Online informal learning of English and receptive vocabulary knowledge: Purpose matters

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Abstract
The research field of online informal English learning has revealed associations of various informal digital English activities and second language vocabulary development. However, most of these studies have regarded digital resources as uniform entities when investigating their potential for vocabulary development and have failed to consider learners' idiosyncratic interaction with the resources driven by self-defined purposes of use. Informed by the uses and gratifications theory, this study explored how three purposes of extramural digital experience (entertainment, socialization and information) relate to vocabulary knowledge, based on the survey responses from 322 undergraduate Chinese EFL learners and their receptive vocabulary knowledge. PLS-SEM analysis uncovered differential associations of the three media use purposes with receptive vocabulary knowledge. The study also revealed that the associations between the purposes of informal digital activities and vocabulary knowledge differed depending on whether the vocabulary was high frequency or low frequency. Additionally, it was found that the strategic use of digital resources, in terms of cognitive attention to and processing of lexical information that are facilitative of vocabulary learning during and/or after the interaction, played a significant moderating role in the relationship between digital activities for information purposes and receptive knowledge of high-frequency vocabulary. The findings highlight the importance of considering media use purposes in future research and pedagogical practices.

1. Introduction

Given the ubiquitous presence of technology in our daily lives, naturalistic language exposure often occurs within digital spaces (Lai, 2023; Lee, 2019). Naturalistic language exposure in the informal context is indispensable for learners to accumulate the large amount of vocabulary required for effective communication in a language, as such experiences contribute uniquely and significantly to vocabulary development in addition to in-class learning (Nation, 2015; Schmitt, 2019). Existing literature has established positive links between online informal learning of English (OILE; Sockett, 2014), namely learners' online naturalistic exposure to and use of English within authentic communicative contexts, and vocabulary knowledge (e.g. De Wilde, Brysbaert & Eyckmans, 2020; Lin & Lin, 2019; Warnby, 2022). These studies have highlighted the vocabulary

learning potentials of various informal digital activities, such as consuming audiovisual resources, visiting English websites, playing computer games, and using social media (e.g. Montero Perez, Peters & Desmet, 2018; Peters, Noreillie, Heylen, Bulté & Desmet, 2019; Schmitt, 2019; Zhang et al., 2021). Despite substantiating the positive association between OILE and vocabulary knowledge, these studies have predominantly employed a technocratic perspective, treating digital activities as fixed and predetermined entities, without fully recognizing the active role of learners in their media usage. The same digital activity can be approached by learners for different purposes and to fulfill various needs. This, in turn, influences how learners engage with the activity and the subsequent learning outcomes (Hu & Yu, 2021; Lai, Hu & Lyu, 2018). Neglecting the specific circumstances in which technology is used can lead to misleading or incomplete understanding (Neufeld & Delcore, 2018). Thus, scholars advocate attending to "finer-grained detail about the nature of extramural exposure" (Schmitt, 2019: 267). Media use purpose, by acknowledging learners' intentional appropriation of digital resources, can provide a lens for generating more meaningful and nuanced insights into the relationship of OILE with vocabulary knowledge.

2. Literature review

2.1 OILE and incidental vocabulary learning

Incidental vocabulary learning refers to the acquisition of vocabulary as a by-product of meaning-focused tasks (Webb, Uchihara & Yanagisawa, 2023). Several critical conditions contribute to successful incidental vocabulary learning, including the presence of rich contextual cues and comprehensible input, the richness of encoding, repeated exposure to vocabulary, and high levels of interest and enjoyment (Fievez, Montero Perez, Cornillie & Desmet, 2023; Lee & Pulido, 2017; Reynolds & Teng, 2021). OILE has the potential to meet the cognitive and motivational conditions necessary for incidental vocabulary learning. This is because such experiences often involve interest-driven, self-selected digital activities that provide learners with access to a wide range of multimodal materials (Niitemaa, 2020). In effect, Webb and colleagues' (2023) meta-analysis revealed that incidental vocabulary learning does take place in meaning-focused input activities. They reported a learning rate of 7% of the target vocabularies through viewing audiovisual materials, 15% through listening to aural input, and 17% through reading.

Various digital activities, including watching audiovisual English input, playing games, visiting English websites and using social media, are found to contribute positively to incidental vocabulary learning (Fievez et al., 2023; Reynolds, Cui, Kao & Thomas, 2022; Zhang et al., 2021). However, the effects of these digital activities on vocabulary learning can vary significantly. For instance, research suggests that captioned audiovisual resources and informational audiovisual input, such as documentary and news clips, tend to have a greater impact compared to subtitled audiovisual resources and entertaining audiovisual input, like movies (Montero Perez, 2022; Reynolds et al., 2022). Additionally, the potential of gameplay for vocabulary learning is contingent on the specific genres of games (Lai & Chen, 2023; Sundqvist, 2019). As a result, mixed findings have been consistently reported for various digital activities (Peters et al., 2019), which hampers our understanding of their associations with vocabulary knowledge.

