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Enhancing willingness to communicate in English among Chinese students in the UK: the impact of MALL with Duolingo and HelloTalk

<https://doi.org/10.1515/jccall-2023-0027>

Received November 17, 2023; accepted January 1, 2024; published online February 1, 2024

Abstract: Over the past decade, mobile-assisted language learning technologies, such as smartphone applications, have become increasingly prominent in language learning; however, empirical research on how the use of mobile apps can influence students' willingness to communicate (WTC) is scarce. This study assessed two mobile apps with distinct language learning approaches: Duolingo, grounded in grammar-translation and behaviourist principles, and HelloTalk, based on social constructivist theory and communicative language learning. The research examined the impact of these apps on Chinese students' WTC in the UK. A mixed-methods approach, including a quasi-experimental design, was adopted, involving 67 International Foundation Year Chinese students from a Confucius Heritage Culture background. The participants were randomly assigned to two experimental groups (Duolingo, $N = 33$; HelloTalk, $N = 34$) and used one app for five weeks. Quantitative data were collected through pre- and post-treatment using a WTC scale and an English media usage frequency questionnaire. Qualitative data were obtained through semi-structured interviews. Results indicated that both apps enhanced WTC, with Duolingo exhibiting a slightly stronger effect. Participants displayed greater WTC with emotionally and socially connected individuals, while WTC with strangers remained lowest. Factors such as usage time, communication goals, and frequency of use influenced participants' WTC with various groups of people.

Keywords: mobile-assisted language learning; Duolingo; HelloTalk; Chinese international students; willingness to communicate

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1 Introduction

Mobile-Assisted Language Learning (MALL) has gained prominence with the advent of mobile technologies, which facilitate learning through increased accessibility and learner autonomy (Burston, 2015; Kukulska-Hulme, 2016). The ubiquity of mobile devices like smartphones and tablets has revolutionized language education, providing learners with the flexibility to engage with language resources beyond the confines of traditional classrooms (Kukulska-Hulme, 2021). This has led to a growing interest in the effectiveness of mobile apps in enhancing language learning, with a particular focus on learners' willingness to communicate (WTC) in a second language (L2), which is a key factor of language use and acquisition (Peng, 2019).

WTC as the propensity to initiate communication when free to do so, plays a pivotal role in L2 learning and use (MacIntyre & Charos, 1996). In the context of mobile learning, understanding the nexus between MALL and WTC can offer valuable insights into improving communicative competence and learner engagement, which are vital for successful language acquisition (Sung et al., 2015). However, research exploring this connection, particularly among Chinese students learning English, remains limited. These students face unique challenges such as linguistic differences, cultural communication disparities, and learning style transitions, which can all influence their WTC in English (Ching et al., 2017).

This study examines two popular mobile apps that incorporate very different language learning paradigms: Duolingo and HelloTalk. Duolingo, a leader in the language app market since 2011, operates on grammar-translation and behaviourist principles, offering structured learning paths and focusing on vocabulary and sentence structure repetition (Loewen et al., 2019). HelloTalk, though less popular, is innovative in its communication-centred approach. Established in 2012, it fosters language practice through interaction with native speakers, embodying social constructivist and communicative language learning theories (Rivera, 2017).

The study addresses the gap in understanding how MALL influences the WTC of learners from Confucius Heritage Culture (CHC) backgrounds by focusing on Chinese international students in the UK, a group representing a significant portion of the global international student population (Darasawang & Reinders, 2021; Yang et al., 2021). By analysing and comparing the effects of Duolingo and HelloTalk on these students' WTC, this research offers insight into the apps' utility and the variables affecting their efficacy.

The significance of this study lies in its exploration of how different MALL applications, rooted in distinct educational philosophies, can influence Chinese students' WTC in English. The findings aim to guide the design of more effective mobile learning tools and strategies, enhancing L2 communicative competence and

engagement. This research not only contributes to the existing literature on MALL but also addresses the practical need for innovative educational solutions to support the growing multilingual global community.

2 Literature review

2.1 Mobile-assisted language learning

Mobile-assisted language learning (MALL) utilises mobile technologies, including smartphones and tablets, to bolster language education, a field growing in popularity due to these devices' ubiquity and their capacity to render language learning more accessible and interactive (Burston, 2015; Kukulska-Hulme, 2021). MALL's primary advantage lies in its facilitation of learning at any time and place, fostering learner autonomy as individuals tailor their study to personal needs and preferences (Godwin-Jones, 2011; Pegrum, 2014; Stockwell & Hubbard, 2013). It also offers immediate feedback, crucial for learners to refine their strategies (Chinnery, 2006; Jeong, 2022), and supports collaborative learning through connectivity with peers and native speakers, enhancing authentic communication and cultural exchange (Viberg & Grönlund, 2013). Additionally, the multimedia and interactive elements in MALL applications are believed to boost motivation and engagement (Duman et al., 2015).

While MALL presents many advantages, it also carries certain drawbacks. Mobile apps like Duolingo and HelloTalk are not comprehensive substitutes for traditional language instruction, falling short in teaching specific language registers and precise pronunciation. For example, the use of smart technologies such as AI has been found to occasionally provide misleading feedback (Rusmiyanto et al., 2023). Their content often emphasises everyday dialogue over rigorous academic language learning (Li et al., 2017). Nevertheless, used alongside conventional methods, these apps can supplement and enrich language learning (Godwin-Jones, 2014).

Prior research on MALL has investigated various aspects of language learning, such as vocabulary acquisition (Alavinia & Qoitassi, 2013; Aziz & Fageeh, 2013), listening and speaking skills (Kassaie et al., 2021; Xu, 2020), and reading and writing abilities (Estarki & Bazayr, 2016). These studies have reported positive effects of MALL on language learning outcomes (Alzubi, 2021), although the extent of the impact may vary depending on factors such as the specific mobile technologies used, the learners' proficiency levels, and the instructional context. Moreover, studies have explored the relationship between MALL and specific language learning constructs, such as motivation (Wu, 2015), self-efficacy (Yang, 2020), and WTC (Chhum & Champakaew, 2019; Lee & Lu, 2023).

Despite the growing body of research on MALL's affordances, such as portability, accessibility, interactivity, and ubiquity, there is still paucity of research on the role of specific apps, namely Duolingo and HelloTalk, in enhancing WTC and the impact of MALL on learners from diverse cultural backgrounds.

