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ARTICLE

The Moderating Effect of Digital Literacy between Extramural Informal Digital Learning of English and L2 Willingness to Speak

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ABSTRACT

The current study investigated the predicting effect of receptive extramural informal digital learning of English (IDLE) activities (RIA) and productive IDLE activities (PIA) on Chinese-foreign cooperation education program (CEP) students' L2 willingness to speak (WTS), and examined the moderating effect of digital literacy on the relationship between RIA/PIA and L2 WTS. Quantitative data (N = 172) were collected through a questionnaire from a university in China, and the subsequent interviews provided supplementary information. The results indicated that RIA and PIA were significant predictors of CEP students' L2 WTS, and digital literacy moderated PIA's effect on L2 WTS. This suggests that CEP students with higher frequency of participation in extramural IDLE tend to initiate speech in English more often in English speaking classes. A more significant role of RIA than PIA was discovered, owing to low frequency of PIA caused by inaccessibility and self-perceived task difficulty. In addition, L2 WTS of CEP students with high digital literacy increased as the frequency of PIA rose. The current study is distinct from previous ones as it investigated the potential moderating role of digital literacy in the effect of RIA/PIA on L2 WTS. For future research, the moderating effect of digital literacy should be further examined as the findings across relevant studies remain inconsistent.

Keywords: Willingness to Speak; Extramural Informal Digital Learning of English; Digital Literacy; Chinese-Foreign Cooperation Education Program

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1. Introduction

The establishment of Chinese-foreign cooperation education programs (CEP) and support for students studying abroad was initiated by China's Ministry of Education against the backdrop of a more closely connected world[1]. The importance of English as a second language (L2) has thus been further reinforced as English requirements for CEP students are higher compared to those from traditional university programs as the former need to finish part of their study in the cooperating university, whose main medium of instruction is English[2]. Consequently, high quality English teaching and learning contribute to CEP students' academic prospects and successful degree attainment[3].

However, university students in China, especially CEP students, have generally weak English proficiency[3], especially in speaking, which creates significant challenge for L2 learners[4]. This is aligned with the IELTS performance statistics 2023–2024, where Chinese test takers displayed weak performance compared to other 39 top-ranked nationalities, with the largest score gap seen in speaking[5]. Having difficulties thinking and tackling problems in English, CEP students prefer not to speak English in class, resulting in unsatisfactory teaching and learning outcomes in speaking[6]. In other words, these students' English speaking can be largely affected by L2 willingness to speak (WTS)[6], referring to "a readiness to enter into discourse" using a L2[7]. Empirical evidence also showed that higher L2 WTS played a significant role in improving learners' speaking performance[8], but the contributing factors of L2 WTS are still being debated upon by researchers[9].

Despite the significant role of formal classrooms for English as a second language (ESL) learning[10], with technological advancement, ESL learners are more proactively involved in English learning within digital settings[11] and are utilizing technology to initiate English acquisition outside classrooms[10]. However, only limited L2 WTS research investigated the effect of this type of English learning[12], whose definition is highly aligned with the concept of extramural informal digital learning of English (IDLE). Therefore, whether extramural IDLE affects L2 WTS requires further investigation. In view of the popularity of learning in digital environments, using technology has been given more priority[13] and encourages the development of 21-century skills such as digital literacy[14], the skills required when using technology to access, communicate, collaborate, create and evaluate information[15]. Digital literacy has been one of the most critical competences for ESL[13]. This calls for research focus on the predicting effect of extramural IDLE on L2 WTS, as well as the potential moderating role of digital literacy.

Based on the identified research gaps and practical needs for improving CEP students' L2 WTS, this study intended to address the following research questions:

1. To what extent do receptive IDLE activities (RIA) and productive IDLE activities (PIA) predict CEP students' L2 WTS?
2. Does digital literacy moderate the relationship between RIA/PIA and CEP students' level of L2 WTS?

The corresponding hypotheses (and null hypotheses) were proposed as follows:

1. PIA and RIA positively predict learners' L2 WTS.
   Null hypothesis 1: PIA and RIA do not positively predict learners' L2 WTS.
2. a. Digital literacy moderates the relationship between RIA and learners' L2 WTS.
      Null hypothesis 2a: Digital literacy does not moderate the relationship between RIA and learners' L2 WTS.
   b. Digital literacy moderates the relationship between PIA and learners' L2 WTS.
      Null hypothesis 2b: Digital literacy does not moderate the relationship between PIA and learners' L2 WTS.