More importantly, studies have shown that learners may use the same digital resource in different ways (Peng, Jager & Lowie, 2022). Lai et al. (2018) discovered that university English as a foreign language (EFL) learners reported diverse ways of using Facebook. Some participants used the platform to access instructional pages on vocabulary and grammar, while others used it to retrieve information from friends' posts. Additionally, some participants employed Facebook as a means to connect with native speakers or engage in social exchanges. The varied purposes of interacting with a digital resource resulted in different potentials for language learning. For instance, Hu and Yu (2021) found that recreational use of social networking sites associated negatively with reading performance, whereas academic use of such resources exhibited a positive association. In Lyu and Lai's (2024)

research, adult learners' perceptions of Lang-8, an online L2 writing sharing community, were found to influence their engagement with feedback received on the platform. Participants who viewed Lang-8 as a language learning platform tended to focus on and respond to instruction-related feedback. However, those who perceived Lang-8 as both a language learning and a social networking platform showed a greater inclination to engage with various types of feedback. Similarly, in a study conducted by Vanderplank (2019), university foreign language learners were instructed to watch self-selected captioned films over a period of 6 to 12 weeks. The findings revealed that these learners exhibited varied viewing behaviors. Some learners primarily focused on enjoying the films, while others utilized the films more intentionally for learning purposes. Given the variation in learners' agentic appropriation of the same technological resource, scholars advocate for a fine-grained perspective to understand the relationship between informal digital activities and vocabulary knowledge (Lai *et al.*, 2018; Schmitt, 2019). Media use purpose may be one such perspective, since purpose defines learners' cognitive attention and the direction and intensity of their actions (Vanderplank, 2019).

2.2 Purposes of informal digital activities and vocabulary development

Uses and gratifications theory, an influential psychological communication perspective, conceptualizes that people are agentic, purposeful users of media who engage with media selectively and intentionally to fulfill individual needs, wants, and/or interests (Palmgreen, 1984; Rubin, 2009). Katz, Blumler and Gurevitch (1973) underscored four needs that individuals seek to fulfill through media usage: cognitive, tension-release, affective and social needs. Similarly, McQuail (1987) identified five primary goals of media use, which include being informed or educated, seeking entertainment, relieving daily stress, enhancing social interaction, and identifying with others in the media environment. These goals and needs have been further categorized into three broad media use purposes in various media studies, namely information seeking, entertainment, and socialization (e.g. Chung & Yoo, 2008; Lin, Lee, Jin & Gilbreath, 2017). Uses and gratifications theory further conceptualizes that media use purposes affect individuals' media consumption behaviors and the resulting attitudes and behaviors (Katz *et al.*, 1973; Ruggiero, 2000). To use Walther and colleagues' (2010) words, media use purposes "shape attention to variations in the content and features of the topical information one consumes, affecting its interpretation and recall" (p. 187). Empirical studies have demonstrated that entertainment, information, and socialization motives activate distinct patterns of interaction with and around media content (Chung & Yoo, 2008; Lin *et al.*, 2017). In the context of language learning, these three types of media use purposes have been observed to impact language processing, attention allocation, and the specific features or parts of information that learners focus on (Knutson, 1998).

Media use for the purpose of acquiring information is found to trigger self-regulatory and evaluative processes, strengthen the intensity of engagement with the content, and activate the utilization of metacognitive strategies (Lee & Wu, 2013; Thums, Artelt & Wolter, 2021). This deeper cognitive processing may contribute to vocabulary development. In effect, Swanborn and de Glopper (2002) found that reading to learn about a specific topic yielded the highest rate of vocabulary acquisition. Lai, Liu and Lin (2023) further revealed that the informational purpose of OILE positively predicted the depth of lexical processing during interaction. But at the same time, researchers caution that the vocabulary learning potential of this media use purpose might be hampered if the input is linguistically too challenging (e.g. Dang, Lu & Webb, 2023). Considering that OILE is often interest-driven and self-chosen, we hypothesized a positive association between OILE for information purposes and vocabulary:

H1: Media use for information purposes directly and positively predicts vocabulary knowledge.

Media use for socialization purposes is characterized by an increased attention to language to achieve effective communication and a greater focus on accurate language use (Lai *et al.*, 2018; Yu, 2023), suggesting a potential positive contribution of this type of activities to vocabulary

development. However, research evidence on the effect of social media use on vocabulary development is rather mixed (Alharthi, Bown & Pullen, 2020). The inconsistent findings have been attributed to factors such as the length of engagement and the (im)possibility for collaborative learning (Hu & Yu, 2021). Given that social interaction is the essence of OILE for socialization purpose, which affords collaborative learning, we would expect a positive association between this media use purpose and vocabulary knowledge. Previous studies have, in effect, evidenced positive associations between OILE for socialization purposes and vocabulary knowledge (De Wilde *et al.*, 2020; Lai *et al.*, 2023). Thus, we hypothesized that

H2: Media use for socialization purposes directly and positively predicts vocabulary knowledge.