2.2 Theoretical approaches to language learning in MALL

Various theoretical approaches to language learning have informed the design and implementation of MALL apps, reflecting the diverse pedagogical principles and methods that underpin language education. In the present study the following theoretical approaches will be explained as they are closely related to the two apps applied:

2.2.1 Grammar-translation

This approach, which has its roots in the traditional teaching of Latin and Greek, focuses on the explicit teaching and understanding of grammatical rules and the translation of texts between the target language and the native language (Chang, 2011). MALL apps that adopt this approach, such as Duolingo, typically feature a structured curriculum that guides learners through a series of lessons and activities centred on drilling and emulating vocabulary and sentence structures (Duman et al., 2015; Nami, 2020; Viberg & Grönlund, 2012).

2.2.2 Behaviourism

This approach is based on the idea that language learning occurs through a process of habit formation, in which learners acquire new linguistic behaviours through repetition, practice, and reinforcement (Dastpak et al., 2017). MALL apps that incorporate behaviourist principles typically include features like spaced repetition, immediate feedback, and reward systems to motivate and reinforce learning (Burston, 2013). In addition to Duolingo, Anki is also a good example of language learning app that grounded in such approach (Duman et al., 2015).

2.2.3 Social constructivism

This approach emphasises the importance of social interaction and collaboration in the language learning process (Dastpak et al., 2017). According to social constructivism, learners develop their language skills by engaging in authentic communication with others, negotiating meaning, and co-constructing knowledge. MALL apps

adopting this approach, such as HelloTalk, facilitate language practice through spoken or written interactions between learners and native speakers or among language learners (Mishou, 2017; Nami, 2020).

2.2.4 Communicative language teaching (CLT)

This approach prioritises the development of communicative competence, focusing on the functional aspects of language and the ability to use language effectively and appropriately in various social contexts (Dos Santos, 2020). CLT encourages learners to engage in meaningful communication and problem-solving activities that reflect real-life situations. MALL apps that incorporate this approach typically include interactive exercises, role plays, and authentic materials that promote the use of the target language for communicative purposes (Hockly, 2016; Pegrum, 2014). Other than HelloTalk, Tandem is also a good example adopting such approach.

The reviewed theories underscore the role of real-life communication, social interaction, and self-directed learning in language acquisition, which MALL can enhance. The theoretical foundation of MALL applications significantly affects learner experiences and achievements. Different pedagogical approaches vary in effectiveness for developing particular language abilities or enhancing WTC, influenced by individual learners' styles, preferences, and objectives (Nami, 2020). Therefore, it's crucial for researchers and educators to thoughtfully select the theoretical frameworks informing the design and implementation of MALL apps. This study aimed to assess two apps grounded in different language learning theories, to advance our knowledge of how MALL can be customised to support distinct learner groups and improve language learning outcomes.

2.3 Willingness to communicate in second language learning

WTC is a critical construct in second language learning, referring to an individual's propensity to engage in communication using a second language when presented with opportunities to do so (MacIntyre et al., 1998). WTC, rooted in communication apprehension theory, is influenced by factors such as linguistic competence, communicative competence, motivation, self-confidence, anxiety, cultural background, and social context (McCroskey & Richmond, 1987; Peng & Woodrow, 2010; Zarrinabadi, 2014). Taking above into consideration, an individual's fear of communication can hinder their ability to effectively engage in social interactions, particularly in L2 learning contexts.

Among the influencing factors, motivation, including extrinsic, intrinsic, and instrumental types, plays an essential role in WTC (Ushioda, 2011). Motivated

students often show greater WTC. However, there is a gap in understanding how specific types of motivation may affect WTC in the context of MALL, especially among Chinese international students. This study aims to bridge this gap by addressing the motivational aspects.

Research on WTC in second language (L2) learning has explored its relationship with different aspects of language learning, such as language proficiency (e.g., Yashima et al., 2004), motivation (e.g., MacIntyre & Charos, 1996), and learning strategies (e.g., Peng & Woodrow, 2010). These studies have generally found that higher levels of WTC are associated with better language learning outcomes and more frequent and effective L2 communication (Cao, 2014; Sadoughi & Hejazi, 2023).

Recent interest has surged in how MALL affects WTC in L2 acquisition. Many studies highlight MALL's potential to diminish communication anxiety and enhance the learning atmosphere (Gromik, 2012; Yu & Zadorozhnyy, 2021). Specifically, Huang et al. (2016) found that mobile devices have a positive impact on EFL learners' WTC, particularly for those with lower proficiency levels. Research also points to the significant role of social elements in shaping WTC. Reinders and Wattana (2012) noted a positive correlation between social presence and support in online learning and WTC, while Peng's research in 2012 and 2014 indicate that factors like group dynamics and norms are critical to WTC in Chinese EFL learners within a mobile learning framework.

While the impact of WTC on L2 learning success is well-documented, exploration of how MALL tools specifically influence WTC, especially among learners with high communication apprehension like Chinese students in UK HE context, remains limited and calls for further research.

2.4 Chinese language learners: cultural background, international study experience, and MALL

Previous research into the influence of cultural background on language learning has found that it significantly shapes learners' attitudes, motivations, and strategies (Jin & Cortazzi, 2019). In the context of Chinese learners, authors investigating the effects of Confucian Heritage Culture (CHC) suggested that its profound impact on educational beliefs and practices can lead to preferences for teacher-centred instruction, memorization, and reluctance to engage in spontaneous communication (Hu, 2002; Phuong-Mai et al., 2005). This unique cultural context may affect Chinese learners' expectations and preferences when using MALL apps, with a tendency to gravitate towards apps that emphasise structured lessons, vocabulary acquisition, and grammar practice (Gudykunst, 2012; Li et al., 2022).

MacIntyre and Gardner (1991) highlighted that language anxiety, a common issue for Chinese learners due to the fear of losing face or the pressure to perform well academically, can negatively impact WTC and L2 development (Ji, 2000; Liu & Jackson, 2011). However, Huang et al. (2016) found that MALL apps providing a safe environment, self-paced learning, and opportunities for anonymous or low-stakes communication can alleviate anxiety and promote WTC among Chinese learners.