To address the research questions, the researchers adopted an explanatory mixed method by distributing a questionnaire to Year-1 and Year-2 CEP students from a university (hereinafter referred to XF University) in Guangdong Province, China, followed by interviews with randomly selected respondents to elicit deeper insights that can further explain the quantitative results.

2. Literature Review

2.1. The Chinese-Foreign Cooperation Education Programs (CEP)

The Regulations of the People's Republic of China on Chinese-Foreign Cooperation in Running Schools was first adopted in 2003, and revised twice, in 2013 and 2019 respectively, for the purpose of strengthening educational cooperation with foreign countries and promoting educational development[16]. The government encourages Chinese-foreign CEP that introduce high-quality foreign educational resources in higher education[16]. The establishment of CEP is based on the cooperation between higher educational institutions of China and those of foreign countries within China's territory, with Chinese citizens as the major source of students[16].

The basic mode of CEP is 3+1, which means students study at a Chinese university for 3 years and then spend the last year studying at the cooperative foreign university, and 2+2. The admission scores of CEP are in general lower than those of traditional undergraduate programs, mostly due to the reason that in China, enrolling in CEP has been regarded as a shortcut to admission to higher-tier universities[17,18]. These students are willing to pay substantial tuition fees to pursue higher-quality education and enhance their employment prospects, but their academic performance may not be sufficiently outstanding[18].

Given that English is the principal medium of instruction and communication of CEP[2], the International English Language Testing System (IELTS) has progressively emerged as the principal instrument for evaluating the language proficiency of students enrolled in these programs[19]. The English courses incorporated constitute an indispensable and crucial part of CEP, whose implementation and quality determine whether the program can be carried out smoothly and sustainably with high quality[6].

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These articles[17,20,21] analyzed the problems and corresponding strategies in IELTS speaking teaching and learning of CEP, with similar perspectives: from the aspects of curriculum design, students and teachers. However, they only scratched the surface of the aforementioned aspects without delving deep into any one of them; nor did they specify the exact research methods employed to gather information from curriculum developers, students or teachers, thus lacking sufficient credibility. Therefore, this study chose to approach CEP students from a more micro perspective: by conducting a survey, it intended to research on the role of extramural IDLE on CEP students' L2 WTS, which plays a significant role in students' speaking performance and scores[8], and the potential moderating role of digital literacy.

2.2. L2 Willingness to speak (WTS)

L2 WTS, often termed as L2 willingness to communicate (WTC), is "a readiness to enter into discourse" using a L2[7]. WTS will be used as a more precise synonym of WTC for this study as communication can be referred to both speaking and writing, while the current research focus is on speaking. The Heuristic Model of Variables Influencing L2 WTC[7] (**Figure 1**), which serves as fundamental underpinning theory of L2 WTC research[22], presents variables influencing L2 learners' decision to participate in speaking in a 6-layer pyramid-shaped construct, with the first 3 layers representing situational influences and the latter 3 layers representing enduring influences. Among all the variables, affective variables, such as anxiety, self-confidence, motivation, enjoyment, etc., have long been perceived to play an essential role in influencing L2 learners' performance and L2 WTS[23].

The contributing factors of L2 WTS are still being debated upon by researchers[9]. L2 motivation, self-confidence and anxiety has been verified as common variables affecting L2 WTS[22,24]; however, within the current context wherein there is a prevalence of cross-cultural communication in digital settings among young English language learners, the role of technology-related factors on L2 WTS has attracted more researchers' attention[12,23]. Technology-related factors, whose importance is underpinned by global and national policies such as Thematic Action Tracks and Key Priorities 2022 of Chinese Ministry of Education, can positively af-

fect L2 WTS [25]. For instance, by adopting the online virtual reality platform Google Expeditions, learners' L2 WTS classrooms has increased [26]. Though most recent relevant studies put foci on how technology-related factors affect L2 WTS in in-class settings, an increasing number of young learners are utilizing technology to learn English outside classrooms [10]. Within such contexts, the concept of extramural IDLE, and its role on L2 WTS should be given more priority.

