from all the studies are context-specific, as the participants in the four studies were native Chinese-speaking English language learners. Consequently, the findings cannot be easily extrapolated to other countries with distinct cultures. For this reason, future studies could be conducted in other cultural contexts to examine the use of self-directed language learning with mobile technology. Additionally, such studies should investigate the impact of language proficiency and various environmental factors on the utilization of self-directed

technology in language learning. By broadening the scope of research beyond a singular cultural context, we can gain a more comprehensive understanding of the dynamics involved in self-directed language learning with mobile technology.

6.5 Implications for practice

The dissertation has several implications for empowering self-directed learners, educators/teachers, and software developers.

6.5.1 Implications for self-directed learners

The findings of Chapter 2, 4, and 5 suggest that self-directed learners engage in preparatory activities prior to embarking on self-directed learning endeavors. Moreover, it appears that self-directed learning is more suitable for intermediate and advanced language learners compared to beginners (Sakai & Takagi, 2009; Ünal, Çeliköz & Sari, 2017). Beginners in language learning may find self-directed learning feasible only after achieving a basic proficiency level. Inspired by the result of moderation analysis in Chapter 4 and the direct and indirect effect of mobile readiness in Chapter 5, self-directed learners should attach great significance to their own mobile readiness. According to our findings, individuals with proficient self-directed learning skills and a favorable attitude towards mobile technology, coupled with confidence in its utilization, are inclined to experience satisfaction and persistence throughout the self-directed language learning process. Consequently, this leads to effective and successful learning outcomes. To enhance their proficiency as self-directed language learners, therefore, individuals should aim to attain a basic level of proficiency in the language, enhance their self-directed learning capabilities, and cultivate a positive outlook towards this learning approach.

6.5.2 Implications for language educators/teachers

Teachers play a pivotal role in fostering independence and self-direction in learners. They achieve this by providing clear objectives, appropriate resources, and effective learning strategies (Thornton, 2013). Self-directed learners often have limited knowledge of strategies and technology use, as highlighted in Chapter 2. Therefore, teachers can bridge this gap by offering a diverse array of technological resources, imparting metacognitive and cognitive strategies to maximize resource utilization, and encouraging active engagement with technology to enhance language learning

(Zhang & Pérez-Paredes, 2019). Chapter 3 underscores the importance of teachers and other facilitators offering specific cognitive and emotional support to self-directed learners whenever possible. Moreover, the positive impact of subjective norms, as evidenced in Chapter 4, suggests that teachers should engage students in discussions related to self-directed language learning using mobile technology. Educational institutions also bear the responsibility of nurturing students' self-regulation skills to facilitate self-directed learning, thereby fostering lifelong learning. Given the significance of learners' mobile readiness in informal learning and the critical role of teacher support, teachers can influence learners' self-directed learning skills and their perception of the advantages and their own capability of using mobile technology. Specifically, teachers can cultivate self-directed learning skills by gradually allowing students to take charge of their learning processes (Francom, 2010). They can also elucidate the benefits of mobile technology by designing mobile-based activities that highlight its positive functions in the foreign language classroom and encourage its extension to out-of-class and self-directed learning. Furthermore, teachers can enhance learners' proficiency in using mobile technology by offering technical guidance, suggesting useful online language resources, and providing explicit demonstrations of effective resource utilization (Hoi & Mu, 2021; Morris & Rohs, 2021). Through these interventions, teachers can empower learners to navigate the landscape of self-directed language learning with mobile technology effectively.

6.5.3 Implications for software developers

To enhance the personalized learning experience on mobile devices, software developers could integrate adaptive learning features into their applications. In both online and mobile learning environments, learners often disengage when they experience negative emotions such as fear, anxiety, and worry (Liu et al., 2022). High levels of anxiety can significantly dampen students' motivation, making it crucial to consider emotional states, as they profoundly influence learning outcomes (Wang et al., 2021). Therefore, it's essential for software developers to include affective monitoring and intervention features in language learning apps. For example, Benta et al. (2015) came up with a multimodal affective monitoring tool which used data from the sensors in a quest to acquire users' emotion for more precise affective states assessment in a foreign language learning application. These features would help learners mitigate negative emotions and sustain motivation and engagement throughout the self-directed learning process. By

addressing learners' emotional needs, software developers can create a more supportive and conducive learning environment, ultimately enhancing the effectiveness of mobile language learning applications.

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Appendices

Appendix A. References of studies included in the systematic scoping review.

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Appendix B. Taxonomy of language learning strategies from O'Malley and Chamot (1990)

Dimensions	Categories	Explanations
Cognitive strategy	Repetition	Intentionally practicing and rehearsing the words or phrases repeatedly.
	Resourcing	Understanding or reciting language elements by utilizing reference books, encyclopaedias, websites, dictionaries, etc.
	Grouping	Making classifications of words, phrases, or sentences based on their attributes or meaning.
	Note taking	Writing down key words and concepts in abbreviated verbal, graphic, or numerical form.
	Summarising	Summing up the gained information in a written or mental way.
	Deduction	Applying rules to comprehend or create language output.
	Imagery	Utilizing visual images to recite and understand new language contents or mentally represent problems.
	Auditory representation	Playing the sound of words, phrases, or sentences in the back of one's mind so as to assist in comprehending and recalling.
	Recombination	Combining known knowledge in a new way to formulate meaningful sentences or language expressions.
	Inferencing	Using the known information to infer the meaning of new elements, predict results, or complete the tasks.
	Translation	Using the native language as a basis to understand and/or produce the foreign language.
	Contextualisation	Assisting comprehension or recall by placing a word or phrase in a meaningful language sequence or situational context.
Metacognitive strategy	Advance organisation	Previewing the main ideas and concepts of the material to be learned, often by skimming the text for the organising principle.

	Selective attention	Knowing how to focus on specific aspects of language learning before executing tasks.
	Directed attention	Doing or setting something beforehand to remind learning tasks.
	Organisational planning	Generating plans for language learning tasks.
	Problem identification	Identifying the problems which should be solved in tasks, or the parts that hinder understanding and completing tasks.
	Production monitoring	Checking whether learners' language output is correct.
	Comprehension monitoring	Checking whether learners understand.
	Time management	Seeking, arranging, or adjusting time for learning.
	Effort management	Seeking, arranging, or adjusting efforts for learning.
	Resourcing management	Seeking, arranging, or adjusting resources for learning.
	Self-evaluation	Checking the outcomes of one's own language learning against a standard after it has been completed.
Affective strategy	Self-motivation	Driving learners to keep going by reminding themselves of the benefits of self-directed learning or mastering new languages.
Social strategy	Questioning for clarification	Eliciting additional explanation, rephrasing, examples, or verification from a teacher or peer.
	Help-receiving	Other agents, such as teachers and friends, actively offering support to learners.
	Cooperation	Learning with others to update information, check learning outcomes, or get feedback on learning performance.

Appendix C. Studies coded by proficiency level, cognitive dimension, metacognitive dimension, affective dimension and social dimension.

	Authors (year)	Country	Proficiency level	Cognitive strategies						Metacognitive strategies			Affective strategies	Social strategies
				Remembering	Understanding	Applying	Analyzing	Evaluating	Creating	Forethought phase	Performance phase	Self-reflecting phase		
1	Alm (2015)	New Zealand	x					x		x				x
2	Çelik, Arkın & Sabriler (2012)	North Cyprus	x		x					x	x		x	x
3	Chen (2013)	China	x							x				x
4	García Botero, Questier & Zhu (2018)	Colombia		x		x					x			
5	Hamat & Hassan (2019)	Malaysia		x										
6	Kuznetsova and Soomro (2019)	The United States												x
7	Lai (2015)	China												
8	Lai (2019)	China	x	x	x	x				x	x			x
9	Lai & Gu (2011)	China	x		x					x	x	x	x	x
10	Lai, Hu & Lyu (2017)	China	x	x	x				x	x	x			x
11	Lai, Yeung & Hu (2015)	China												x
12	Lai & Zheng (2017)	China	x	x	x			x			x	x		x
13	Ma (2017)	China		x	x			x	x	x		x		x
14	Sockett & Toffoli (2012)	France	x	x	x						x			x
15	Steel (2012)	Australia		x						x		x		
16	Trinder (2017)	Austria	x	x										
17	Wrigglesworth & Harvor (2017)	South Korea	x		x									x
18	Yao (2016)	China			x									x

19	Zhang & Pérez-Paredes (2019)	China		x	x					x	x	x		
20	Zou & Yan (2014)	China	x	x	x					x				x

Appendix D. Mobile applications mentioned in this study.