Existing literature has yielded rather mixed findings with regard to the relationship of entertainment media, such as TV series, songs and games, with vocabulary knowledge (e.g. Peters *et al.*, 2019). Researchers have attributed the inconsistent findings to potential differences in genres, the extent of engagement in interaction (active or passive), and the level of cognitive attention (De Wilde *et al.*, 2020; Lai *et al.*, 2023; Schmitt, 2019). Considering that media use for entertainment purposes is often associated with casual browsing, less attention to and involvement with language forms, and a lower level of cognitive engagement (De Wilde, Brysbaert & Eyckmans, 2022; Lai *et al.*, 2018; Lee & Wu, 2013; Vanderplank, 2019), we would expect the direct contribution of this media use purpose to vocabulary knowledge to be minimal, a hypothesis that is supported by previous studies (Lai *et al.*, 2023; Leona *et al.*, 2021; Swanborn & de Glopper, 2002). However, media use for entertainment purposes may contribute to vocabulary development indirectly, since engaging with media for one purpose may arouse new needs and motives, thereby leading to content congruent exposure (Sundar & Limperos, 2013). Shade, Kornfield and Oliver (2015) observed that media use for entertainment purposes, such as watching a movie, prompted media migration activities aimed at fulfilling other purposes. After watching a movie (an activity for entertainment purposes), individuals may search the internet to gain a deeper understanding of the movie's historical context (an activity for information purposes) or participate in online discussion about the movie (an activity for socialization purposes). Moreover, Leona and colleagues (2021) observed that consuming entertaining media had a mediated, rather than a direct, influence on young English language learners' vocabulary knowledge via linguistic self-confidence. Since linguistic self-confidence is critical to the use of English for information seeking and socialization (Lai *et al.*, 2018; Trinder, 2016), the effect of entertainment purposes might be mediated by media use for information purposes and for socialization purposes. Furthermore, media use for entertainment and information purposes primarily involve receptive activities, where individuals consume media content. These activities can serve as antecedents to media use for socialization purposes, which often involves more productive activities and requires a higher level of proficiency (Lai *et al.*, 2018; Yu, 2023; Zhang *et al.*, 2021). Thus, we hypothesized that

H3: Media use for entertainment purposes predicts vocabulary knowledge indirectly via media use for information purposes and media use for socialization purposes.

H4: Media use for information purposes predicts vocabulary knowledge indirectly via media use for socialization purposes.

2.3 Strategic use of digital resources and vocabulary development
According to Hulstijn (2013), vocabulary learning is "mainly a matter of selective attention and elaborated processing" (p. 2634). Seminal discussions on vocabulary development underscore the

crucial role of diverse resources and experiences, deliberate word learning, and the cognitive operations and attention dedicated to words (Laufer, 2017; Nation, 2015; Schmitt, 2008). Thus, the selection of digital resources and the manner in which learners interact with them can significantly impact the potential of informal digital activities for vocabulary development. Lai and colleagues (2022) discovered that both the extent of dual focus on meaning and form during interaction with digital resources, as well as the depth of lexical processing during and after these activities, significantly predicted vocabulary knowledge. More importantly, literature suggests that strategic use of digital resources can also moderate the relationship between language experience and vocabulary development. For instance, Shin, Sok and Do (2023) found that learners who employed mental translation strategies to a greater extent gained more vocabulary through listening to stories compared to those who used these strategies less frequently. Thus, strategic engagement with digital resources may moderate vocabulary development potentials of digital activities. However, previous studies also show that the moderation effects of strategy use were context-dependent. For instance, Lin, King, Fu and Leung (2024) found that summarization strategy failed to moderate the link between ICT use inside the school and digital reading performance but significantly moderated that of ICT use outside the school. They revealed that as the use of summarization strategy increased, the negative association of ICT use outside the school and digital reading performance decreased. Thus, the moderation effect of strategic engagement might be more salient in the context with less attention to learning. Informed by these findings, we hypothesized that strategic engagement with digital resources in terms of cognitive attention and lexical processing during and/or after the interaction might moderate the path from media use for information purposes to vocabulary knowledge for two reasons: first, this type of digital experience often involves global text processing with the primary focus on understanding the discourse level rather than on the sentential or word level (Zhou, 2011); second, these activities require a higher vocabulary threshold for comprehension and consume a significant amount of cognitive attention, which can present challenges for incidental vocabulary learning (Dang *et al.*, 2023; Webb & Nation, 2012; Webb & Rodgers, 2009). In contrast, the moderation effect might not be as pronounced in the context of media use for socialization purposes, since such activities often involve a heightened attention to language forms (Lai *et al.*, 2018; De Wilde *et al.*, 2022; Yu, 2023). Thus, we hypothesized that

H5: Strategic use of digital resources moderates the associations between media use for information purposes and vocabulary knowledge.

3. The study

This study investigated how different purposes of informal digital activities associated with receptive vocabulary knowledge and how strategic use of digital resources might moderate the relationships. Receptive vocabulary knowledge was the focal point due to the prevalence of receptive activities in the informal digital engagement of second language learners (Lai, 2018; Trinder, 2016). The study addressed the following research question:

RQ: How do informal digital English activities for different purposes (entertainment, information and socialization) relate to English language learners' receptive vocabulary knowledge?