To distinct between Chinese students in general and Chinese students in the UK HE, Bodycott (2012) emphasised the unique experiences faced by Chinese international students that can influence their language learning process and WTC. Studies conducted by Gu and Maley (2008), Gallagher (2012), Gan (2013), and Rajendran and Yunus (2021) argued that factors such as adapting to the UK educational system, social integration, and acculturative stress can impact Chinese students' language learning experiences and potentially their engagement with MALL tools. These factors should be considered when interpreting findings of studies investigating the impact of MALL on Chinese students' WTC in English.

Moreover, many studies also identified challenges for Chinese learners facing MALL context, including the digital divide, technical issues, internet restrictions, language barriers, cultural appropriateness, learner autonomy, and maintaining motivation (An et al., 2021; Chen & Li, 2010; Godwin-Jones, 2011; Huang et al., 2016; Mortazavi et al., 2021; Wu, 2015; Zhang et al., 2023; Zhang & Pérez-Paredes, 2019). To address these challenges, Liu and Chen (2015) and Wang et al. (2016) suggested incorporating translation tools, bilingual interfaces, and culturally relevant content to maximise MALL effectiveness for Chinese learners. Additionally, providing additional scaffolding, guidance, and support can facilitate the development of learner autonomy and self-regulation among Chinese learners influenced by CHC and teacher-centred instructional practices (Li et al., 2022).

In sum, accounting for Chinese learners' cultural background, international study experiences, and challenges in a MALL context is vital for the effective design and implementation of MALL interventions. Specifically, influences such as the CHC background, language anxiety, adaptation to the UK educational system, and technical issues can considerably shape learners' interaction with MALL tools. Moreover, as mentioned in Section 2.1, MALL apps while beneficial, may not sufficiently address the complexities of academic language, pointing to the importance of integrating MALL with traditional language instruction for comprehensive language learning (Kannan & Munday, 2018; Li et al., 2017). This study aims to explore these dynamics by analysing the experiences of Chinese international students in the UK HE context using Duolingo and HelloTalk, and how these tools might influence their WTC.

2.5 MALL and Chinese students' willingness to communicate in English

A handful of studies have investigated the relationship between MALL and WTC in L2 learners, with a few focusing specifically on the Chinese context. Previous research has generally shown that MALL can have a positive impact on students' WTC in L2 (Chhum & Champakaew, 2019; Luo et al., 2015). Mobile technologies can provide opportunities for authentic communication, promote learner autonomy, and reduce anxiety in language learning, all of which may contribute to increased WTC (Alzubi, 2021).

A study by Guo and Wang (2018) explored the effects of using WeChat, a popular Chinese social media platform, on EFL students' WTC. The results showed that this integration substantially boosted learners' WTC, with authentic interaction and teamwork being pivotal. Wu and Marek (2016) also discovered that MALL applications with social networking capabilities notably heightened Chinese students' WTC in English, indicating that apps promoting social engagement and real-world communication can enhance WTC. Fadilah (2018) reported similar findings, with mobile-assisted peer feedback in a business English course leading to greater WTC among Chinese learners. Nonetheless, the influence of MALL on WTC varies according to the app's design, learning environment, and individual learner differences (Lee, 2019). Therefore, more research is necessary to elucidate the dynamics between MALL and WTC in the Chinese context and to determine the effects of particular factors and methods within this interplay.

Although existing studies suggest a positive relationship between MALL and Chinese students' WTC, the specific mechanisms through which MALL influences WTC and the potential role of different MALL apps in this process remain under-explored. It's particularly important to identify how these tools can best support Chinese learners in their unique linguistic and cultural contexts. Therefore, this study aims to investigate the impact of MALL tools, specifically Duolingo and HelloTalk, on these students' WTC, offering valuable insights to enhance their engagement in English communication.

In summary, while the reviewed literature signifies the potential of MALL in enhancing learners' WTC in an L2/EFL context, it also exposes several research gaps. There is a limited understanding of how MALL can be effectively utilised to foster WTC among Chinese international students studying in UK HE, considering their unique cultural backgrounds and learning experiences. The influence of different MALL apps on students' WTC and how various factors can affect this relationship also remain unclear. Therefore, this study aims to bridge these gaps by exploring the relationship between the use of MALL apps (Duolingo and HelloTalk) and Chinese

students' WTC, and identifying factors that may influence this relationship. The following specific research questions (RQs) were formulated to guide the present study:

RQ1: Which smartphone application is more helpful in developing WTC of Chinese students with CHC background?

RQ2: What are the Chinese students' perceptions of the usefulness of the apps in developing their WTC?

RQ3: What factors may have an influence on the relationship between the use of the apps and the students' WTC?

3 Methodology

To address the proposed research questions, the study employs a mixed-methods approach with a quasi-experimental design, involving a total of 67 Chinese students studying on International Foundation Year (IFY) programmes in different UK universities, and were fully educated in Chinese mainland before coming to the UK with limited experience in app-assisted language learning.

3.1 Participants

The participants in this study were Chinese international students enrolled in IFP at various universities in the UK. The IFP is designed to help international students develop their academic English language skills and prepare them for undergraduate studies. The entrance requirements for students in terms of English competence, and the design of the IFP is similar across the UK universities. The students aim for different subjects after successfully completing the IFP. A total of 67 students aged from 18 to 22 participated in the study. They were fully educated in China's mainland before coming to the UK and had little or no experience with language learning apps, ensuring a similar cultural background and a consistent starting point. The consequences of sampling bias were limited in the present study by using multiple sampling strategies: purposive sampling in Phase 1, and convenience sampling in Phase 3.

3.2 Instruments

Data in this study was collected through questionnaires with different sections and semi-structured interviews.