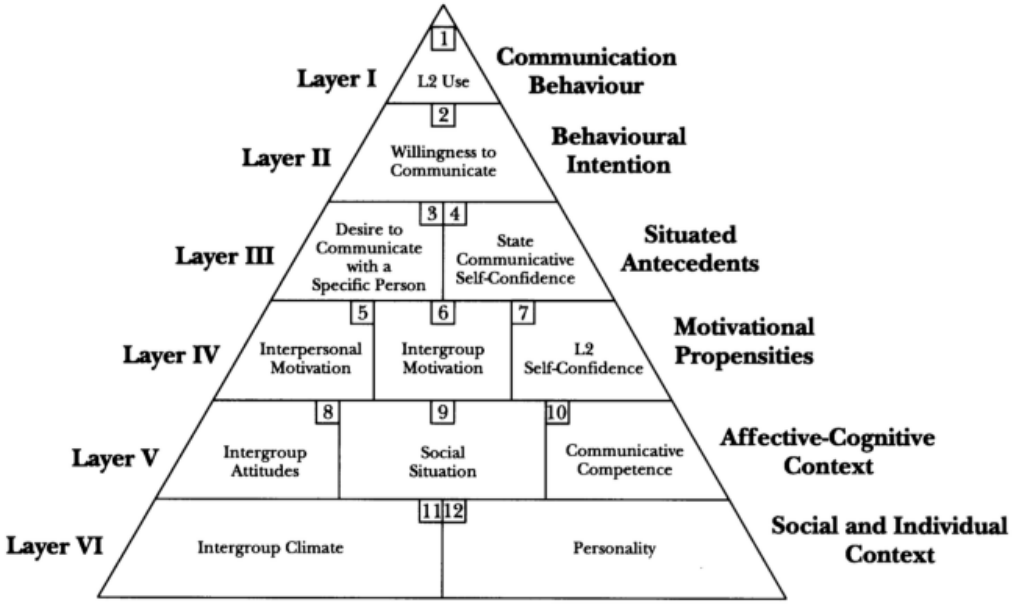

Figure 1. The Heuristic Model of Variables Influencing WTC.

Source: MacIntyre et al. [7].

2.3. Extramural Informal Digital Learning of English (IDLE)

Extramural IDLE, differentiated from formal, non-formal digital learning of English, refers to naturally self-conducted English activities out of learners' interest without teachers' assignment and assessment in out-of-class digital settings [27]. Extramural IDLE activities can be divided into 2 categories: RIA, focusing on understanding, such as reading and watching English content online, and PIA, focusing on producing English, such as speaking to others online in English [12].

The significance of extramural IDLE is firmly grounded in the acquisition-learning distinction hypothesis proposed by Krashen, which accentuates the significance of informal L2 learning without conscious focus on grammar rules as it offers abundant comprehensible input, which are essential for L2 performance and occupies an irreplaceable position, one that formal learning cannot replace [28].

Theoretically, previous digital learning studies have been based on classrooms or structured extracurricular settings [22]. Positive relationship has been discovered between formal digital learning and L2 WTS [24], but there is limited literature on the relationship between extramural IDLE and L2 WTS [12]. Extramural IDLE is a growing trend across Asia [29], and several studies have investigated the effect of extramural IDLE on L2 WTS in Korea, Indonesia, and Taiwan [24], but to the best of the researchers' knowledge, none have focused on university students from Chinese-foreign CEP. This calls for research focus on the relationship between extramural IDLE and L2 WTS of CEP students.

2.4. Digital Literacy

Digital literacy refers to skills required when using technology to access, communicate, collaborate, create and evaluate information [15]. It has been the one of the most critical competences for English as a L2 learners [13]. The Digital Competence Framework for Citizens (DigComp), initially introduced in 2013 and revised to version 2.2 in 2022 [15], offers a systematic definition of digital literacy. Within this framework, digital competence is conceptualized as the knowledge,

skills, and attitudes requisite for technological engagement, with the 'skills' domain aligned with the construct of 'digital literacy'. DigComp 2.2 comprises 5 core areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving[15] (see **Figure 2**). For each aspect, a proficiency chart (e.g. **Figure 3**) delineates levels of digital literacy attainment.

As a nascent field in academic research, digital literacy has seen limited empirical investigations. A targeted search of Web of Science revealed that few articles published between 2020 and 2024 incorporated questionnaires for evaluating students' digital literacy, and even fewer examined digital literacy as a potential moderator between extramural IDLE and L2 WTS. Therefore, the present study aimed to bridge the research gap by investigating this underexplored dimension.