In our model, we distinguished between high-frequency and low-frequency vocabulary knowledge, as informal digital activities contribute differently to vocabulary knowledge at different frequency levels (Nation, 2015; Niitemaa, 2020). A conceptual framework (Figure 1) was proposed based on the literature review.
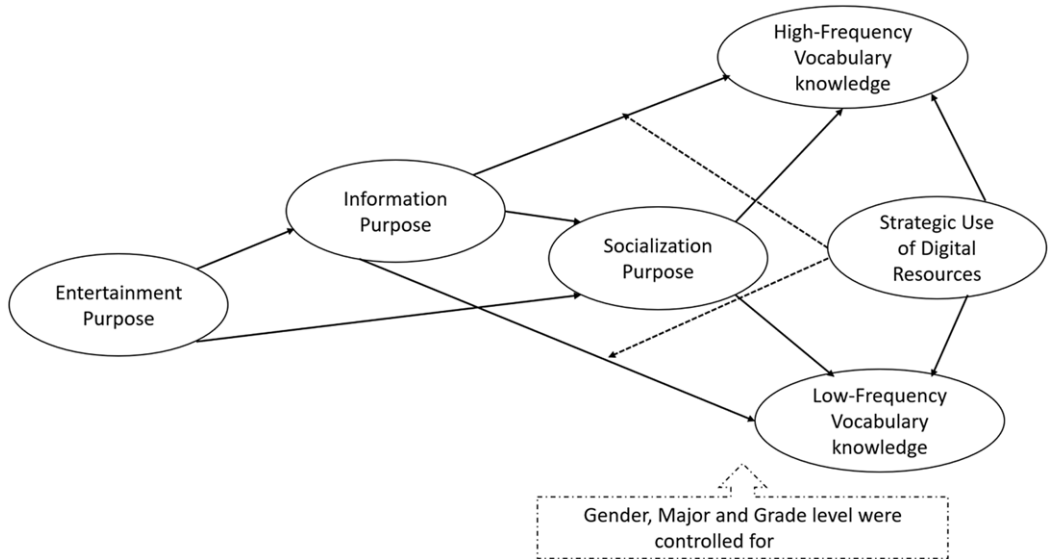
Figure 1. The conceptual model.

4. Method

4.1 Participants

Participants were 348 undergraduate foreign language learners from two universities in socio-economically well-developed regions in mainland China, where English digital resources are easily accessible. Nonetheless, informal digital English learning was neither a course requirement nor actively promoted at these universities. The participants were all language majors, one third being first- and second-year English majors (35%) and the rest being second- to fourth-year foreign language majors (e.g. Italian, Korean, Arabic) with a strong focus on English (65%). They were of intermediate level (CEFR B2-B3 level) according to Jin, Wu, Alderson and Song (2017). Roughly around 25% of the participants were in each year group of undergraduate education. The participants were predominantly female (83%) with an average age of 20. This study targeted language majors because they might be likely to engage in informal digital activities for language learning in general, which is the prerequisite for examining media use purposes. Students from different year groups were recruited to allow us to include participants with potentially varying vocabulary knowledge. Participants were recruited through convenient sampling, with the help of their English teachers at the two universities.

4.2 Research instrument

The research instrument included a questionnaire (see Appendix 1 in the supplementary material) and a receptive vocabulary knowledge test.

4.2.1 Questionnaire

We measured the frequency of participants' engagement in informal English digital activities for different purposes in the past six months, using 5-point Likert scale items (1 = *almost never*; 5 = *almost always*). A definition of online and digital resources was provided at the beginning of the questionnaire: "It refers to any online and digital English resources that give you exposure to English, including online communities and forums, public channels, online gaming, audiovisual

resources, instant messaging tools, blogging and podcasting, social media and mobile apps." Questionnaire items were adapted from Lai *et al.* (2018) to measure the three media use purposes: *Entertainment Purpose* ($n = 4$, $\alpha = 0.87$) measured participants' use of English digital resources for recreation and relaxation purposes, using items like "I use online and digital resources to access interesting entertainment resources in English." *Information Purpose* ($n = 5$, $\alpha = 0.82$) measured participants' use of English digital resources to seek information of personal interest and personal needs, using items like "I use online and digital resources to obtain daily life information I need in English." *Socialization Purpose* ($n = 4$, $\alpha = 0.90$) measured participants' use of English digital resources to communicate and socialize with others, using items like "I use online and digital resources to expand my social network in English."

We further assessed participants' strategic use of digital resources facilitative of vocabulary development, such as attending to multiple medium and dual attention to both language meaning and form (Lai *et al.*, 2022). *Strategic Use of Digital Resources* ($n = 4$, $\alpha = 0.80$) was measured by having participants rate their agreement with statements like "I focus on both the gist and language use when interacting with the online and digital resources in English." This construct was measured using a 6-point Likert scale ($1 = $ *strongly disagree*; $6 = $ *strongly agree*). In addition, we collected demographic data including age, gender, major and grade level, as these variables have been found to influence receptive vocabulary learning (De Wilde *et al.*, 2020; Puimège & Peters, 2019).