Mobile Apps	Description	Websites
Baicizhan	Bai Ci Zhan is an APP that helps users to recite words. The software sets up a series of dictionaries such as high school entrance examination vocabulary, college entrance examination vocabulary, and sixth-level vocabulary. Users can choose a dictionary and make a study plan to determine the amount of words to recite every day. Users can also play vocabulary games with others.	https://www.baicizhan.com/
Douban	Douban.com is a Chinese social networking service website that allows users to record information and create content related to film, books, music, recent events, and activities in Chinese cities.	https://www.douban.com/
Duolingo	Duolingo is an American platform that includes a language-learning website and mobile app, as well as a digital language-proficiency assessment exam.	https://www.duolingo.com/
English Liulishuo	English Liulishuo App is an engaging and fun English learning mobile app. It empowers you to learn English efficiently and happily through the combination of advanced auto-scoring engine of spoken English developed in Silicon Valley, professional English training courses, comprehensive learning materials, and well-designed leveled games.	https://www.liulishuo.com/en/liulishuo.html
Facebook	Facebook is an American online social media and social networking service.	https://www.facebook.com/
MySpace	Myspace is a social networking website that allows users to make personal profiles to connect with friends, share messages, photos, blog posts, and video, as well as stream music.	https://myspace.com/

Quizlet	Quizlet is an American online study application that allows students to study information via learning tools and games. It trains students via flashcards and various games and tests.	https://quizlet.com/en-gb
Skype	Skype is a telecommunications application that specializes in providing video chat and voice calls between computers, tablets, mobile devices, and smartwatches over the Internet. Skype also provides instant messaging services. Users may transmit text, video, audio and images. Skype allows video conference calls.	https://www.skype.com/zh-Hans/
Twitter	Twitter is an American microblogging and social networking service on which users post and interact with messages known as “tweets”. Users can read, post, like, and retweet tweets. It can also be used for the purpose of foreign language learning.	https://twitter.com/
WeChat	WeChat is a Chinese multi-purpose messaging, social media and mobile payment app developed by Tencent. Some learners take advantages of its functions of social media and messaging to learn foreign languages with others.	https://www.wechat.com/en/
WhatsApp	WhatsApp Messenger, or simply WhatsApp, is an American freeware, cross-platform messaging and Voice over IP (VoIP) service owned by Facebook, Inc. It allows users to send text messages and voice messages, make voice and video calls, and share images, documents, user locations, and other media.	https://www.whatsapp.com/
Yahoo	Yahoo provides a Web portal, search engine Yahoo! Search, and related services, including Yahoo! Directory, Yahoo! Mail, Yahoo! News, Yahoo! Finance, Yahoo! Groups, Yahoo! Answers, advertising, online mapping, video sharing, fantasy sports, and its social media website.	https://hk.yahoo.com/

Youdao Dictionary	Youdao Dictionary is an online and offline electronic dictionaries and it can support of 107 languages among Chinese in translation, such as English, Japanese, Korean, French, German, Russian, Spanish, Portuguese etc.. https://youdao.com/
YouTube	YouTube is an American online video-sharing platform. It allows users to upload, view, rate, share, add to playlists, report, comment on videos, and subscribe to other users. It offers a wide variety of user-generated and corporate media videos. https://www.youtube.com/
Zhihu	Zhihu is a Chinese question-and-answer website where questions are created, answered, edited and organized by the community of its users. https://www.zhihu.com/signin?next=%2F

Appendix E. Constructs and items (Chapter 4).

Constructs	Items
Actual behavior (AB)	AB1: I use mobile technology to help understand learning materials.
	AB2: I use mobile technology to acquire more knowledge of English.
	AB3: I use mobile technology to help express my thoughts.
	AB4: I use mobile technology to seek learning strategies and tips.
	AB5: I use mobile technology to check my understanding.
	AB6: I use mobile technology to check my learning progress.
	AB7: I use mobile technology to expand opportunities to use English.
	AB8: I use mobile technology to sustain motivation and interest in learning English.
	AB9: I use mobile technology to ask for support and help.
Behavioral intention (BI)	BI1: I will use mobile technology on a regular basis.
	BI2: I will frequently use mobile technology.
	BI3: I will strongly recommend others to use mobile technology if they self-study English language.
Attitude (ATT)	ATT1: Using mobile technology is a good idea.
	ATT2: Using mobile technology is a wise idea.
	ATT3: I like the idea of using mobile technology.
	ATT4: Using mobile technology would be pleasant.
Self-efficacy (SE)	SE1: I am confident about using mobile technology.
	SE2: Using mobile technology would not challenge me.
	SE3: I would be comfortable to use mobile technology.
Self-regulation skills (SRL)	SRL1: I constantly check my understanding.
	SRL2: I have ways to make learning the language more attractive.
	SRL3: I try to sort out and address the problem, when learning environment becomes less favorable.
	SRL4: I know how to arrange time and environment to make learning more efficient and effective.

	SN1: Most people who are important to me (teachers and peers) think that it would be fine to use mobile technology.
Subjective norms (SN)	SN2: I think other students in my classes would be willing to adapt mobile technology.
	SN3: Most people who are important to me (teachers and peers) would be in favor of using mobile technology.

Appendix F. Constructs and items (Chapter 5).

Constructs	Items
	Learning Engagement
Behavioral engagement	1. I set aside a regular time each week to use mobile technology for self-studying English.
	2. I marked what I did not understand while using mobile technology for self-studying English.
	3. I revisited my notes when using mobile technology for self-studying English next time.
Cognitive engagement	1. I searched for further information when I encountered something that puzzled me during using mobile technology for self-studying English.
	2. When I had trouble understanding a word or a sentence while using mobile technology for self-studying English, I went over it again until I understood it.
	3. If I listened or read something while using mobile technology for self-studying English that I did not understand at first, I listened or reread it again to make sure I understood the content.
Emotional engagement	1. I was inspired to expand my knowledge while using mobile technology for self-studying English.
	2. I found it interesting to use mobile technology for self-studying English.
	3. I enjoyed learning knowledge while using mobile technology for self-studying English.
	Learning persistence
	1. When self-studying English, I intend to continue to use mobile technology for learning resources gathering
	2. When self-studying English, I intend to continue to use mobile technology for knowledge construction.
	3. When self-studying English, I intend to continue to use mobile technology for learning resources sharing
	4. Next time I am willing to use mobile technology again to learn English language.
	5. I think mobile technology is suitable for learners who want to self-study English.
	6. I will recommend other people who want to self-study English to use mobile technology.

	7. Overall, I intend to continue to use mobile technology when self-studying English.
	Learning Satisfaction
	1. When self-studying English, I am satisfied with mobile technology
	2. When self-studying English, I am satisfied with the Internet speed of mobile technology.
	3. When self-studying English, I am satisfied with the functions provided by mobile technology
	4. When self-studying English, I am satisfied with the quality of information available on mobile technology.
	5. When self-studying English, I am satisfied how learning materials are presented in mobile technology.
	6. When self-studying English, I can easily download the available learning materials in mobile technology
	7. When self-studying English, I have no problem in viewing the posted information in mobile technology
	Mobile learning readiness
ML self-efficacy	1. I feel confident in performing the basic functions of mobile technology.
	2. I feel confident in my knowledge and skills of mobile technology.
	3. I feel confident in using mobile technology to effectively communicate with others
	4. I feel confident in using the internet (Baidu, etc.) to find or gather information for self-directed learning.
	5. I feel confident in studying with mobile technology.
	6. I feel confident in how to use mobile technology.
	7. I feel confident in how to use mobile technology for learning
Optimism	1. I like studying via mobile technology because I am able to study anytime and at any place.
	2. Mobile technology make me more efficient in my studying.
	3. I like mobile technology (or mobile apps) that allows me to tailor things to fit my own needs.
	4. I like mobile technology.
	5. Mobile technology give me control over my studying time

	6. The newest mobile technology (or mobile apps) is convenient to use.
	7. Mobile technology gives me freedom of studying.
Self-directed learning	1. When self-studying English, I can manage my own learning progress
	2. When self-studying English, I carry out my own study plan
	3. When self-studying English, I set and actively pursuit my goals.
	4. When self-studying English, I manage time well
	5. When self-studying English, I am self-disciplined and find it easy to set aside learning time
	Teacher support
	1. My English teacher encouraged us to use mobile technology for self-studying English.
	2. My English teacher discussed with us how technological resources or tools could enhance language learning.
	3. My English teacher shared with us useful technological resources/sites/tools for language learning outside the classroom.
	4. My English teacher shared tips/strategies on how to use technological resources or tools for language learning.
	5. My English teacher often used technological resources or tools in her/his classes.
	6. My English teacher engaged us with learning activities that involve the use of technological resources or tools.