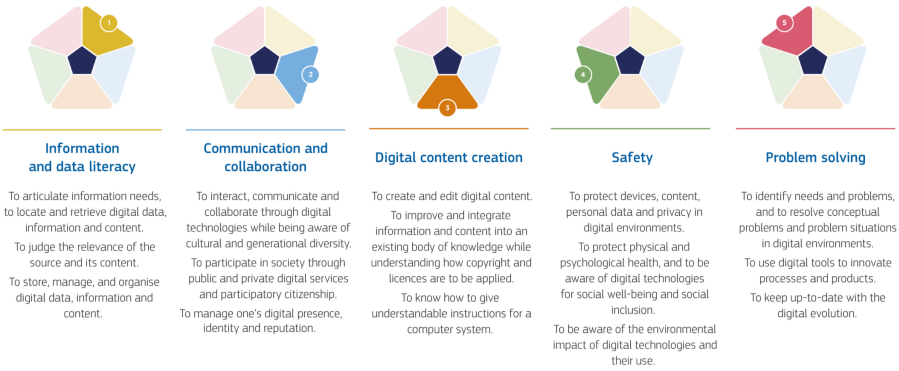

Figure 2. DigComp 2.2 areas.

Source: European Commission[15].

FOUNDATION	1	At basic level and with guidance, I can:	• **identify** my information needs, find data, information and content through a **simple** search in digital environments, • **find** how to access these data, information and content and navigate between them, • **identify simple** personal search strategies.
	2	At basic level and with autonomy and appropriate guidance where needed, I can:	• **identify** my information needs, • **find** data, information and content through a **simple** search in digital environments, • **find** how to access these data, information and content and navigate between them. • **identify simple** personal search strategies.
INTERMEDIATE	3	On my own and solving straightforward problems, I can:	• **explain** my information needs, • **perform well-defined and routine** searches to find data, information and content in digital environments, • **explain** how to access them and navigate between them, • **explain well-defined and routine** personal search strategies.
	4	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:	• **illustrate** information needs, • **organise** the searches of data, information and content in digital environments, • **describe** how to access these data, information and content, and navigate between them, • **organise** personal search strategies.
ADVANCED	5	As well as guiding others, I can:	• **respond** to information needs, • **apply** searches to obtain data, information and content in digital environments, • **show** how to access these data, information and content and navigate between them. • **propose** personal search strategies.
	6	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	• **assess** information needs, • **adapt** my searching strategy to find the **most appropriate** data, information and content in digital environments, • **explain** how to access these **most appropriate** data, information and content and navigate among them, • **vary** personal search strategies.
HIGHLY SPECIALISED	7	At highly specialised level, I can:	• **create solutions to complex problems with limited definition** that are related to browsing, searching and filtering of data, information and digital content, • **integrate** my knowledge **to contribute to professional practice and knowledge and guide others** in browsing, searching and filtering data, information and digital content.
	8	At the most advanced and specialised level, I can:	• **create solutions to solve complex problems with many interacting factors** that are related to browsing, searching and filtering data, information and digital content. • **propose new** ideas and processes to the field.

Figure 3. Information and data literacy proficiency level.

Source: European Commission[15].

3. Research Methodology

3.1. Participants

A total of 175 students from a Chinese-foreign CEP of XF University participated in the survey. These students were Year-1 and Year-2 students who have been taking IELTS speaking preparation courses offered by the program. All participants volunteered to participate in the survey. The informed consent was obtained by inviting them to read through and sign a click-if-you-agree type informed consent form stating the research aim and procedures, the researchers' guarantee of the participants' rights, and participants' willingness to be involved in the study, acknowledgement of the protection they will receive. Only participants who gave their consent by reading the information carefully and clicking the "Agree" button were able to see the survey questions and complete the survey.

3.2. Instrument

The questionnaire adopted in this study consisted of 4 parts. The first part required participants to fill in demographic information. Part 2, adapted from Lee and Lee [30], was intended to investigate students' in-class L2 WTS. The 5 items were to be answered on a 5-point Likert scale ranging from 1 strongly unwilling to 5 strongly willing. Part 3, adapted from Lee and Sylvén [23], was designed to assess the frequency of RIA (5 items) and PIA (6 items), on a 5-point Likert scale ranging from 1 never to 5 very often (1 time per day). Part 4, modified from Ulfert-Blank and Schmidt [31], was employed to measure the level of digital literacy (13 items), on a 5-point Likert scale ranging from 1 strongly disagree to 5 strongly agree.