4.2.2 Vocabulary test

Nation and Beglar (2007)'s Vocabulary Size Test (VST) was used to measure the participants' receptive vocabulary knowledge. VST measures written meaning recognition knowledge of form-meaning links via a multiple-choice test on 140 vocabularies sampled from the most frequent 14,000-word families of English, 10 from each 1,000-word level. For each test item, the stem contains each word followed by a simple non-defining sentence, which specifies the part of speech and limits the meaning of words that might have homographs without giving much contextual cue on the specific meaning of the word. Four choices are given for each test item (see below for a sample).

<div align="center">

bristle: The **bristles** are too hard.
1. a. 问题
2. b. 短而硬的毛
3. c. 折叠床
4. d. 鞋底

</div>

The test follows a progression from the most frequent 1,000-word level to the less frequent word levels. This study used the bilingual (Mandarin) version of the test, which has been validated in previous studies (e.g. Zhao & Ji, 2018). Although the original VST contains 14 levels, previous research conducted in the Chinese university context has indicated that including the first eight levels of the test is adequate for distinguishing different proficiency levels and that the higher levels of the VST, specifically words from the 7th to the 14th frequency level, do not effectively differentiate between intermediate and high proficiency levels (Wang & Fan, 2011; Zhao & Ji, 2018). Following Nation and Beglar's (2007) recommendation of letting elementary and intermediate learners attempt a few levels beyond their present level, we included the first 10 levels of the VST in this study.

4.3 Data collection and analysis

A bilingual version (English and Chinese) of the questionnaire was administered. To ensure the accuracy of the translation, a process of backward translation was conducted by two bilingual

speakers to maintain the original meaning of the questions. Both the questionnaire and the vocabulary test were administered in a paper-based format inside the classroom in the presence of a supervising teacher. Prior to administering the questionnaire and the test, participants were required to sign and submit written consent forms. Ample time was provided for participants to complete both the questionnaire and the test, with all participants finishing within a 40-minute time frame. After removing incomplete questionnaires, a total of 322 valid questionnaires were included in the analysis.

Each test item was scored as either 1 (correct) or 0 (incorrect), and a percentage score was calculated for each level by dividing the number of correct items by the total number of items in that level. To account for the variation in incidental vocabulary learning across different word frequency levels (Pigada & Schmitt, 2006), we calculated sub-scores for high-frequency and low-frequency words. Considering that College English Curriculum Requirement in China covers the first 5,000-word families (Zhao & Ji, 2018) and that Chinese EFL undergraduate learners' receptive vocabulary size falls between 4,000- and 5,000-word families (Zhao & Ji, 2018; Zheng, 2009), we computed the average pooled percentage scores across the first five frequency levels (1st–5th level) as an indicator of high-frequency vocabulary knowledge. These words are more likely to be covered in the participants' English classes. Similarly, we calculated the average pooled percentage scores of the next five levels (6th–10th level) to indicate low-frequency vocabulary knowledge. The reliability index (Cronbach's alpha) for the whole test was 0.91 (0.77 for test items on high-frequency words and 0.89 for those on low-frequency words), indicating satisfactory internal consistency (Kline, 1999).

Partial least squares structural equation modeling (PLS-SEM) was used to analyze the data. PLS-SEM is a variance-based modeling technique that calculates parameters of the measurement model (loadings) and structural model (regression coefficients) via an iteration-algorithm approach (Hair, Hult, Ringle & Sarstedt, 2021). PLS-SEM was chosen because it is appropriate for exploratory research aimed at theory development and does not require a large sample size nor the assumption of normal distribution for the data (Hair *et al.*, 2021). SmartPLS was used to fit the data, with 5,000 bootstrapping samples, against the conceptual model. Prior to the analysis, we examined the data for common method bias, as the data were self-reported by a single group of respondents at a single time point. Harman's single factor test via principal components factor analysis yielded a value of 40% (lower than 50%) and the Variance Inflation Factors (VIFs) were all below 2, indicating the absence of common method bias in the data.

5. Results

5.1 Descriptive statistics

The participants reported using digital resources for entertainment purposes most often and for socialization purposes the least often (Table 1). They gave a slightly positive appraisal of their strategic use of digital resources. The VST score revealed an average receptive vocabulary size of 6,600-word families ($M = 66.15$, $SD = 13$), slightly below the 8,000 needed to comprehend authentic spoken and written texts (Nation, 2006).

5.2 The measurement model

Confirmatory factor analysis of the conceptual model yielded satisfactory model fit (CMIN/DF = 1.72, CFI = 0.97, TLI = 0.97, SRMR = 0.05, RMSEA = 0.047, with a 90% confidence interval of [0.036, 0.059]), suggesting that the constructs were well represented by the corresponding indicators.