Summary

In today's interconnected global landscape, the ability to communicate in multiple languages is not only advantageous but often essential. Language skills open doors to a plethora of opportunities, spanning career growth, effective collaboration, knowledge sharing, and cultural enrichment. Traditionally, language learning has been confined to the walls of classrooms, following structured curricula and guided by instructors. However, the landscape of language education is rapidly evolving, propelled by advancements in technology and shifting pedagogical paradigms. One of the most prominent trends in contemporary language learning is the emergence of self-directed learning (SDL) facilitated by mobile technology beyond the classroom environment. SDL, as elucidated by Knowles (1975) emphasizes the active role of learners in taking charge of their educational journey. While SDL shares similarities with self-regulated learning (SRL), particularly in terms of active engagement and goal-directed behavior, it differs in the level of control learners exert, especially at the onset of the learning process (Loyens & Rikers, 2008). Self-directed learners initiate learning tasks independently, while self-regulated learners might not necessarily do so. Mobile technology in this study refers to portable electronic devices such as smartphones, tablets, and laptops, as well as the software and applications designed to be used on them. With the ubiquity of these technologies, learners now have unprecedented access to a wealth of language-learning resources at their fingertips. From language learning apps and online courses to podcasts and social media platforms, the possibilities for self-directed language learning are virtually limitless. For example, mobile technology enables it through its accessibility, offering resources like apps and online courses accessible anytime, anywhere. Its interactivity, including quizzes and games, fosters engagement and skill reinforcement. Personalization tailors learning experiences based on individual goals and proficiency levels. Synchronization across devices ensures seamless learning progression, while social features facilitate interaction with peers and native speakers. In essence, mobile technology empowers learners by providing diverse, interactive, and personalized language learning experiences, regardless of time or location.

In higher education, the incorporation of foreign language learning into the core curriculum of specific disciplines continues to be constrained. Additionally, in some regions, students face a lack of adequate exposure to foreign languages in classroom settings, impeding their language

acquisition journey (Richards, 2015; Trinder, 2017; Tsou et al., 2006). To bridge this gap, many students are embracing self-directed language learning via mobile technology (SDLLMT) to augment their language skills beyond formal instruction. SDLLMT enables individuals to take control of their language learning journey independently, determining what and how to learn (Merriam & Bierema, 2013). This is facilitated through the utilization of mobile applications such as italki, Babbel, Duolingo, HelloTalk, Tandem, YouTube, and Google Translate to craft personalized learning environments. While students may receive assistance from teachers or peers, the process predominantly hinges on the learners' initiative and self-direction (Lai et al., 2022). This approach allows learners to customize their learning experiences based on their unique needs and preferences, fostering a more adaptable and efficacious language acquisition process outside the confines of traditional classrooms. Moreover, self-directed learning outside of the classroom promotes autonomy and self-motivation among learners. By providing them with the freedom to set their own learning goals, manage their progress, and take responsibility for their learning outcomes, this approach fosters a sense of ownership and agency. Empowered learners are more likely to stay engaged, persevere through challenges, and ultimately achieve greater proficiency in the target language.

Research indicates that self-directed language learning with technology outside the classroom correlates with positive affective outcomes and language proficiency gains (Lai et al., 2015; Sundqvist & Wikström, 2015). However, students exhibit diverse patterns in their self-directed technology usage (Lai & Gu, 2011), highlighting the need to understand university students' specific self-directed English language learning behaviors with technology. Understanding these behaviors can assist educators and researchers in identifying potential avenues for supporting and enhancing students' use of technology for self-directed language learning.

This dissertation aims to contribute to our understanding of self-directed language learning using mobile technology in higher education, focusing on the learning experience and learning effectiveness of university students' self-directed language learning behaviors with technology. Four studies were designed to understand (1) the learning strategies that students used in their self-directed learning process; (2) self-directed learners' learning experience when they prepared for IELTS, (3) the determinants that influenced students' behavioral intention and actual use of mobile technology in their self-directed learning; and (4) the factors affecting learning engagement,

learning satisfaction and learning persistence in the context of self-directed language learning using mobile technology. The findings of this dissertation aim to inform pedagogical practices, shape educational policies, and inspire future innovations in language education.

Chapter 2 presents a systematic scoping review aiming at providing an overview of empirical research concerning learning strategies that self-directed learners use with the support of mobile technology in language learning. The central research question in this study was what cognitive strategies, metacognitive strategies, affective strategies, and social strategies students use during their self-directed language learning using mobile technology. To address this question, we adopted the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) extension for Scoping Reviews (Tricco, Lillie, Zarin et al., 2018) as our guiding framework. Utilizing these guidelines, we systematically reviewed 20 relevant studies, extracting key information such as author names, publication years, participants' proficiency levels, and learning activities described in each study. From each selected study, we extracted information on learning activities outlined in both the results and conclusion sections. These activities were then coded and categorized as cognitive, metacognitive, affective, or social strategies based on O'Malley's classification scheme. This systematic approach allowed us to comprehensively analyze the various strategies employed by self-directed learners utilizing mobile technology for language learning.

Bloom's revised taxonomy served as the framework to assess cognitive strategies, enabling the measurement of students' thinking levels (Anderson et al., 2001; Crompton et al., 2019). Among the 20 articles reviewed, 16 reported the utilization of cognitive strategies by learners. Notably, more strategies were observed at the *remembering* and *understanding* levels compared to the *applying, analyzing, evaluating*, and *creating* levels. This suggests that language learners predominantly employ low-order learning strategies rather than high-order ones. While these low-level strategies are suitable for short-term learning goals or memorization tasks (Setiyadi, 2001), enhancing overall language performance requires the integration of high-order strategies throughout the learning process (Aharony, 2006; Setiyadi, 2001; Yot-Domínguez & Marcelo, 2017). Consequently, further research is encouraged to explore higher-order strategies in language learning. To categorize metacognitive strategies illustrating how students regulate their learning process, Zimmerman's cyclical self-regulatory phases (2000, 2008) were adopted. 13 out of the 20 reviewed articles were associated with metacognitive strategies in self-directed language learning.

Notably, the *forethought* phase was most frequently addressed, followed by the *performance* phase and the *self-reflection* phase, with only two articles covering all three phases. Three kinds of affective strategies were examined. Social strategies reported include *cooperation* and *questioning for clarification* (O'Malley & Chamot, 1990), and *help-receiving*. 14 out of 20 of the reviewed articles reported social strategies used in the self-directed language learning process. Future studies are encouraged to delve deeper into social and affective strategies, given their association with effective language learning. The findings underscore the need for additional research to explore all self-regulatory stages within the process of self-directed learning facilitated by mobile technology, as well as to examine the influence of both learners and teachers on this process. In response to these identified research gaps, Chapters 3 to 5 have been conducted to address these areas comprehensively.