The content validity of the questionnaire was assessed by 2 experts who have devoted to L2 research and teaching for more than 5 years. Systematic examination of the questionnaire was conducted to evaluate to which degree the items included could represent the content being measured, and the questionnaire was refined based on the experts' comments. Cronbach's alpha was then used to test the reliability of the questionnaire. The alpha value of all constructs is as follows: L2 WTS ($\alpha = 0.950$), RIA ($\alpha = 0.906$), PIA ($\alpha = 0.950$), and digital literacy ($\alpha = 0.946$). The alpha value demonstrated the internal consistency of each construct within the questionnaire.

3.3. Data Collection

In the quantitative research phase, 175 students from the CEP of XF University were invited to complete the four-part questionnaire. The questionnaire was disseminated via Wenjuanxing (https://www.wjx.cn/), a well-known Chinese online survey platform, with QR codes provided by their teachers either in class or through WeChat for completion. Prior to questionnaire administration, the researchers conducted a brief training session to introduce the survey's objectives, structure, and questions. A concise overview of key concepts in the questionnaire was provided, including definitions of extramural IDLE, RIA, PIA, and digital literacy. For instance, the researchers differentiated 3 types of digital learning of English. Formal digital learning of English refers to organized in-class online English learning under teacher guidance; extracurricular IDLE denotes out-of-class online English learning with teachers' assignment; and extramural IDLE represents student-initiated out-of-class online English learning, irrelevant to classroom assignments [10].

Following quantitative data collection and analysis, qualitative data was collected to further elaborate on the quantitative findings. To be specific, 15 questionnaire respondents were randomly selected after quantitative data analysis to share their perceptions of the frequency of their engagement in PIA and RIA.

3.4. Data Analysis

The quantitative phase started with the analysis of descriptive statistics. Subsequently, a Pearson's Correlation analysis was conducted to examine the relationship among variables (RIA, PIA, digital literacy, and L2 WTS). This was followed by linear regressions analysis to determine the predicting effect of RIA and PIA on L2 WTS, and the moderating effect of digital literacy on the relationship between RIA/PIA and L2 WTS. Three responses were removed from the raw data after the data screening process, with 172 responses remaining for further analysis.

The interview transcripts were transcribed verbatim subsequently and analyzed by adopting thematic analysis. Thematic analysis could examine different participants' views, identifying patterns and themes across data to seek

similarities and differences, and the analysis results was used for further explaining the quantitative statistics.

4. Results

4.1. Descriptive Statistics

Table 1 presents the descriptive data on the students' L2 WTS, extramural IDLE, and digital literacy. Overall, the students showed a moderate level of L2 WTS (M = 3.22, SD = 0.98) and digital literacy (M = 3.6, SD = 0.61). Their level of participation in RIA (M = 2.9, SD = 0.92) was slightly higher than that in PIA (M = 2.52, SD = 1.06), both remaining at a moderate level.

4.2. Correlation Analysis

The correlation analysis shown in **Table 2** indicates that students' L2 WTS correlated significantly with all other variables in this study. Specifically, L2 WTS was positively associated with RIA ($r = 0.62$, $p < 0.001$), PIA, ($r = 0.56$, $p < 0.001$), and digital literacy ($r = 0.35$, $p < 0.001$). The strong correlation between these variables provided preliminary evidence for exploring their linear relationship.

Table 1. Descriptive statistics.

Variables	Min	Max	M	SD
L2 WTS	1	5	3.22	0.98
RIA	1	5	2.9	0.92
PIA	1	5	2.52	1.06
Digital literacy	1	5	3.6	0.61

Table 2. Correlations.

Variables	L2 WTS	RIA	PIA	Digital Literacy
L2 WTS	1	0.62*	0.56*	0.35*
RIA	0.62*	1	0.78*	0.44*
PIA	0.56*	0.78*	1	0.32*
Digital literacy	0.35*	0.44*	0.32*	1

Note: *$p < 0.001$.

4.3. Regression Statistics

A stepwise linear regression was carried out with L2 WTS as the dependent variable to examine the predicting effect (if any) of RIA and PIA (Research Question 1). The results (**Table 3**) showed that in Model 2, RIA ($\beta = 0.47$, $p < 0.01$) and PIA ($\beta = 0.20$, $p < 0.05$) were significant predictors of CEP students' L2 WTS, thus rejecting Null Hypothesis 1, while RIA played a more important role. Meanwhile, the adjusted R^2 of Model 1 is 0.380, which was increased to 0.40 in Model 2, indicating that the combination of RIA and PIA could explain more variance in CEP students' L2 WTS.