Standardized loadings of the indicators ranged from 0.68 to 0.90, all exceeding the threshold value of 0.60 (Awang, 2012). The average values explained (AVEs) for all the constructs were

Table 1. Descriptive statistics ($N = 322$)

Constructs (Label)	Measures	M	SD
Purpose of informal English digital activities [a]	Entertainment	3.03	1.00
	Information	2.78	0.77
	Socialization	2.00	0.77
Strategic use of digital resources [b]		4.51	0.79
Receptive vocabulary knowledge	Overall vocabulary size	0.66	0.13
	High-frequency vocabulary	0.78	0.10
	Low-frequency vocabulary	0.55	0.18

Note.[a]5-point scale, where 2 = *once in a while* and 3 = *sometimes*;
[b]6-point scale, where 4 = *slightly agree* and 5 = *agree*.

Table 2. Reliability and validity indices of measurement models

	CR	α	AVE	1	2	3	4
1 Entertainment	0.91	0.87	0.72	(0.85)			
2 Information	0.88	0.82	0.59	0.63	(0.77)		
3 Socialization	0.93	0.90	0.77	0.46	0.52	(0.88)	
4 Strategic use	0.87	0.80	0.62	0.34	0.40	0.24	(0.79)

Note. Diagonal numbers in parentheses: square root for average values explained (AVEs) from observed variables (items); off-diagonal numbers: correlations between constructs. All the construct correlation values were statistically significant. CR = composite reliability.

above 0.50, indicating satisfactory convergent validity (see Table 2). The square root values of the AVEs were all larger than the inter-construct correlations and the HTMT values for all the constructs ranged from 0.04 to 0.78, all below the threshold value of 0.85 (Kline, 2011), suggesting satisfactory discriminant validity (Hair *et al.*, 2021). All these results indicate sufficient construct validity of the model. Moreover, all the Cronbach's alpha (α) values and composite reliability (CR) values were above 0.80, indicating sufficient construct reliability.

5.3 The structural model

PLS-SEM analysis yielded an SRMR value of 0.05, a satisfactory model fit. The model explained 15% of the variance in high-frequency vocabulary size and 23% of the variance in low-frequency vocabulary size (see Figure 2).

The hypothesized paths among the three media use purposes were all significant: entertainment purposes → information purposes ($\beta = 0.64$, $p < .001$); entertainment purposes → socialization purposes ($\beta = 0.24$, $p < .01$); and information purposes → socialization purposes ($\beta = 0.36$, $p < .001$). The findings suggest that digital activity for entertainment purposes and for information purposes were significant antecedents of digital activity for socialization purposes, with the interplay of these two media use purposes accounting for 29% of its variance. Digital activity for entertainment purposes was also a significant determinant of digital activity for information purposes, accounting for 40% of its variance (see Figure 2).

As hypothesized, media use for socialization purposes demonstrated significant direct associations with receptive vocabulary knowledge: it significantly predicted receptive knowledge of both high-frequency vocabulary ($\beta = 0.14$, $p < .05$) and low-frequency vocabulary ($\beta = 0.13$,

Table 3. Direct, indirect and total effects

		High-frequency vocabulary size ($R^2 = 15\%$)			Low-frequency vocabulary size ($R^2 = 23\%$)		
		β	t-value (p)	f^2	β	t-value (p)	f^2
Entertainment purpose	Direct	–	–	–	–	–	–
	Indirect	**0.09***	2.53* (.01)	–	**0.09***	2.36* (.02)	–
	Total	**0.09***	2.53* (.01)	–	**0.09***	2.36* (.02)	–
Information purpose	Direct	0.04	0.69 (.56)	.00	0.04	0.56 (.57)	.00
	Indirect	0.05	1.89 (.06)	–	**0.05***	1.97* (.049)	–
	Total	0.09	1.66 (.10)	–	0.09	1.49 (.14)	–
Socialization purpose	Direct	**0.14***	2.12* (.04)	.02	**0.13***	2.12* (.03)	.02
	Indirect	–	–	–	–	–	–
	Total	**0.14***	2.12* (.04)	–	**0.13***	2.12* (.03)	–
Strategic use		**0.20***	3.67*** (.000)	.04	**0.16****	2.94** (.003)	.03
Strategic use X information purpose		**0.08***	2.33* (.02)	.01	0.03	0.81 (.42)	.00
Control variables	Female	−0.22	1.58 (.11)	.01	−0.10	0.75 (.46)	.00
	Grade	0.13	1.72 (.09)	.01	0.14	1.85 (.06)	.01
	Major	**0.74***	4.84*** (.000)	.06	**1.04***	7.17*** (.000)	.13