The goal of **Chapter 3** is to describe the learning experience of language learners in the context of self-directed learning using mobile technology. The research questions included (1) How do language learners initiate their learning in the context of self-directed learning using mobile technology? (2) What do language learners do in the forethought phase, performance phase ,and self-reflection phase in the context of self-directed learning using mobile technology? The netnography approach was employed to analyze how Chinese learners learned English through the process of preparing for IELTS (International English Language Testing System) in the context of self-directed learning using mobile technology. Nine questions were eventually screened. Under these questions, a total of 6182 answers were identified. We only selected the entries with a final grade as this is an indication that students went through all learning stages until the examination. To include the answers that presented learners' learning process or experience about preparing for IELTS in a self-directed way, we further screened the answers based on the following criteria: (1) These answers should be relevant to preparing for IELTS in a self-directed way; (2) They should be written by users instead of educational institutions; (3) They are about sharing learning experiences; and (4) They should not contain advertisements. Finally, 29 posts from an online platform for knowledge exchange were screened as the data. The coding of 29 answers was carried out based on a theory-driven framework.

The findings revealed that the process experienced by these language learners included four phases, namely *learning task initiation, forethought, performance*, and *self-reflection* phases. *Motivation for English learning* and *self-directed learning* were identified in the *learning task*

initiation phase. The *forethought phase* included *goal setting, strategic planning, task value* and *self-efficacy*. Learners set their goals of target scores and small learning goals based on their needs, and make the strategic plans by understanding the test, selecting appropriate materials and making study plans. Some of them considered self-directed learning feasible for IELTS preparation, and they also perceived their self-learning ability through a self-test or by referring to their prior self-learning experience. The *performance phase* consisted of *task strategies, help-seeking, management, interest incentives, self-consequences, self-recording* and *self-monitoring*. Twelve cognitive and four metacognitive strategies were presented. Learners solicited support from teachers, peers, internet, native speakers, and parents, and managed the environment, resources, effort, and time during the learning process. Learners used some methods to motivate themselves and remain persistent. Additionally, they made recordings about their learning process and monitored the production and comprehension in the process. *Self-evaluation* and *self-reaction* were identified in the *self-reflection phase*. Participants evaluated their performance by using their final grades and they made suggestions and concluded the difficult parts and successful self-directed learning requirements when reflecting on the whole learning process.

In **Chapter 4**, we investigated the factors influencing university students' utilization of mobile technology for self-directed language learning outside the classroom. The central research question focused on exploring the interconnections among attitude, subjective norm, self-efficacy, and behavioral intention. Additionally, it aimed to explore how intention, facilitating conditions, and self-regulation skills relate to the utilization of mobile technology in self-directed language learning. Furthermore, the research delved into the potential moderating role of self-regulation skills on intention and actual usage. The theoretical framework employed for this investigation was the Integrative Model of Behavior Prediction (IMBP) proposed by Fishbein and Ajzen (2010). A questionnaire was developed to collect data, including demographic information, self-regulation skills, activities students engaged in when using mobile technology for self-directed English language learning, and factors such as attitude, subjective norm, self-efficacy, facilitating conditions, behavioral intention, and actual behavior. The participants targeted for this study were students from various disciplines in Chinese universities engaged in self-directed English language learning. A total of 676 students participated in the survey, and Structural Equation Modeling (SEM) using Mplus 8.3 (Muthén & Muthén, 2017) was employed for data analysis.

The findings revealed that 37.1 percent of respondents never utilized mobile technology for self-directed language learning, with the majority exhibiting extrinsic motivation. Over 50% of participants engaged in self-directed English learning to pass language tests or to enhance future work or study opportunities. Most participants primarily used mobile technology for activities such as vocabulary learning and translation, compared to other language skills like listening, speaking, reading, and writing. Moreover, the results indicated that attitude towards mobile technology had the most significant predictive power on students' behavioral intention, while subjective norm was positively associated with behavioral intention. Both behavioral intention and self-regulation skills positively and significantly predicted actual behavior. Surprisingly, no significant relationship was found between self-efficacy and behavioral intention. Notably, a significant moderation effect of self-regulation skills on the relationship between intention and behavior was observed, indicating that higher self-regulation skills enhance the likelihood of transforming behavioral intention into actual behavior compared to lower self-regulation skills.

After examining the factors influencing students' initial adoption of mobile technology in self-directed learning, **Chapter 5** moved to focus on continued usage and satisfaction. To achieve this goal, we employed a quantitative study to examine the factors affecting learners' persistence and satisfaction when conducting SDLLMT. It also sought to investigate whether differences in SDLLMT existed between students with high and low language proficiencies. A total of 446 respondents visited the questionnaire website and 352 completed the questionnaire. Four stages of analyses were performed, including an independent sample *t*-test, the measurement model, the structural model, and a mediation analysis. The research questions that guided this study were (1) Is there any difference in SDLLMT between students with high and low language proficiency?; (2) How is learners' satisfaction explained by teacher support, learners' mobile readiness and engagement in SDLLMT?; (3) How is learners' persistence explained by teacher support, learners' mobile readiness and engagement in SDLLMT?; and (4) How do mobile readiness and engagement mediate the relationship between teacher support and both outcome variables of SDLLMT?

The findings revealed that students with varying levels of language proficiency did not exhibit statistically significant differences in their mobile readiness, engagement, satisfaction, persistence, or the level of teacher support they received. Moreover, teacher support was

significantly and positively associated with learners' mobile readiness. This suggests that teachers play a crucial role in enhancing students' self-directed learning skills, bolstering their perceived ability to utilize mobile technology, and their recognition of its benefits in language learning. Furthermore, learners' mobile readiness made a substantial contribution to their engagement in SDLLMT. This suggests that students who exhibit greater readiness for mobile learning, characterized by enhanced self-directed learning abilities, favorable attitudes toward the effectiveness of mobile technology in language acquisition, and increased confidence in its utilization, are inclined to sustain higher levels of engagement throughout their learning journey. While teacher support was significantly but negatively correlated with learners' engagement, it exhibited an indirect and positive impact on engagement by mediating through mobile readiness. This suggests that learners who receive more support from teachers tend to have higher mobile readiness, leading to increased engagement in SDLLMT. Although some self-directed learners may prefer autonomy in their learning, many may still require guidance from teachers to navigate their self-directed learning journey effectively. Moreover, mobile readiness significantly and positively predicted learners' satisfaction and persistence. However, the relationship between mobile readiness and persistence remains unclear since Leung and Chen (2019) have shown partially significant relations between mobile readiness and persistence. Therefore, it warrants further investigation. Additionally, teacher support did not significantly influence learners' satisfaction or persistence in SDLLMT, highlighting the need for deeper exploration of these relationships in the context of self-directed learning. While engagement did not directly relate to satisfaction, it had a direct effect on persistence. This finding contrasts with previous studies that suggested engagement could predict satisfaction (Fisher et al., 2021; Rajabalee & Santally, 2020). Thus, further research is needed to explore the nuanced relationships between the subdimensions of engagement and satisfaction, potentially through interview analysis to gain deeper insights into these dynamics.

Chapter 6 concluded this dissertation by reflecting on the main research findings of four studies, presenting the discussion in terms of learning experience and learning effectiveness, and providing directions for future research to further enhance our understanding of self-directed language learning using mobile technology in higher education.

The current dissertation deepens our comprehension of informal and self-directed learning with mobile technology in the subject of foreign language in higher education. Specifically, it

enhances our comprehension of the learners' experience of self-directed their learning process while preparing for IELTS, and offers implications for enhancing the effectiveness of self-directed learning for learners, educators, and IT practitioners. **Chapter 2** and **3** provide valuable insights into how learners navigate their self-directed learning process with the aid of mobile technology. However, there is a need for increased attention to be directed towards the self-reflection phase and affective aspects of learning. Moreover, **Chapters 4** and **5** delve into the factors influencing the initial adoption and continued usage of mobile technology in self-directed learning. The findings underscore the importance of learners' variables while also highlighting the crucial role of teacher support.