Table 3. Stepwise linear regression of RIA and PIA.

Model	Predictors	Regression Coefficients			*t*	*p*
		β	*SE*	*β*		
1	Constant	1.3	0.20		6.63	0.00
	RIA	0.67	0.06	0.62	10.29	0.00
2	Constant	1.32	0.19		6.78	0.00
	RIA	0.50	0.10	0.47	4.87	0.00
	PIA	0.18	0.09	0.20	2.04	0.04

Note: n = 172; Model 1: $R^2 = 0.384$, Adjusted $R^2 = 0.380$; F (1, 170) = 105.95; Model 2: $R^2 = 0.40$, Adjusted $R^2 = 0.392$; F (2, 169) = 56.

Further linear regressions were conducted to assess if digital literacy moderated the relationship between RIA/PIA and L2 WTS respectively (Research Question 2). The results of the interaction models are presented in

Tables 4 and **5**. Digital literacy moderated the effect of PIA had on L2 WTS with the $\beta = 0.17$, $p < 0.05$ (see **Table 4**), thus rejecting Null Hypothesis 2b. However, digital literacy did not significantly moderate the effect of RIA had on L2 WTS (see **Table 5**), which failed to reject Null Hypothesis 2a.

Table 4. Moderation analysis with digital literacy moderating between PIA and L2 WTS.

Predictors	Regression Coefficients			*t*	*p*
	β	*SE*	*β*		
Constant	1.31	0.40		3.25	0.001
PIA	0.38	0.07	0.41	5.50	0.00
Digital Literacy	0.25	0.11	0.16	2.33	0.021
PIA*DL	0.12	0.05	0.17	2.28	0.024

Note: n = 172; $R^2 = 0.367$, Adjusted $R^2 = 0.356$; F (3, 168) = 32.45.

Table 5. Moderation analysis with digital literacy moderating between RIA and L2 WTS.

Predictors	Regression Coefficients			*t*	*p*
	β	*SE*	*β*		
Constant	1.00	0.38		2.60	0.01
RIA	0.58	0.08	0.54	7.23	0.00
Digital Literacy	0.14	0.11	0.09	1.30	ns
RIA*DL	0.05	0.05	0.07	0.99	ns

Note: n = 172; $R^2 = 0.395$, Adjusted $R^2 = 0.384$; F (3, 168) = 36.55, ns = not significant.

4.4. Qualitative Data

To further interpret the finding that RIA was a more significant predictor of L2 WTS than PIA, 15 respondents were randomly selected after quantitative data analysis to share their perceptions of the frequency of their engagement in PIA and RIA. Thirteen of the selected participants were engaged in fewer PIA than RIA, and 2 main reasons were identified: self-perceived task difficulty and accessibility. More than half of the respondents (9/15) believed participation in RIA required less effort as they did not have to produce any English sentences or communicate with someone in real-time. Meanwhile, 6 respondents stated that they lack access to establishing connections with other English users online due to inadequate knowledge of relevant digital platforms.

5. Discussion

This study investigated the relationship between extramural IDLE activities (RIA and PIA) and L2 WTS among China-foreign CEP students, and the moderating effect of digital literacy on the relationship between RIA/PIA and L2 WTS. The results showed that RIA and PIA were significant predictors of CEP students' L2 WTS, which was congruent with the findings of previous studies such as Lee et al.[32], and Lee and Sylvén[23]. The effectiveness and positive effect of digital learning of English in higher education on students' communication and performance has been proved according to the literature[33]. This could be explained by evidence that digital learning enables students to construct their own knowledge through interaction with online information and peers, according to constructivism[34]. RIA helps students expand their vocabulary, and acquire grammatical as well as topic-specific knowledge; PIA offers students more opportunities to speak in English, enhancing their productive skills and socio-communicative strategies in authentic communicative scenarios; therefore, both activities can contribute to improving L2 WTS[35]. Specifically, students who participate in digital learning activities supporting declarative knowledge (e.g. grammatical rules) and procedural knowledge (e.g. knowing how to apply those rules in real-time communication) tend to have higher L2 WTS in communicative tasks in class[36].