- (1) **Demographic questionnaire:** The demographic questionnaire collected information about participants' age, gender, educational background, IELTS test result (including individual scores), and prior experiences of learning other foreign languages such as French and German if any. This data was used to describe the sample and control for potential confounding variables.
- (2) **Main questionnaire:** This questionnaire included three sections. The objective of the first section was to measure the WTC, using the scale adapted from McCroskey and Richmond (1987). The second section recorded the Frequencies of usage of other English media, and the third section collected the participants' estimated time of weekly usage of the assigned apps. The first two sections were administered before and after the treatment, whereas the third section was only given to participants after the five-week treatment. The WTC scale was used to assess participants' WTC in English in 20 different situations, with responses ranging from 0 (never) to 100 (always), indicating participants' WTC in the specific situation such as when facing a large audience or individuals with closer relationship. The WTC scale has been widely used in language learning research and has demonstrated good reliability and validity (Yashima et al., 2004). The Frequencies of Usage of Other English Media (Section 2) asked participants to estimate their weekly time spent on English-related activities, such as watching films or listening to music in English.
- (3) **Semi-structured interviews:** Following the treatment, semi-structured interviews were conducted with four participants from each group who volunteered to provide qualitative data. The interviews aimed to explore participants' perceptions of the usefulness of the apps in terms of developing their WTC and the factors that may have influenced the relationship between app use and WTC.

All instruments were offered in both English and Mandarin Chinese to provide the participants with the opportunity to select their preferred language to fully express their thoughts and experiences (Bryman, 2016).

3.3 Research design and procedure

This study employed the mixed-methods approach in conducting a quasi-experimental design over five weeks. The five-week treatment period served the

dual purpose of maximising the potential for observing meaningful changes in WTC and ensuring the feasibility and sustainability of the study design (Stockwell, 2010). The choice of a quasi-experimental design allows for a nuanced examination of the impact of the apps on the participants' WTC, while taking into account the challenges associated with controlling participants' language learning activities outside the scope of the study (Geers et al., 2020).

The study unfolded in three phases (see Table 1): Phase 1 (before treatment) involved the collection of quantitative data through questionnaires, including participants' demographic information, WTC scale in different situations (based on McCroskey & Richmond, 1987), and frequencies of usage of English media. In Phase 2, 67 participants were randomly allocated to two experimental groups to certify an equal distribution of demographic characteristics, such as age, gender. With 33 participants (15 male, 18 female) assigned to the Duolingo group and 34 participants (15 male, 19 female) assigned to HelloTalk, they used the assigned apps independently. All participants were required to spend 15–30 min per day, on average 1 h per week, four days per week for five weeks using the assigned apps (five-week treatment). In Phase 3 (after treatment), quantitative data was collected using the main questionnaire, and qualitative data was collected through semi-structured interviews from four participants volunteering from each of the two groups.

A control group was not included in the study for the following reasons: (1) it was not possible to control what the participants would do outside and inside the school, although the International Foundation Programme (IFP) are similarly designed across the universities, and (2) the study aimed to assess the impact of each app and determine if the two apps had different effects. The WTC of the participants was assessed before and after the language app treatment, and as participants engaged in different activities in the two apps, they served as a natural control group for each other (Geers et al., 2020).

Table 1: Research procedure and instrumentation.

Research phases	Methods	Instruments
Phase 1 Before treatment	Quantitative (Questionnaires)	Demographic information Main questionnaire (first two sections)
Phase 2 Five-week treatment	Duolingo and HelloTalk usage	Prescribed apps usage
Phase 3 After treatment	Quantitative and qualitative (questionnaires and Interviews)	Main questionnaire Semi-structured interviews

3.4 Characteristics of Duolingo and HelloTalk

It is crucial to briefly outline the main characteristics of the two apps used in this study, Duolingo and HelloTalk, to provide a clearer understanding of the type of data collected. These mobile apps are designed based on distinct theoretical approaches (see Section 2.2) to language learning, which impact their functionalities and user experiences.

Duolingo, based on grammar-translation and behaviourist approaches, offers a structured curriculum and utilises gamification to engage users. Learners complete practice tasks before progressing, focusing on vocabulary and sentence structure drills (Hopkins et al., 2015; Loewen et al., 2019). Despite introducing a paid service, Duolingo remains popular and accessible. HelloTalk, grounded in social constructivist learning theory and a communicative approach, emphasises communication over curriculum. Users engage in spoken or written interactions with self-matched global language partners, determining their learning content and methods (Hockly, 2016). HelloTalk fosters interaction and a language exchange approach.

3.5 Data analysis

The data analysis in this study involved both quantitative and qualitative methods. For the quantitative data, descriptive statistics were used to summarise the demographic characteristics of the participants and describe the pre- and post-treatment WTC scores. Regression analysis was performed to compare each app's effectiveness before and after using the assigned app, as well as to compare the effectiveness between the two apps. The two models used in analysing the quantitative data will be introduced in Section 4.1.

For the qualitative data, thematic analysis was employed to identify common themes and patterns in the interview transcripts (Braun & Clarke, 2006). The primary data coding was carried out by the author who is well-versed in the context of the study. To enhance reliability and reduce bias, an inter-rater reliability check was performed by two other PhD researchers in the field. The inter-rater reliability check resulted in a consistency rate of 92 %, indicating a high level of agreement in coding among the researchers. To ensure a thorough check of the data, six interviews out of the eight (three from each group) were evaluated, which provided a reliable representation of the overall data. The themes were used to further interpret the quantitative findings and provide insights into participants' perceptions of the apps' usefulness and the factors influencing the relationship between app use and WTC.

3.6 Ethical considerations

To ensure the ethical integrity of the study, informed consent was obtained from all participants before they were enrolled in the study. The consent forms outlined the purpose of the research, the expected time commitment, the potential benefits and risks, and the voluntary nature of participation. Participants were assured of the confidentiality and anonymity of their responses, as well as their right to withdraw from the study at any time without penalty. The study received Ethical Approval before data collection began.

4 Results

This section presents the quantitative and qualitative findings examining the impact of Duolingo and HelloTalk on Chinese international students' WTC in English. The quantitative results offer statistical evidence on this relationship across various contexts, while the qualitative analysis provides insight into students' subjective experiences and perceptions of these applications. Together, they provide a comprehensive understanding of the applications' influence on English language learning and communication willingness.

4.1 Quantitative results

This section presents the quantitative results based on the data collected by the demographic questionnaire including information such as gender, age, their IELTS score, and the WTC scale with different groups/activities. The participants are also required to provide their estimated usage time of using the assigned app after five weeks. The 20 communicational situations provided in the WTC scale were grouped into different contexts and interlocutors before carrying out the analysis, their WTC with essential services, WTC with strangers, WTC with acquaintance, WTC with friends, WTC in informal context, WTC in formal context, WTC with individual, WTC with small group, WTC with large group, and WTC with girl/boyfriend/partner. A 0 (never) – 100 (always) scale was employed for measuring the WTC.