This dissertation makes several significant contributions to the field of informal and self-directed language learning with mobile technology in higher education. Researchers, self-directed learners, teacher educators, and IT practitioners stand to benefit from the insights provided, as the dissertation not only presents a comprehensive conceptual model for informal and self-directed learning with mobile technology in the context of foreign language education, but also identifies key determinants for student self-directed learning. Furthermore, it underscores the importance of ongoing efforts in advancing future research and practices related to self-directed learning. One notable contribution of this dissertation is its provision of a conceptual model outlining the dynamics of informal and self-directed language learning with mobile technology, along with a delineation of essential determinants influencing student self-directed learning. This model serves as a valuable framework for understanding and analyzing self-directed learning processes in the context of foreign language education. Moreover, the dissertation emphasizes the need for continuous exploration of self-directed learning, thereby paving the way for future research endeavors. Several directions for future research are identified based on the findings of the dissertation. Firstly, while the dissertation covers aspects such as students' learning experiences, perceptions, actual usage, satisfaction, and persistence, it does not delve deeply into learning outcomes and the affective domain. Future research could explore these dimensions to gain a comprehensive understanding of self-directed learning processes. Secondly, there is a call for research to investigate how facilitators can effectively support self-directed learning. Understanding the role of facilitators and identifying best practices in this regard can significantly enhance the efficacy of self-directed learning interventions. Thirdly, future research endeavors could leverage multiple methods of data collection to enrich the understanding of self-directed

learning processes. For instance, incorporating recorded data to track learners' actual usage, engagement, and persistence, along with employing sentiment analysis techniques to analyze learners' emotional perceptions from comments and reviews, can provide valuable insights into satisfaction and other affective aspects of self-directed learning.

The dissertation carries significant implications for empowering self-directed learners, educators/teachers, and software developers in the realm of language learning with mobile technology. Firstly, self-directed learners are encouraged to undertake necessary preparatory work before embarking on self-directed learning journeys. It is evident that self-directed learning is more conducive for intermediate and advanced language learners compared to beginners. Therefore, learners should attain a basic proficiency level and cultivate self-directed learning skills in order to make substantial progress in their language learning endeavors. Moreover, the positive influence of subjective norms, as revealed in Chapter 4, emphasizes the critical roles played by various agents such as teachers, peers, and parents in supporting learners' self-directed learning. Hence, these agents should offer assistance and encouragement as needed to facilitate learners' self-directed learning processes. Furthermore, Chapter 2 highlights that self-directed learners often possess limited knowledge of strategies and technology utilization. Teachers can play a pivotal role in bridging this gap by providing a diverse range of technological resources, imparting metacognitive and cognitive strategies to optimize resource utilization, and fostering active engagement with technology to enhance language learning outcomes. Lastly, software developers can contribute to enhancing self-directed language learning experiences by integrating more personalized and adaptive learning features into their applications. By incorporating features that cater to individual learning needs and preferences, developers can create a supportive and conducive learning environment, ultimately maximizing the effectiveness of mobile language learning applications.

Nederlandse samenvatting

In de hedendaagse, onderling verbonden, wereld is het vermogen om in meerdere talen te communiceren niet alleen een voordeel maar vaak ook noodzakelijk. Taalvaardigheden openen deuren naar een overvloed aan mogelijkheden, variërend van loopbaangroei, effectieve samenwerking, kennisdeling en culturele verrijking. Traditioneel is taalonderwijs beperkt gebleven tot de muren van klaslokalen, met gestructureerde leerplannen en begeleid door docenten. Echter, het landschap van taalonderwijs evolueert snel, gedreven door technologische vooruitgang en verschuivende pedagogische paradigma's. Een van de meest prominente trends in hedendaags taalonderwijs is de opkomst van zelfgestuurd leren (SDL) buiten de klasomgeving dat wordt gefaciliteerd door mobiele technologie. SDL, zoals uiteengezet door Knowles (1975), benadrukt de actieve rol van studenten bij het overnemen van de regie over hun leerproces. Hoewel SDL overeenkomsten vertoont met zelfgereguleerd leren (SRL), met name wat betreft actieve betrokkenheid en doelgericht gedrag, verschilt het in het niveau van controle dat studenten uitoefenen, met name aan het begin van het leerproces (Loyens & Rikers, 2008). Zelfsturende studenten initiëren leeractiviteiten onafhankelijk, terwijl zelfregulerende studenten dat niet per se doen. Mobiele technologie in dit onderzoek verwijst naar draagbare elektronische apparaten zoals smartphones, tablets en laptops, evenals de software en applicaties die daarop zijn ontworpen. Met de alomtegenwoordigheid van deze technologieën hebben studenten nu ongekende toegang tot een schat aan hulpmiddelen voor het leren van een taal. Van taal-leerapps en online cursussen tot podcasts en sociale media platforms, de mogelijkheden voor zelfgestuurd leren van een taal zijn praktisch eindeloos. De interactiviteit van mobiele technologie, inclusief quizzen en spelletjes, bevordert betrokkenheid en vaardigheidsversterking. Personalisatie past leerervaringen aan op basis van individuele doelen en vaardigheidsniveaus. Synchronisatie over apparaten zorgt voor gemak bij het monitoren van de leerprogressie, terwijl sociale functies interactie met leeftijdsgenoten en moedertaalsprekers vergemakkelijken. Hiermee geeft mobiele technologie studenten de mogelijkheid om diverse, interactieve en gepersonaliseerde taallerende ervaringen op te doen, ongeacht tijd of locatie.

In het hoger onderwijs blijft de integratie van het leren van vreemde talen in het kerncurriculum van specifieke disciplines beperkt. Bovendien worden studenten in sommige

regio's geconfronteerd met een gebrek aan adequate blootstelling aan vreemde talen in de klas, wat hun taalverwervingstraject belemmert (Richards, 2015; Trinder, 2017; Tsou et al., 2006). Om deze kloof te overbruggen, omarmen veel studenten zelfgestuurd taal leren via mobiele technologie (in het Engels: self-directed language learning via mobile technology (SDLLMT)) om hun taalvaardigheden buiten het formele onderwijs te verbeteren. SDLLMT stelt individuen in staat om de regie over hun taal-leertraject te nemen, waarbij zij bepalen wat en hoe te leren (Merriam & Bierman, 2013). Dit wordt mogelijk gemaakt door het gebruik van mobiele applicaties zoals italki, Babbel, Duolingo, HelloTalk, Tandem, YouTube en Google Translate. Ofschoon studenten hulp kunnen krijgen van docenten of medestudenten, berust het proces voornamelijk op de initiatie door en zelfregulatie van de studenten (Lai et al., 2022). Deze aanpak stelt studenten in staat om hun leerervaringen aan te passen op basis van hun unieke behoeften en voorkeuren, wat een meer flexibel en effectief taalverwervingsproces bevordert buiten de grenzen van klaslokalen. Bovendien bevordert zelfgestuurd leren buiten de klas autonomie en zelfmotivatie bij studenten. Door hen de vrijheid te geven om hun eigen leerdoelen te stellen, hun voortgang te beheren en verantwoordelijkheid te nemen voor hun leerresultaten, bevordert deze aanpak een gevoel van eigenaarschap en agency. Daardoor blijven studenten meer betrokken, zetten zij meer door en breieken zij uiteindelijk een betere vaardigheid in de doeltaal.

Onderzoek toont aan dat zelfgestuurd taal leren met technologie correleert met positieve affectieve uitkomsten en verbeterde taalvaardigheid (Lai et al., 2015; Sundqvist & Wilström, 2015). Echter, studenten vertonen diverse patronen in hun zelfgestuurd technologiegebruik (Lai & Gu, 2015). Een beter begrip van deze patronen kan docenten en onderzoekers helpen om mogelijkheden te identificeren voor het ondersteunen en verbeteren van het gebruik van technologie door studenten voor zelfgestuurd taal leren.

Deze dissertatie heeft tot doel bij te dragen aan ons begrip van zelfgestuurd taal leren in het hoger onderwijs met behulp van mobiele technologie, met de nadruk op de leerervaring en leereffectiviteit van het zelfgestuurde universiteitsstudenten die een taal willen leren met behulp van technologie. Er zijn vier studies ontworpen om het volgende beter te begrijpen (1) de leerstrategieën die studenten gebruiken in hun zelfgestuurde leerproces; (2) de leerervaring van zelfgestuurde studenten bij het voorbereiden op IELTS; (3) de determinanten die van invloed zijn op de gedragsintentie en daadwerkelijk gebruik van mobiele technologie in hun zelfgestuurd leren; en (4) de factoren die van invloed waren op leerbetrokkenheid, leertevredenheid en

leerdoorzettingsvermogen in de context van zelfgestuurd taal leren met behulp van mobiele technologie. De bevindingen van deze dissertatie leiden tot implicaties voor de onderwijspraktijk, onderwijsbeleid en toekomstige innovaties in taalonderwijs.