Note. The bolded numbers are effects that were significant. *p<.05; **p<.01; ***p<.001.
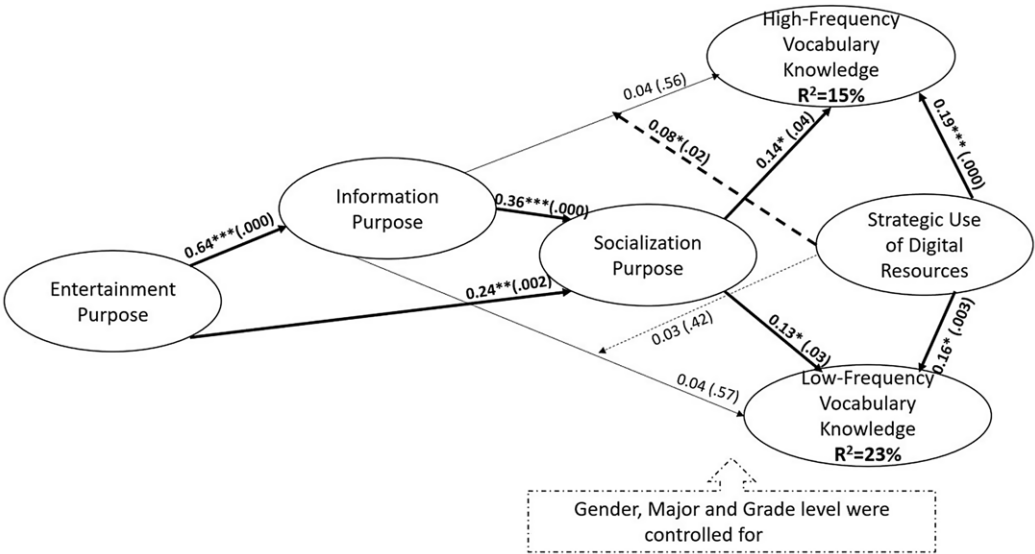

Figure 2. The structural model.

$p < .05$) after controlling for grade level, major and gender (see Table 3). Media use for entertainment purposes predicted both high-frequency vocabulary and low-frequency vocabulary knowledge indirectly via the other two media use purposes ($\beta_{\text{high-frequency}} = 0.09$, $p < .05$; $\beta_{\text{low-frequency}} = 0.09$, $p < .05$). Contrary to the hypothesis, media use for information purposes did

not emerge as a significant predictor of receptive vocabulary knowledge, as both its direct and total effect sizes were not found to be significant. The absence of direct associations may be attributed to the inherent difficulty faced by second language learners when utilizing media to retrieve information, which often requires a significant cognitive effort to unpack and comprehend information, leaving limited attentional resources available for the noticing and acquisition of unfamiliar linguistic forms (Dang *et al.*, 2023). However, the results did reveal a noteworthy indirect effect on the participants' low-frequency vocabulary knowledge via digital activities for socialization purposes ($\beta = 0.05$, $p < .05$). This suggests that increased involvement in media use for information purposes is associated with a greater likelihood of utilizing media for socialization purposes, which, in turn, contributes to higher levels of receptive knowledge of low-frequency vocabularies. More importantly, the path from media use for information purposes to receptive knowledge of high-frequency vocabulary was positively moderated by strategic use of digital resources ($\beta = 0.08$, $p < .05$). This finding suggests that participants who employed cognitive strategies that facilitated vocabulary development during digital activities exhibited a stronger association between media use for information purposes and high-frequency vocabulary knowledge. However, this moderation effect was not significant for low-frequency vocabulary knowledge ($\beta = 0.03$, $p = .42$), suggesting that strategic engagement with digital resources alone may not be sufficient to strengthen the connection between media use for information purposes and low-frequency vocabulary knowledge.

Moreover, strategic use of digital resources was a significant direct predictor of vocabulary knowledge of both high-frequency ($\beta = 0.19$, $p < .000$) and low-frequency vocabulary ($\beta = 0.16$, $p < .001$). Thus, employing cognitive strategies facilitative of vocabulary learning contributed to receptive vocabulary knowledge. Among the control variables examined (grade level, gender and major), only the participants' major demonstrated a significant association with their vocabulary knowledge. English majors exhibited significantly greater receptive knowledge for both high-frequency and low-frequency vocabulary compared to non-English majors.

6. Discussion

The study revealed that media use purpose accounted for 15%–23% of the variance in learners' receptive vocabulary knowledge, indicating a medium level of explanatory power (Cohen, 2013). The different purposes of digital activities contributed to receptive vocabulary knowledge in varying degrees. These findings support the notion that media use purposes have an impact on learning (Hu & Yu, 2021; Lai *et al.*, 2023; Thums *et al.*, 2021; Vanderplank, 2019) and suggest that this analytic framework provides meaningful insights into the relationship of informal digital activities and vocabulary knowledge.