This study uses a pre and post treatment quasi-experimental design testing the effectiveness of the treatments (using apps HelloTalk or Duolingo) on individual's WTC. The estimation is conducted using multiple regression analysis, which allows for the control of both invariant and variant factors and the assessment of treatment impacts on WTC. Specifically, Model 1 employs a standard multiple regression

framework to evaluate the overall effect of the intervention on the outcome variable of WTC:

Model 1:

$$Y_{it} = \beta_0 + \beta_1 \text{Post intervention}_{it} + \delta \text{Controls}_i + \emptyset \text{controls}_{it} + \varepsilon_{it}$$

As the individuals in this experimental setup use two apps, the differences in effectiveness between the two apps are also estimated using Model 2:

Model 2:

$$Y_{it} = \beta_0 + \beta_1 \text{Post intervention}_{it} + \beta_2 \text{InterventionType}_{it} + \beta_3 (\text{Post intervention}_{it} \times \text{InterventionType}_{it}) + \delta \text{Controls}_i + \emptyset \text{controls}_{it} + \varepsilon_{it}$$

Y_{it} represents the outcome variable of WTC with different groups for individual i at time t (denoting pre or post treatment). In the case of Model 1, β_1 is the coefficient of interest and captures the impact of using an app on the outcomes. In the case of Model 2, β_3 is the coefficient of interest and captures the difference in effectiveness of the treatment in using one app (HelloTalk) over other (vs. using Duolingo). δ and $\emptyset$ refer to time invariant and time varying control variables, respectively. Control variables are included in the models to ensure that any observed difference is due to the use of the App and not to other contextual factors. ε_{it} is the idiosyncratic error term.

Multiple regression is commonly used in educational and psychological research for evaluating intervention outcomes and has been effectively applied in studies measuring WTC (Dewaele & Dewaele, 2018). By including both pre- and post-intervention data along with control variables, this method allows for robust estimates of treatment effects, even in the presence of potential confounding variables (Cohen et al., 2003).

Table 2 reports the results for Duolingo. The findings indicate that using an app (Duolingo or HelloTalk) has a significant positive effect on WTC across different contexts and types of interlocutors. For example, the post-treatment results show that using an app increases WTC with essential services by 0.59, $p < 0.05$, strangers by 1.33, $p < 0.01$, acquaintances by 1.04, $p < 0.01$, and friends by 0.6, $p < 0.01$. Furthermore, the effects of using an app on WTC are consistent across different communication settings, including informal (1.14, $p < 0.01$), formal (0.79, $p < 0.01$), individual (0.85, $p < 0.01$), small group (1.40, $p < 0.01$), and large group (0.95, $p < 0.01$) contexts. These results suggest that using an app makes individuals more likely to engage in communication in various situations and with different types of interlocutors.

Overall, the participants showed higher WTC with people who they had emotional and social connection with, such as friends, boyfriends/girlfriends and

Table 2: Duolingo impact on WTC.

Willingness to communicate with	(1)		(2)		(3)		(4)	
	Essential services		Strangers		Acquaintances		Friends	
Post-treatment	0.54*** (0.05)	0.59** (0.25)	1.15*** (0.07)	1.33*** (0.23)	0.84*** (0.07)	1.04*** (0.24)	0.69*** (0.09)	0.60** (0.26)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
R-Squared	0.07	0.14	0.33	0.4	0.18	0.25	0.12	0.23
Observations	134	134	134	134	134	134	134	134
Willingness to communicate with								
	(5)		(6)		(7)		(8)	
	Informal		Formal		Individual		Small group	
Post-treatment	1.02*** (0.07)	1.14*** (0.23)	0.70*** (0.07)	0.79*** (0.22)	0.82*** (0.09)	0.85*** (0.26)	1.33*** (0.08)	1.40*** (0.24)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
R-Squared	0.26	0.34	0.12	0.24	0.17	0.25	0.45	0.52
Observations	134	134	134	134	134	134	134	134

Standard errors in parentheses, they are robust-clustered within individual observations, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

acquaintances, and similar impact was also observed when they were facing individuals or smaller groups of people. Moreover, participants reported lowest WTC with strangers both before and after treatment with both language learning apps.

Table 3 presents the additional effects of using HelloTalk over Duolingo, accounting for all other covariates. The overall results show that both apps have significant positive effects on WTC. The interaction term suggests that there is no significant effect of using one app over the other. There is a mild advantage in using Duolingo as the estimates are slightly higher for the outcomes in all contexts. However, the advantage is not statistically significant.

In summary, the quantitative results indicate that both Duolingo and HelloTalk have a significant positive impact on learners' WTC across different contexts and with various interlocutors. While both apps show positive effects on WTC, the comparison between Duolingo and HelloTalk suggests that Duolingo may have a more consistent impact on WTC across different contexts and interlocutors. The control variables included in the analysis reveal that factors such as time spent on various activities in English may also influence WTC. It is important to consider these factors when interpreting the results and designing future research.

One potential explanation for the positive impact of both Duolingo and HelloTalk on WTC could be the increased exposure to the target language, which in turn may boost learners' confidence and competence in communicating. Some of the qualitative results confirmed such a hypothesis. Additionally, the apps' interactive features, such as gamification and social networking, may encourage learners to engage in more authentic communication, thus enhancing their WTC in real-life situations.

Nevertheless, further research with a more rigorous experimental design with bigger sample size and longer time period would be necessary to determine the causal effects of Duolingo and HelloTalk on WTC. Additionally, future studies may explore other factors that could potentially influence WTC, such as motivation, and anxiety. More will be explained in the qualitative results.

In conclusion, this quantitative analysis demonstrates the positive impact of both Duolingo and HelloTalk on learners' WTC in various contexts and with different interlocutors. These findings answer the research question by illustrating the significant relationship between the use of these apps and an increase in WTC, confirming that they may enhance learners' communication skills and confidence, ultimately increasing their WTC. It is evident that both apps, albeit Duolingo slightly more consistently, contribute to developing WTC among Chinese international students. However, other contextual factors, such as learners' emotional and social connections with their interlocutors, play a vital role as well. This reiterates the importance of understanding these influencing factors when designing future research and pedagogical practices.