Hoofdstuk 2 presenteert een systematische thematische review met als doel een overzicht te bieden van empirisch onderzoek naar leerstrategieën die zelfgestuurde studenten met de ondersteuning van mobiele technologie gebruiken bij het leren van talen. De centrale onderzoeksvraag in deze studie was welke cognitieve strategieën, metacognitieve strategieën, affectieve strategieën en sociale strategieën studenten gebruiken tijdens hun zelfgestuurde taal leren met behulp van mobiele technologie. Om deze vraag te beantwoorden, hebben we de Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA)-uitbreiding voor verkennende reviews (Tricco, Lillie, Zarin et al., 2018) als ons leidend kader aangenomen. Met behulp van deze richtlijnen hebben we systematisch 20 relevante studies beoordeeld, waarbij we informatie zoals auteursnamen, publicatiejaren, de taalvaardigheidsniveaus van deelnemers en leeractiviteiten beschreven in elke studie hebben geëxtraheerd. Uit elke geselecteerde studie hebben we informatie over leeractiviteiten uit zowel de resultaten- als conclusiesecties gehaald. Deze activiteiten werden vervolgens gecodeerd en gecategoriseerd als cognitieve, metacognitieve, affectieve of sociale strategieën op basis van het classificatieschema van O'Malley. Deze systematische benadering stelde ons in staat om de verschillende strategieën die worden toegepast door zelfgestuurde studenten die mobiele technologie gebruiken voor taalleren uitgebreid te analyseren.

Bloom's herziene taxonomie diende als het raamwerk om cognitieve strategieën te beoordelen, referrerend naar de denkniveaus van studenten mogelijk was (Anderson et al., 2001; Crompton et al., 2019). Onder de 20 beoordeelde artikelen meldden er 16 het gebruik van cognitieve strategieën door studenten. Opmerkelijk is dat er meer strategieën werden waargenomen op de niveaus van herinneren en begrijpen in vergelijking met toepassing, analyse, evaluatie en creëren. Dit suggereert dat taalleerders voornamelijk laag-niveau leerstrategieën gebruiken in plaats van hoog-niveau strategieën. Hoewel deze laag-niveau strategieën geschikt zijn voor kortetermijnleerdoelen of memorisatietaken (Setiyadi, 2001), vereist het verbeteren van de algehele taalprestaties de integratie van hoog-niveau strategieën in het leerproces (Aharony, 2006; Setiyadi, 2001; Yot-Domíngues & Marcelo, 2017). Daarom wordt verder onderzoek aangemoedigd om hoger-niveau strategieën in taal leren te verkennen. Om metacognitieve

strategieën te categoriseren die illustreren hoe studenten hun leerproces reguleren, werden Zimmerman's cyclische zelfregulerende fasen gebruikt /Zimmernam, 2000, 2008). Van de 20 beoordeelde artikelen waren er 13 geassocieerd met metacognitieve strategieën in zelfgestuurd taal leren. Opmerkelijk is dat de voorbereidingsfase het meest frequent werd besproken, gevolgd door de uitvoeringsfase en de zelfreflectiefase, waarbij slechts twee artikelen alle drie de fasen behandelden. Drie soorten affectieve strategieën werden onderzocht. De onderzichte sociale strategieën omvatten samenwerking en vragen om verduidelijking, en hulp ontvangen. Van de 20 beoordeelde artikelen meldden er 14 sociale strategieën die werden gebruikt in het zelfgestuurde taal leren proces. Toekomstige studies worden aangemoedigd om dieper in te gaan op sociale en affectieve strategieën, gezien hun verband met effectief taal leren. De bevindingen benadrukken de noodzaak van aanvullend onderzoek om alle zelfregulerende stadia binnen het proces van zelfgestuurd leren gefaciliteerd door mobiele technologie te verkennen, evenals om de invloed van zowel studenten als docenten op dit proces te onderzoeken. Als reactie op deze geïdentificeerde onderzoeksmogelijkheden zijn Hoofdstukken 3 tot en met 5 uitgevoerd.

Het doel van Hoofdstuk 3 is om de leerervaring van taalleerders te beschrijven in de context van zelfgestuurd leren met behulp van mobiele technologie. De onderzoeksvragen zijn (1) Hoe initiëren taalleerders hun leren in de context van zelfgestuurd leren met behulp van mobiele technologie? (2) Wat doen taalleerders in de voorbereidingsfase, uitvoeringsfase en zelfreflectiefase in de context van zelfgestuurd leren met behulp van mobiele technologie? De netnografische benadering werd gebruikt om te analyseren hoe Chinese studenten Engels leerden tijdens de voorbereiding op IELTS (International English Language Testing System) in de context van zelfgestuurd leren met behulp van mobiele technologie. Uiteindelijk werden negen vragen geselecteerd. Onder deze vragen werden in totaal 6182 antwoorden geïdentificeerd. We hebben alleen de antwoorden geselecteerd die zijn gekoppeld aan een eindcijfer, omdat dit een indicatie is dat studenten alle leerfasen tot aan het examen hebben doorlopen. De antwoorden zijn vervolgens verder geselecteerd op basis van de volgende criteria: (1) Deze antwoorden moeten relevant zijn voor het voorbereiden op IELTS op een zelfgestuurde manier; (2) Ze moeten worden geschreven door gebruikers in plaats van door onderwijsinstellingen; (3) Ze gaan over het delen van leerervaringen; en (4) Ze mogen geen advertenties bevatten. Uiteindelijk werden 29 berichten van een online platform voor kennisuitwisseling geselecteerd. De codering van deze 29 antwoorden werd uitgevoerd op basis van een theoriegestuurd kader.

De bevindingen gaven aan dat het proces dat door deze taalleerders werd ervaren vier fasen omvatte, namelijk de initiatiefase van leeractiviteiten, de voorbereidingsfase, de uitvoeringsfase en de zelfreflectiefase. Motivatie voor het leren van Engels en zelfgestuurd leren werden geïdentificeerd in de initiatiefase van leeractiviteiten. De voorbereidingsfase omvatte het stellen van doelen, strategische planning, taakwaarde en zelfeffectiviteit. Studenten stelden hun streefscores en kleine leerdoelen vast op basis van hun behoeften, en maakten strategische plannen na het doorgronden van de test, het selecteren van geschikte materialen en het maken van studieplannen. Sommigen van hen beschouwden zelfgestuurd leren als geschikt voor de IELTS-voorbereiding, en ze maten ook hun zelf-leerbaarheid door middel van een zelftest of door te verwijzen naar hun eerdere zelf-leerervaring. De uitvoeringsfase bestond uit taakstrategieën, hulp zoeken, management, interesse-incentives, zelfconsequenties, zelfopname en zelfbewaking. Twaalf cognitieve en vier metacognitieve strategieën werden gepresenteerd. Studenten vroegen ondersteuning van leraren, medestudenten, internet, moedertaalsprekers en ouders, en beheerden de omgeving, middelen, inspanning en tijd tijdens het leerproces. Studenten gebruikten enkele methoden om zichzelf te motiveren en vol te houden. Zelfevaluatie en zelfreactie werden geïdentificeerd in de zelfreflectiefase. Deelnemers evalueerden hun prestaties door gebruik te maken van hun eindcijfers en ze trokken conclusies over welke onderdelen moeijlijk waren en welke vereisten zijn gesteld aan zelfsturing tijdens het reflecteren op het gehele leerproces.