What should be noted is that in some previous studies[12,37], RIA was not a significant predictor of L2 WTS, which is inconsistent with the current research findings, where RIA served as a more significant predictor of L2 WTS

than PIA. This can be primarily attributed to the lower frequency of PIA participation among CEP students of XF University compared to RIA due to self-perceived task difficulty and accessibility. As mentioned in the research results, more than half of the respondents (9/15) believed participation in RIA required less effort as they did not have to produce any English sentences or communicate with someone in real-time. Their perceptions of lower difficulty of RIA than PIA could be underpinned by Richards[38], which indicated that receptive skills can be more readily developed than productive skills in language acquisition; and students' acquisition of language items through receptive activities does not directly translate to improvements in productive skills. Meanwhile, students failed to reach out to other English users online due to inadequate knowledge of relevant digital platforms, which is perceived to be one of the main obstacles hindering students using technology for English language learning[39]. Even when students are aware of which software to use, they may still lack understanding of how to apply it in assisting English language learning[40].

While several prior studies have already verified the role of extramural IDLE as a strong predictor of L2 WTS, this study provides novel empirical insights into the effect of digital literacy on the relationship between RIA/PIA and L2 WTS. The current study revealed that digital literacy links PIA and L2 WTS more strongly, suggesting that the participation in PIA is more likely to increase L2 WTS if students have better skills in using technology. To elaborate, when students perceive PIA as being low in difficulty and high in accessibility, they tend to engage in PIA more frequently. In such cases, students who demonstrate stronger capabilities in all 5 areas of digital literacy will show higher L2 WTS in English speaking classes. In contrast, when students perceive PIA as being difficult and are unsure about approaches to engage in these activities, their frequency of PIA participation will be lower. Under such circumstances, if their digital literacy is strong only in certain areas (e.g. information and data literacy), the L2 WTS will be even lower. In sum, students who do not encounter task difficulty issue and accessibility barrier of PIA, and meanwhile have higher digital literacy, will reach a presumably more ideal condition of L2 WTS in English speaking classes within the current research context. Meanwhile, digital literacy did not moderate the effect of RIA on L2 WTS. This could be explained by different levels of requirement for digital literacy of RIA and PIA due to their nature. Digital literacy is categorized into 5 areas in DigComp 2.2 (see **Figure 2**), with 1 area (i.e. information and data literacy) associated with RIA, and 3 areas (communication and collaboration, digital content creation, and problem-solving) with PIA basically, based on the description of European Commission[15]. RIA is related to fewer digital literacy areas, indicating the weak correlation between RIA and digital literacy, compared to that between PIA and DL, which may render digital literacy ineffective in moderating the relationship between RIA and L2 WTS.

6. Pedagogical and Research Implications

The current research findings have implications for practitioners and scholars in the fields of L2 acquisition.

6.1. Pedagogical Implications

Universities and teachers can encourage students' active engagement in extramural IDLE. Fewer than half of the Chinese students show favorable attitude towards fragmented English learning[41], indicating their insufficient interest in extramural IDLE. Teachers may first attempt to integrate digital English learning into both classroom and extracurricular scenarios, enabling students to more proficiently use technological tools for English learning. This initiative can further facilitate students' application of acquired knowledge in extramural contexts, ultimately empowering them to construct their own IDLE environment.

To increase students' frequency of engagement in IDLE, teachers can enhance their motivation by introducing fragmented learning English apps suitable for IDLE in class—such as apps featuring 10-minute daily reading, offering instructions on how to efficiently utilize the apps and concurrently providing more comprehensible input in class by teaching English expressions used in daily life scenarios. This helps improve students' performance in extramural IDLE, as the similarity in the contexts of where knowledge is acquired and where it is used can yield more learning outcome, according to social constructivist theories[42], while reducing barriers to L2 acquisition caused by anxiety[28],

ultimately leading to higher motivation for learning.

Digital literacy represents a critical aspect of English language learning, and should serve as a complement to English language proficiency for ESL students in higher education[43]. Specifically, the importance of digital literacy manifests as a skill to complement communicative competences[44] and achieve academic success[45]. According to the current research findings, as the frequency of PIA increased, the rise in L2 WTS became more obvious for respondents with higher digital literacy, which underscores the importance of improving digital literacy as an approach to strengthen the effect of PIA on L2 WTS. Since the importance of digital literacy has been overlooked due to rare implementation of emerging technologies in class[46], this finding calls for the attention of schools and educators: digital literacy can have potential influence on students' performance in English speaking classes. Universities and teachers can organize seminars and workshops to improve students' skills using technology to access, communicate, collaborate, create and evaluate information[15].