Table 3: Comparative effects of Duolingo and HelloTalk on WTC.

Willingness to communicate with	(1)		(2)		(3)		(4)	
	Essential services		Strangers		Acquaintances		Friends	
Post-treatment	0.58*** (0.09)	0.59** (0.25)	1.23*** (0.10)	1.39*** (0.22)	0.91*** (0.10)	1.10*** (0.22)	0.80*** (0.14)	0.68** (0.26)
HelloTalk	0.06 (0.27)	0.09 (0.27)	0.15 (0.20)	0.14 (0.20)	0.04 (0.25)	0.06 (0.25)	0.17 (0.26)	0.19 (0.26)
Post-treatment × HelloTalk	−0.08 (0.10)	0.01 (0.12)	−0.17 (0.14)	−0.14 (0.15)	−0.13 (0.13)	−0.13 (0.14)	−0.22 (0.17)	−0.2 (0.18)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
R-Squared	0.07	0.14	0.34	0.4	0.18	0.25	0.12	0.23
Observations	134	134	134	134	134	134	134	134
Willingness to communicate with								
	(5)		(6)		(7)		(8)	
	Informal		Formal		Individual		Small group	
Post-treatment	1.11*** (0.10)	1.21*** (0.21)	0.80*** (0.10)	0.85*** (0.22)	0.92*** (0.14)	0.95*** (0.25)	1.42*** (0.10)	0.84*** (0.10)
HelloTalk	0.09 (0.22)	0.1 (0.23)	0.21 (0.27)	0.22 (0.26)	0.14 (0.23)	0.13 (0.24)	0.04 (0.18)	0.15 (0.25)
Post-treatment × HelloTalk	−0.18 (0.14)	−0.17 (0.13)	−0.19 (0.13)	−0.14 (0.15)	−0.2 (0.18)	−0.23 (0.17)	−0.17 (0.16)	−0.14 (0.12)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
R-Squared	0.27	0.34	0.13	0.24	0.17	0.25	0.45	0.52
Observations	134	134	134	134	134	134	134	134

Standard errors in parentheses, they are robust-clustered within individual observations, ***p < 0.01, **p < 0.05, *p < 0.

4.2 Qualitative results

The qualitative methods aimed to explore the perceptions and experiences of participants using Duolingo and HelloTalk to develop their WTC in English. Four participants from each group volunteered to do the semi-structured interviews. They are Participants Abi, Chad, Eli, Gary (HelloTalk), and Participants Betty, Debbi, Fiona, Helen (Duolingo). Five key themes were identified through thematic analysis relating to participants' perceptions on (1) traditional approaches for developing WTC in English; (2) using the installed apps for developing WTC; (3) challenges faced in Developing WTC inside and outside the apps; (4) personal practices for developing WTC; and (5) future opportunities for developing WTC in English.

4.2.1 Perceptions of traditional approaches for developing WTC in English

The first theme focused on participants' perceptions of traditional approaches to developing WTC in English. Participants reported that the traditional methods of language learning were less effective in enhancing their WTC. The limitations of traditional methods include a lack of personalisation, grammar orientated, and limited opportunities for interaction. For example, Eli from the HelloTalk group mentioned that the English classes at her school were “*Typical exam-only, mute English.*” The participants acknowledged that while the traditional methods were essential for building foundational knowledge, they lacked the dynamic and engaging aspects necessary for improving WTC (see Appendix I for more).

4.2.2 Perceptions of using the installed apps for developing WTC

The second theme concerned the participants' perceptions of using Duolingo and HelloTalk for developing WTC. Overall, participants expressed positive experiences using these apps. They appreciated the personalised learning approach, real-time interactions, and immediate feedback provided by the apps. Participants also highlighted that the gamification and social features of the apps made learning more engaging and enjoyable, leading to a higher WTC. Furthermore, the apps' flexible learning environment allowed participants to practice English at their own pace, resulting in increased confidence and motivation. Betty from the Duolingo Group, for example, highlighted that by completing the practice within the app enabled her to engage in conversations outside Duolingo, which significantly improved her confidence. While participants in HelloTalk may feel redundant to communicate on similar topics outside the app (see Appendix I).

4.2.3 Perceptions of challenges faced by participants in developing WTC

While participants acknowledged the benefits of using Duolingo and HelloTalk for developing WTC, they also encountered challenges both inside and outside the apps that affected their progress. One prevalent challenge was the fear of making mistakes, which caused anxiety and hindered their willingness to engage in conversations. For instance, participants expressed that concerns over potential judgment regarding their grammatical accuracy led to reluctance in engaging in conversations with English speakers (more example in Appendix I).

Time constraints and fluctuating motivation posed other challenges for participants, who found it difficult to balance language learning with academic and personal commitments. For instance, Abi from the HelloTalk group noted the struggle to find time for consistent English practice, a sentiment echoed by others who reported waning enthusiasm when burdened with other responsibilities (refer to Appendix I for details).

Participants also faced difficulties in aligning their expectations with the reality of app-based language exchanges. HelloTalk users such as Abi often met partners on the apps with divergent goals, ranging from socialising to flirting, rather than language learning. Similarly, Duolingo users felt the app sometimes failed to meet their learning needs or provided content that was “way too easy.”

Moreover, cultural disparities and apprehension regarding discrimination presented challenges for several participants. For example, Eli, from the HelloTalk Group, expressed concerns about facing discrimination based on her race and cultural background, adversely impacting her WTC and hindering the establishment of meaningful relationships with language partners within the app. She specifically recounted an incident where her language partner jokingly referred to her pet dog as a “family snack package,” insinuating that Chinese people have indiscriminate eating habits. Eli vehemently objected to this comment, her partner apologised and justified it as a form of stereotypical humour and sarcasm prevalent in British culture and comedy. Participants acknowledged the persistence of such challenges, including comprehending regional accents and cultural nuances in spoken language.

The third theme is particularly noteworthy, as it highlights the intersection of cultural factors and linguistic challenges in shaping participants’ experiences and WTC development. Participants encountered difficulties in understanding and adapting to cultural norms, humour, and customs in their interactions with English speakers, which occasionally led to miscommunications, discomfort, or even offense. These cultural barriers, combined with linguistic hurdles such as regional accents, idiomatic expressions, and colloquial language, presented additional challenges that participants needed to overcome in their quest to enhance WTC. Consequently, it is

crucial for MALL apps to not only focus on language skills development but also to incorporate components that address cultural understanding and sensitivity, thereby fostering a more holistic and effective learning experience for users.