In Hoofdstuk 4 onderzochten we de factoren die van invloed zijn op het gebruik van mobiele technologie door universiteitsstudenten voor zelfgestuurd taal leren buiten het klaslokaal. De centrale onderzoeksvraag richtte zich op het verkennen van de verbanden tussen attitude, subjectieve norm, zelfeffectiviteit en gedragsintentie. Daarnaast beoogde het te onderzoeken hoe intentie, faciliterende omstandigheden en zelfregulerende vaardigheden verband houden met het gebruik van mobiele technologie in zelfgestuurd taal leren. Bovendien onderzochten we de mogelijke modererende rol van zelfregulerende vaardigheden op intentie en daadwerkelijk gebruik. Het theoretisch kader dat voor dit onderzoek werd gebruikt, was het Integratieve Model van Gedragsvoorspelling (IMBP) voorgesteld door Fishbein en Ajzen (2010). Een vragenlijst werd ontwikkeld om gegevens te verzamelen, waaronder demografische informatie, zelfregulerende vaardigheden, activiteiten waarbij studenten betrokken waren bij het gebruik van mobiele technologie voor zelfgestuurd Engels taal leren, en factoren zoals attitude, subjectieve norm, zelfeffectiviteit, faciliterende omstandigheden, gedragsintentie en daadwerkelijk gebruik. De

deelnemers die voor dit onderzoek werden geselecteerd, waren studenten uit verschillende disciplines aan Chinese universiteiten die betrokken waren bij zelfgestuurd Engels taal leren. In totaal hebben 676 studenten deelgenomen aan de enquête, en structurele vergelijkingenmodelering (SEM) met Mplus 8.3 (Muthén & Muthén, 2017) werd gebruikt voor de gegevensanalyse.

De bevindingen gaven weer dat 37,1% van de respondenten nooit mobiele technologie gebruikte voor zelfgestuurd taal leren, waarbij de meerderheid extrinsieke motivatie rapporteerde. Meer dan 50% van de deelnemers was betrokken bij zelfgestuurd Engels leren om taaltesten te halen of om toekomstige werk- of studiekansen te verbeteren. De meeste deelnemers gebruikten mobiele technologie voornamelijk voor activiteiten zoals woordenschat leren en vertalen, en minder voor andere taalvaardigheden zoals luisteren, spreken, lezen en schrijven. Bovendien wezen de resultaten uit dat attitude ten opzichte van mobiele technologie de grootste voorspellende kracht had op de gedragsintentie van studenten, terwijl subjectieve norm positief geassocieerd was met gedragsintentie. Zowel gedragsintentie als zelfregulerende vaardigheden voorspelden positief en significant daadwerkelijk gedrag. Verrassend genoeg werd geen significant verband gevonden tussen zelfeffectiviteit en gedragsintentie. Opmerkelijk was een significant moderatie-effect van zelfregulerende vaardigheden op de relatie tussen intentie en gedrag, wat aangeeft dat hogere zelfregulerende vaardigheden de kans vergroten dat gedragsintentie wordt omgezet in daadwerkelijk gedrag.

Na het onderzoeken van de factoren die van invloed zijn op de initiële adoptie van mobiele technologie in zelfgestuurd leren, richtte Hoofdstuk 5 zich op voortgezet gebruik en tevredenheid. Hiertoe hebben we een kwantitatieve studie uitgevoerd om de factoren te onderzoeken die van invloed zijn op de volharding en tevredenheid van studenten bij het uitvoeren van zelfgestuurd taal leren met behulp van mobiele technologie. Het onderzocht ook of verschillen in zelfgestuurd taal leren met mobiele technologie bestonden tussen studenten met een hoog en laag taalvaardigheidsniveau. In totaal bezochten 446 respondenten de vragenlijstwebsite en 352 voltooiden de vragenlijst. Vier stadia van analyses werden uitgevoerd, waaronder een onafhankelijke steekproeftoets, het meetmodel, het structurele model en een mediatie-analyse. De onderzoeksvragen voor dit onderzoek waren (1) Is er een verschil in zelfgestuurd taal leren met mobiele technologie tussen studenten met een hoog en laag taalvaardigheidsniveau?; (2) Hoe wordt de tevredenheid van studenten verklaard door de ondersteuning van leraren, de mobiele gereedheid van studenten en betrokkenheid bij zelfgestuurd taal leren met mobiele technologie?;

(3) Hoe wordt de volharding van studenten verklaard door de ondersteuning van leraren, de mobiele gereedheid van studenten en betrokkenheid bij zelfgestuurd taal leren met mobiele technologie?; en (4) Hoe mediëren mobiele gereedheid en betrokkenheid de relatie tussen ondersteuning van leraren en beide resultaatvariabelen van zelfgestuurd taal leren met mobiele technologie?

De bevindingen toonden aan dat studenten met verschillende taalvaardigheidsniveaus geen statistisch significante verschillen vertoonden in hun mobiele gereedheid, betrokkenheid, tevredenheid, volharding of het niveau van ondersteuning van leraren die ze ontvingen. Bovendien was ondersteuning van leraren significant en positief geassocieerd met de mobiele gereedheid van studenten. Dit suggereert dat leraren een cruciale rol spelen bij het verbeteren van de zelfgestuurde leervaardigheden van studenten, waardoor hun waargenomen vermogen om mobiele technologie te gebruiken wordt versterkt en hun erkenning van de voordelen ervan bij taalverwerving wordt vergroot. Verder droeg de mobiele gereedheid van studenten aanzienlijk bij aan hun betrokkenheid bij zelfgestuurd taal leren met mobiele technologie. Dit suggereert dat studenten die meer gereedheid tonen voor mobiel leren, gekenmerkt door verbeterde zelfgestuurde leer vaardigheden, positieve houdingen ten opzichte van mobiele technologie bij taalverwerving, en verhoogd vertrouwen in het gebruik ervan, geneigd zijn om hogere niveaus van betrokkenheid te behouden gedurende hun leertraject. Hoewel ondersteuning van leraren significant maar negatief gecorreleerd was met de betrokkenheid van studenten, had het een indirect en positief effect op betrokkenheid door middel van mobiele gereedheid. Dit suggereert dat studenten die meer ondersteuning van leraren ontvangen, de neiging hebben om een hogere mobiele gereedheid te hebben, wat leidt tot een verhoogde betrokkenheid bij zelfgestuurd taal leren met mobiele technologie. Hoewel sommige zelfgestuurde studenten misschien autonomie verkiezen in hun leren, hebben velen toch begeleiding nodig van leraren om hun zelfgestuurde leertraject effectief te navigeren. Bovendien voorspelde mobiele gereedheid significant en positief de tevredenheid en volharding van studenten. De relatie tussen mobiele gereedheid en volharding blijft echter onduidelijk omdat Leung en Chen (2019) slechts gedeeltelijk significante relaties hebben aangetoond tussen mobiele gereedheid en volharding. Bovendien beïnvloedde ondersteuning van leraren de tevredenheid of volharding van studenten niet significant in zelfgestuurd taal leren met mobiele technologie, wat wijst op de noodzaak van diepgaander onderzoek naar deze relaties in de context van zelfgestuurd leren. Hoewel betrokkenheid niet rechtstreeks verband hield met

tevredenheid, had het wel een direct effect op volharding. Deze bevinding staat in contrast met eerdere studies die suggereerden dat betrokkenheid tevredenheid kan voorspellen (Fisher et al., 2021; Rajabalee & Santally, 2020). Daarom is verder onderzoek nodig om de genuanceerde relaties tussen de subdimensies van betrokkenheid en tevredenheid te verkennen, mogelijk door middel van interviewanalyse om diepere inzichten in deze relatie te krijgen.

Hoofdstuk 6 concludeerde dit proefschrift door te reflecteren op de belangrijkste onderzoeksbevindingen van vier studies, de discussie te presenteren in termen van leerervaring en leereffectiviteit, en richtingen te bieden voor toekomstig onderzoek om ons begrip van zelfgestuurd taal leren met behulp van mobiele technologie in het hoger onderwijs verder te verbeteren.

Dit proefschrift verdiept ons begrip van informeel en zelfgestuurd leren met mobiele technologie op het gebied van vreemde talen in het hoger onderwijs. Specifiek verbetert het ons begrip van de ervaringen van studenten met het zelfgestuurd maken van hun leerproces terwijl ze zich voorbereiden op IELTS, en biedt het implicaties voor het verbeteren van de effectiviteit van zelfgestuurd leren voor studenten, docenten en IT-professionals. Hoofdstukken 2 en 3 bieden waardevolle inzichten in hoe studenten hun zelfgestuurde leerproces uitvoeren met behulp van mobiele technologie. Er is echter behoefte aan meer aandacht voor de zelfreflectiefase en affectieve aspecten van leren. Hoofdstukken 4 en 5 gaan in op de factoren die van invloed zijn op de initiële adoptie en het voortgezet gebruik van mobiele technologie in zelfgestuurd leren. De bevindingen benadrukken het belang van studentvariabelen en wijzen ook op de cruciale rol van ondersteuning van leraren.