6.2. Research Implications

The present study revealed that CEP students' L2 WTS was significantly influenced by the frequency of RIA and PIA. As previously discussed, feedback from respondents indicated that low frequency of PIA was primarily attributed to insufficient accessibility and self-perceived task difficulty. Future research could further leverage qualitative research methods to conduct an in-depth exploration of the factors affecting the frequency of RIA and PIA, with the aim of more effectively enhancing students' extramural IDLE engagement and ultimately, L2 WTS. Additionally, most existing studies on the relationship between extramural IDLE activities and L2 WTS have focused on the frequency of activities. Future research could consider adopting new perspectives—such as investigating students' willingness to engage in these activities or analyzing the discrepancies between the willingness and actual frequency of IDLE participation—to more strategically enhance students' L2 WTS.

Digital literacy's potential role as a moderator exhibits instability across studies. Digital literacy moderated between PIA and L2 WTS, while failed to moderate between RIA and L2 WTS in the current study. Recent studies have investigated the role of digital literacy in moderating between technology-, learning- or affective- related variables. Hassan et al.[45] demonstrated the positive moderating role of digital literacy in the relationship between self-regulatory learning and academic performance. Kim and Lee[47] found that media literacy positively moderated between social media use and loneliness. However, Aryani and Rosyid[48] reported no moderating effect of digital literacy on the relationship between online learning engagement and operational accounting competencies. Although the independent and dependent variables in these studies shared homogeneity in type, heterogeneous outcomes emerged across different domains and scenarios. This suggests that the findings of research treating digital literacy as a moderator may not be universally generalizable to cross-domain contexts and may require problem-specific analysis, calling for more systematic investigations into its moderating effect on the relationship between extramural IDLE and L2 WTS across diverse contexts in the future.

7. Conclusions

The current study investigated the predicting effect of RIA and PIA on Chinese-foreign CEP students' L2 WTS, and examined the moderating effect of digital literacy on the relationship between RIA/PIA and L2 WTS. The overall results indicated that RIA and PIA were significant predictors of CEP students' L2 WTS, and digital literacy moderated PIA's effect on L2 WTS. This suggests that CEP students with higher frequency of participation in extramural IDLE tend to initiate speech in English more often in English speaking classes. A more significant role of RIA than PIA was discovered, owing to low frequency of PIA caused by inaccessibility and self-perceived task difficulty. In addition, L2 WTS of CEP students with high digital literacy increased as the frequency of PIA rose. The current study is distinct from previous ones as it investigated the potential moderating role of digital literacy in the effect of RIA/PIA on L2 WTS. For future research, the moderating effect of digital literacy should be further examined as the findings across relevant studies remain inconsistent.

8. Limitation

The main limitation of this study lies in its exclusive focus on Chinese-foreign CEP students in one university. Its

program-specific feature may hinder its generalizability to traditional programs that have different English language requirements for students. However, since the English education policy of CEP in each university of China is relatively unified, the findings of the study could be applicable to situations with similar contexts and backgrounds in China. In addition, this study only employed self-reported data, such as questionnaire and interview data as it primarily investigated and explored students' personal feelings and their IDLE in extramural settings. In future studies, the adoption of diverse research methods, such as longitudinal research involving classroom observations or experiments, will be able to provide a more comprehensive understanding of how RIA and PIA can predict L2 WTS, and how digital literacy can moderate the relationship between extramural IDLE and L2 WTS.

Author Contributions

Conceptualization, K.K.; methodology, M.M.; software, M.K.M.N.; validation, K.K., M.M. and M.K.M.N.; formal analysis, K.K.; investigation, K.K.; resources, K.K.; data curation, M.K.M.N.; writing—original draft preparation, K.K.; writing—review and editing, M.M.; visualization, K.K.; supervision, M.M. and M.K.M.N.; project administration, M.M. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

Consent has been obtained from the Review Board of XF University.

Informed Consent Statement

Informed consent was obtained from all participants involved in the study.

Data Availability Statement

The data used in this study can be accessed from the corresponding author upon reasonable request.

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Conflicts of Interest

The authors declare no conflict of interest.

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