4.2.4 Perceptions of personal practices for developing WTC

The fourth theme centred on participants' personal strategies to enhance WTC, employing "Chinglish" – a blend of Chinese and English linguistic elements or speaking with a Chinese accent, and valuing their cultural identity in their English communication. They did not wish to lose their cultural distinctiveness post English proficiency improvement (see Appendix I for examples). This attitude highlights the need to acknowledge and respect learners' cultural and linguistic diversity in WTC development.

Additionally, participants' WTC was influenced by the conversation topics, occasions, and the specific language mode. For instance, participants showed a higher WTC when discussing their favourite topics in both written and spoken forms. Furthermore, they expressed interest in native-like communications without a preferred mode.

4.2.5 Perceptions of future opportunities for developing WTC in English

The fifth theme entailed participants' perceptions regarding future opportunities for developing WTC in English while using the apps. Participants expressed their intention to continue using Duolingo and HelloTalk, along with other learning apps, to enhance their WTC. They were also open to exploring different learning apps not specifically designed for language learning.

Participants recognised the benefits of integrating learning apps with traditional classroom settings, whilst affirming that these technological tools should complement rather than supplant established instructional practices. Moreover, participants found that incorporating humour and cultural elements into language learning through the apps made the process more engaging and contextual (see example in Appendix I). The cultural background of their language partners make a difference in their language interactions.

In conclusion, the qualitative results offer valuable insights into how Chinese international students' experience using Duolingo and HelloTalk for enhancing their WTC in English. The findings suggest that these apps offer personalised, and interactive language learning experiences, thereby positively influencing their perception of the apps' usefulness in enhancing their WTC. Furthermore, the results suggest several factors that impact students' WTC. Namely, the time committed to the app usage, and their level of familiarity with conversation partners. Although the

participants' positive experiences and intent to continue using the apps, the study also revealed challenges such as understanding cultural nuances and overcoming language anxiety.

5 Discussion

The primary aim of this study was to investigate the relationship between Chinese international students' WTC in English and their use of apps Duolingo and HelloTalk. The research also explored students' perceptions of these apps' usefulness in developing WTC and the factors that influenced this relationship. In this section the findings are discussed and organised according to the specific research questions addresses by this study.

5.1 Comparative effectiveness of Duolingo and HelloTalk on WTC enhancement

The quantitative analysis demonstrated a significant positive link between app usage and WTC enhancement, aligning with literature advocating for interactive mobile apps in language learning (Burston, 2013; Kukulska-Hulme, 2016). The qualitative feedback confirmed these apps' roles in fostering WTC, particularly through features like personalised learning and real-time interaction (Dörnyei & Csizér, 2002; Godwin-Jones, 2014). While both Duolingo and HelloTalk were beneficial, Duolingo users reported marginally higher WTC levels. This outcome was unexpected given HelloTalk's communicative design, suggesting that the cultural background of the Chinese participants and potential content repetitiveness may influence app effectiveness. Overall, Duolingo was more helpful with developing WTC among Chinese students with CHC background, albeit the statistical insignificance of the difference.

5.2 Learner insights on Duolingo and HelloTalk in WTC development

Chinese students perceived the apps Duolingo and HelloTalk as advantageous for enhancing their WTC in English, valuing the customised and interactive experiences that facilitated self-paced learning and increased both confidence and motivation (Gass & Mackey, 2014). They found the gamification and social connectivity of the apps engaging, affirming their efficacy in elevating WTC, which aligns with existing literature (Deterding et al., 2011; Godwin-Jones, 2014; Peterson, 2010).

Contrasting with studies suggesting that English learning may compromise cultural integrity (Barbosa & Ferreira-Lopes, 2023; Le & Phan, 2013; Pan & Seargeant, 2012), this research found that app-based learning did not detract from the participants' CHC cultural identity. Despite some critique of traditional CHC pedagogy, students acknowledged its fundamental role in their educational journey. Furthermore, they saw Western educational approaches, encompassing English language acquisition, as a valuable addition. This reflects a view of language learning apps as a practical tool for reconciling CHC values with the goal of developing WTC in English, amidst persistent cultural integration issues.

5.3 Influencing factors in app-enhanced WTC development

The key factors shaping the relationship between app use and students' WTC were found to be: Time and frequency of usage, goal of communication, emotional and social connection, group size, and familiarity with conversation partners:

Firstly, the study determined that consistent and regular app engagement correlates with WTC enhancement. This observation supports prior studies asserting the crucial role of practice frequency and regularity in language skill development and WTC improvement (Kim & Webb, 2022; Tode, 2008). Hence, sustained MALL app interaction could foster notable advancements in WTC.

The study also identified that the purpose behind app-mediated communication, such as honing specific language skills, or establishing friendships, significantly influenced students' WTC. This is congruent with findings from previous studies (Dörnyei & Otto, 1998; Anjomshoa & Sadighi, 2015) that underscored the profound impact of communication objectives on WTC. Hence, the diverse goals of the study's participants, whether for skill practice or partner engagement, markedly affected their WTC in English.

Moreover, the study observed enhanced WTC in participants when interacting with individuals they shared an emotional or social bond with, such as friends or romantic partners. This aligns with research emphasizing the pivotal role of affective factors and interpersonal relationships in language learning and WTC, as suggested by Khajavy et al. (2018). Thus, cultivating emotional and social connections within app-based communication contexts can potentially foster increased WTC in learners.

The findings further demonstrated that participants were more inclined to exhibit elevated WTC when engaging with individuals or smaller groups. This observation supports the assertion by Cao and Philp (2006) that learners often communicate more freely in more intimate settings, reinforcing the notion that group size and communication context significantly influence students' WTC when utilising the apps.

Participants in this study exhibited the lowest WTC with strangers both before and after treatment with the respective language learning apps. This outcome echoes the findings of prior studies (e.g. Peng & Woodrow, 2010; Riasati, 2012), reaffirming the pivotal role of comfort and familiarity with conversation partners in promoting WTC when using such applications. This emphasises the necessity of cultivating an environment in which learners can interact comfortably, thereby facilitating the enhancement of their WTC.