Deze dissertatie levert verschillende significante bijdragen aan het domein van informeel en zelfgestuurd taalleren met mobiele technologie in het hoger onderwijs. Onderzoekers, zelfgestuurde studenten, docentopleiders en IT-professionals kunnen profiteren van de inzichten die worden geboden, aangezien de dissertatie niet alleen een uitgebreid conceptueel model presenteert voor informeel en zelfgestuurd leren met mobiele technologie in de context van vreemdetalenonderwijs, maar ook belangrijke determinanten identificeert voor het zelfgestuurde leren van studenten. Bovendien benadrukt het het belang van voortdurende inspanningen om toekomstig onderzoek en praktijken met betrekking tot zelfgestuurd leren te bevorderen. Een opmerkelijke bijdrage van deze dissertatie is het bieden van een conceptueel model waarin de dynamiek van informeel en zelfgestuurd taalleren met mobiele technologie wordt beschreven,

samen met een afbakening van essentiële determinanten die van invloed zijn op het zelfgestuurde leren van studenten. Dit model dient als een waardevol kader voor het begrijpen en analyseren van zelfgestuurde leerprocessen in de context van vreemdetalenonderwijs. Bovendien benadrukt de dissertatie de noodzaak van voortdurende verkenning van zelfgestuurd leren, waardoor de weg wordt vrijgemaakt voor toekomstige onderzoeksinspanningen. Verschillende richtingen voor toekomstig onderzoek worden geïdentificeerd op basis van de bevindingen van de dissertatie. Ten eerste behandelt de dissertatie aspecten zoals de leerervaringen, percepties, daadwerkelijk gebruik, tevredenheid en volharding van studenten, maar gaat het niet diep in op leerresultaten en het affectieve domein. Toekomstig onderzoek zou deze dimensies kunnen verkennen om een beter begrip van zelfgestuurde leerprocessen te verkrijgen. Ten tweede is er een oproep om te onderzoeken hoe facilitators zelfgestuurd leren effectief kunnen ondersteunen. Het begrijpen van de rol van facilitators en het identificeren van best practices op dit gebied kan de effectiviteit van interventies voor zelfgestuurd leren aanzienlijk verbeteren. Ten derde kunnen toekomstige onderzoeksinspanningen gebruikmaken van meerdere methoden voor gegevensverzameling om het begrip van zelfgestuurd leren te verrijken. Het includeren van opgenomen gegevens om het daadwerkelijke gebruik, de betrokkenheid en de volharding van studenten te meten, samen met het gebruik van technieken voor sentimentanalyse om de emotionele percepties van studenten uit opmerkingen en beoordelingen te analyseren, kan waardevolle inzichten bieden in tevredenheid en andere affectieve aspecten van zelfgestuurd leren.

De dissertatie heeft significante implicaties voor het empoweren van zelfgestuurde studenten, docenten/leraren en softwareontwikkelaars op het gebied van taalleren met mobiele technologie. Allereerst worden zelfgestuurde studenten aangemoedigd om noodzakelijk voorbereidend werk te verrichten voordat ze aan zelfgestuurde leertrajecten beginnen. Het is duidelijk dat zelfgestuurd leren gunstiger is voor gevorderde en gevorderde taalstudenten dan voor beginners. Daarom zouden studenten een basisvaardigheidsniveau moeten bereiken en zelfgestuurde leercompetenties moeten ontwikkelen om aanzienlijke vooruitgang te boeken in hun taalleren. Bovendien benadrukt de positieve invloed van subjectieve normen, zoals weergegeven in hoofdstuk 4, de cruciale rollen die worden gespeeld door verschillende ‘agenten’ zoals docenten, medestudenten en ouders bij het ondersteunen van het zelfgestuurde leren van studenten. Daarom zouden deze ‘agenten’ hulp en aanmoediging moeten bieden om de zelfgestuurde leerprocessen van studenten te vergemakkelijken. Bovendien benadrukt hoofdstuk 2 dat zelfgestuurde studenten

vaak een beperkte kennis hebben van strategieën en technologiegebruik. Docenten kunnen een cruciale rol spelen bij het overbruggen van deze kloof door een diverse reeks technologische middelen te bieden, metacognitieve en cognitieve strategieën over te brengen om het gebruik van hulpmiddelen te optimaliseren, en actieve betrokkenheid bij technologie te bevorderen om taalleren te verbeteren. Tot slot kunnen softwareontwikkelaars bijdragen aan het verbeteren van de ervaringen van zelfgestuurd taal leren door meer gepersonaliseerde en adaptieve leermogelijkheden te integreren in hun applicaties. Door functies op te nemen die tegemoet komen aan individuele leerbehoeften en voorkeuren, kunnen ontwikkelaars een ondersteunende en bevorderlijke leeromgeving creëren, wat uiteindelijk de effectiviteit van mobiele taal-leerapplicaties vergroot.

Curriculum Vitae

Yuzhi Lai was born in Jincheng, China on August 22, 1992. Following her graduation from Zezhou No. 1 Middle School in 2011, she embarked on studying English language at Changzhi University and obtained her bachelor degree in 2015. Subsequently, she deepened her expertise by completing her MA in English Translation at Southwest University in 2017. Transitioning into the professional realm, Yuzhi commenced her career as an English teacher, where her interactions with students ignited her interest in self-directed learning and second language learning. Driven by this burgeoning curiosity, she made the pivotal decision to pursue a doctoral degree at Leiden University Graduate School of Teaching (ICLON) in 2019. Her research project focused on self-directed learning, technology-enhanced learning and second language learning.

Publications and presentations

Scientific publications

Lai, Y., Saab, N., & Admiraal, W. (2022). University students' use of mobile technology in self-directed language learning: Using the Integrative Model of Behavior Prediction. *Computers & Education*, 179, 104413. https://doi.org/10.1016/j.compedu.2021.104413

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Manuscripts under review

Lai, Y., Saab, N., & Admiraal, W. (2024). *Factors influencing university students' persistence and satisfaction towards self-directed language learning using mobile technology*. Manuscript submitted for publication.

Lai, Y., Saab, N., & Admiraal, W. (2024). *A netnography study on self-directed language learning using mobile technology*. Manuscript submitted for publication.

Conference contribution

Lai, Y., Saab, N., & Admiraal, W (2022, August). *Factors influencing foreign language learners' persistence in self-directed learning using mobile technology in higher education*. Poster presented at the European Conference on Educational Research (ECER), 22-26 August 2022, Yerevan Armenia.

Lai, Y., Saab, N., & Admiraal, W (2022, October). *Examining the factors affecting learning engagement in self-directed language learning using mobile technology in higher education*. Poster presented at The 21st World Conference on Mobile, Blended and Seamless Learning (mLearn), 10-12 October 2022, Heerlen, The Netherlands.

Lai, Y., Saab, N., & Admiraal, W (2022, June). *The impact of university students' mobile learning readiness, teacher support and engagement on satisfaction and persistence in self-directed learning with mobile technology*. Poster presented at LTA Teaching festival, 7 June 2022, Leiden, The Netherlands.

Lai, Y., Saab, N., & Admiraal, W (2022, May). *Self-directed learning using mobile technology in higher education*. At the 16th European Association of Technology Enhanced Learning Summer School on Technology Enhanced Learning (EATEL), 21-28 May, Sani, Halkidiki, Greece.

Lai, Y., Saab, N., & Admiraal, W (2022, March). *The impact of university students' mobile learning readiness, teacher support and engagement on satisfaction and persistence in self-directed learning with mobile technology*. Paper presented at ICO National Spring School, 17-18 March, Online.

Lai, Y., Saab, N., & Admiraal, W (2021, March). *Predicting Chinese university students' use of mobile technology in self-directed learning*. Round Table at ICO International Spring School, 16-18 March, Online.

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