Other factors such as motivation fluctuations and expectation management can potentially be associated with such relationship, more in-depth studies need to be carried out in the future. This study's findings shed light on Chinese international students' use of Duolingo and HelloTalk for WTC improvement in English, highlighting how these apps offer tailored and interactive learning experiences that supplement conventional methods. It is vital to address learners' challenges, such as accent comprehension, cultural insights, language anxiety, and expectation alignment. Additionally, insights into learners' personal strategies and preferences are crucial for developing more nuanced language apps. Incorporating humour and cultural content, as demonstrated by participants, can enrich the learning experience and promote WTC.

Finally, the participants' openness to exploring other learning apps and their desire to see language learning apps integrated into traditional classroom settings highlight the evolving landscape of language education. The fusion of traditional pedagogy with digital learning tools presents opportunities for developing a more holistic approach to fostering English language WTC. Future research should explore the sustained effects of language app usage on WTC and examine additional factors affecting learner engagement and success in this domain (Hung, 2017; Liu & Huang, 2011; Zou et al., 2020).

Overall, it could be argued that smartphone apps such as Duolingo and HelloTalk have the potential to contribute significantly to the development of WTC among Chinese international students. However, it is essential to consider the challenges and factors that influence the relationship between the use of these apps and students' WTC. By addressing these challenges and understanding the personal practices and preferences of learners, future language learning apps and educational approaches can better support the development of WTC in English for international students.

6 Conclusions

This study explored the efficacy of Duolingo and HelloTalk mobile applications in fostering Willingness to Communicate (WTC) among UK-based Chinese international

students from a Confucius Heritage Culture (CHC) background. Employing a mixed-methods, quasi-experimental design, the investigation revealed that both applications exert a positive influence on WTC. Despite Duolingo's slight edge, attributed to its grammar-translation and behaviourist leanings, over HelloTalk's social constructivist and communicative language learning approach, the difference was not statistically significant, indicating the effectiveness of both apps in enhancing WTC regardless of their theoretical foundations.

Participants notably reported increased WTC within their social circles and in smaller, more intimate group interactions, indicating that these digital tools are more potent in familiar and emotionally connected settings. This nuanced understanding of context-dependent WTC can inform the strategic deployment of these applications in language instruction, recommending a focus on facilitating connections that transcend the digital interface. The qualitative dimension illuminated determinants of application impact, such as the amount of time spent on the apps, the learners' communicative objectives, and the frequency of app interaction. These insights can guide pedagogical choices and app development to better align with educational outcomes in varied social landscapes.

This study acknowledges certain limitations which must be considered when interpreting the findings. The empirical data derived from a relatively small sample of only 67 participants is limited given the vast number of Chinese students learning English globally. The short five-week period of app engagement and the reliance on self-reported measures, including hypothetical scenarios such as talking with not yet existing partner, may impact the generalisability and accuracy of the results. Such self-reporting might not fully reflect actual communication behaviours, indicating a need for corroborative observational studies. These limitations alongside the modest participant pool, highlight the necessity for caution in extending these results to the larger population of English learners.

Moving forward, this research enriches the corpus of literature on MALL applications' role in language learning and their specific impact on WTC. It provides a foundation for integrating digital tools like Duolingo and HelloTalk into language education, encouraging educators to consider the diverse learning preferences they cater to. The structured nature of Duolingo may appeal to learners favouring systematic language study, while HelloTalk's interactive design is likely to attract those who thrive on conversational practice.

Beyond immediate pedagogical applications, the study opens several avenues for future inquiry. Subsequent research could extend to different language skills, assess the longitudinal outcomes of app usage, and perhaps, most critically, evaluate these applications' effectiveness across diverse cultural landscapes. Comparing the influence of other MALL tools could reveal additional dimensions of language

learning technology. Furthermore, the interplay between such tools and various external factors, including motivation, self-efficacy, and learning preferences, merits in-depth examination.

Overall, this study highlights the potential of MALL apps like Duolingo and HelloTalk to positively impact language learners' WTC. By understanding the factors influencing these apps' effectiveness and incorporating them into teaching practices, educators can help create more engaging and effective learning experiences for students. However, further research is needed to explore the potential of MALL tools and their integration with other resources and instructor support, to ensure that these apps continue to contribute to the successful development of WTC and overall language proficiency among learners.

Appendix I: Detailed Participant Quotes from Semi-Structured Interviews

4.2.1 Perceptions of traditional approaches for developing WTC in English

Eli (HelloTalk): *"... all teacher talks, we take notes, doing translation practice and memorise vocabularies all the time. Typical mute English..."*

Helen (Duolingo): *"I actually liked memorising vocabularies and grammar structures. Thanks to those practices I got 6.5 for IELTS. But yeah...I got the lowest in speaking."*

4.2.2 Perceptions of using the installed apps for developing WTC

Gary (HelloTalk): *"since the same conversation has happened in HelloTalk with my language partners, why would I REPEAT it again with others? There is no fun in it."*

4.2.3 Perceptions of challenges faced by participants in developing WTC

Chad (HelloTalk): *"I'm not a fan talking to strangers for no reason. It's just too weird and embarrassing. I know they probably wouldn't but I'd still worry that I might get judged for it."*

Debbi (Duolingo): *“What if they don’t understand my Chinese accent? What if they think I’m stupid when I make simple grammatical mistake? I mess up he and she a lot when speaking, that’s frustrating.”*

Fiona (Duolingo): *“When I was doing my essays, even five minutes practice (on Duolingo) could kill me dead!”*

Debbi (Duolingo): *“WAY TOO EASY! So, I didn’t like it at the beginning. I thought it was a waste of my time. Why was I practising on things that I have already known?...”*

4.2.4 Perceptions of personal practices for developing WTC

Chad (HelloTalk): *“I watched The Big Bang Theory many times. Penny (the leading female character) thinks Italian accent is nice, she thinks French accent is nice. What’s wrong with Chinese accent then. It could be funny, but what’s wrong with being funny. I’m from Tianjin City, I was born funny.”*

4.2.5 Perceptions of future opportunities for developing WTC in English

Chad (HelloTalk): *“My partner and I exchanged one joke in each other’s language every day, and then we explained why it was considered funny in our respective languages and cultural settings to ensure that we both understood (it). Quality times.”*

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