6.1 Differential relationships between purposes of informal digital activities and vocabulary knowledge

This study revealed differential associations between informal digital activities for various purposes and vocabulary knowledge. Informal digital activities for socialization purposes were found to play the most prominent role in determining receptive vocabulary knowledge, being both a direct predictor and a significant mediator. The significant association observed between socialization purposes and vocabulary knowledge may be attributed to the greater incentive for sense-making and self-expression. Engaging in online interactions for social connection motivates individuals to actively search for the meaning of unknown words used by their interlocutors (Sivagnanam & Yunus, 2020; Zainal & Rahmat, 2020), leading to deeper language processing, heightened cognitive engagement, and increased linguistic engagement (De Wilde *et al.*, 2022; Zhang *et al.*, 2021). Furthermore, activities for socialization purposes are characterized by their interactive nature and often involve the use of multimodal materials. The interactive and

multimodal environment can lower the comprehension hurdle and prompt conscious attention to linguistic forms, thereby facilitating incidental vocabulary learning (Domingo & Aguillon, 2021; Jin, 2018). The findings hence suggest encouraging the use of digital spaces for socialization purposes. However, it is important to note that this finding might have been influenced by the specific research population, which in this case was Chinese EFL learners. The cultural value of saving face and maintaining positive social image (Lim & Basnyat, 2016) may result in Chinese EFL learners paying greater attention to linguistic accuracy in their online interactions, contributing to the observed association between these digital activities and vocabulary knowledge.

The study confirmed an indirect association of digital activities for entertainment purposes and vocabulary knowledge. The lack of direct effect may be attributed to the interaction patterns exhibited by learners when using media for pleasure. Learners have been found to avoid games with intense language, prefer L1 subtitled videos, disregard lyrics or captions (De Wilde et al., 2022; Vanderplank, 2019), and lack deliberate use of metacognitive strategies (Lee & Wu, 2013), all of which may hinder vocabulary acquisition (De Wilde, Brysbaert & Eyckmans, 2021; Warnby, 2022). Another possible explanation for the lack of a direct effect is the educational culture and discourses within the Chinese EFL learning context, where learning is often not associated with fun but viewed as a disciplined and serious activity (Li, 2003). Consequently, Chinese EFL learners may perceive entertainment and learning as separate entities, which can diminish the contribution of entertainment activities to vocabulary learning. Instead, this study observed an indirect relationship between digital activities for entertainment purposes and vocabulary knowledge. These activities may either generate motivational sources, such as linguistic self-confidence (Leona et al., 2021), that activate and fuel other types of digital activities, or provide linguistic sources that need to be supplemented by other types of digital activities, such as utilizing the linguistic form for information retrieval and social interactions, in order to have a notable impact on vocabulary learning. Future research may need to delve deeper into the mediation mechanisms underlying the relationship between digital activities for entertainment purposes and vocabulary learning.

The finding that media use for information purposes was the weakest predictor of receptive vocabulary knowledge is counterintuitive, considering that utilizing digital resources to seek information is typically associated with deeper processing, increased engagement in strategy use, and self-regulatory behaviors (Lee & Wu, 2013; Thums et al., 2021). However, this finding might be biased by the research participants who were of intermediate proficiency level with an average vocabulary size short of the recommended 8,000-word families for effective processing of authentic text, as specified by Nation (2006). The participants' limited vocabulary size might have hindered them from fully engaging in and benefiting from information-oriented digital activities. Thus, the finding might be different for learners with more advanced language proficiency. Additionally, the study discovered that the association between informal digital activities for information purposes and receptive knowledge of low-frequency vocabulary was mediated by media use for socialization purposes. This finding is consistent with the notion that low-frequency words are not encountered frequently enough in naturalistic exposure to be acquired incidentally (Vilkaitė-Lozdienė & Schmitt, 2019). Therefore, repeated exposure to such vocabularies in different language use contexts, which can be facilitated through media use for socialization purposes, becomes crucial for their acquisition. The findings hence suggest that media migration activities in the informal learning context play a crucial role in harnessing the potential of informal digital activities, particularly those for entertainment and information purposes, for vocabulary development. Media migration facilitates "linked skill activities" that are essential for incidental vocabulary development (Nation, 2015). Findings from this study not only support the significance of considering media use purposes when examining the relationship between informal digital activities and vocabulary knowledge (e.g. Lai et al., 2023; Vanderplank, 2019) but also draw attention to the dynamic interplay and potential mediation effects of various media use purposes. The fluid nature of informal digital activities highlights the need to understand the

transitions between different media use purposes in order to gain nuanced insights into the relationship between these activities and vocabulary knowledge.

6.2 Relative associations of purpose of informal digital activities with vocabulary knowledge

This study further revealed that the purpose of informal digital activities accounted for a greater proportion of the variance in receptive knowledge of low-frequency vocabulary compared to high-frequency vocabulary. The finding that the purpose of informal digital activities played a more critical role in the development of less frequently encountered words aligns with previous research indicating a stronger relationship between informal digital activities and low-frequency vocabulary knowledge (Nation, 2015; Niitemaa, 2020). The finding on the stronger association of informal digital activities with low-frequency vocabulary knowledge suggests the importance of informal digital English learning, especially in the Chinese context, where college English syllabus centers around the 5,000 high-frequency word families (Wang & Fan, 2011; Zhao & Ji, 2018). The smaller contribution of informal digital activities to high-frequency vocabulary knowledge is understandable given that high-frequency vocabularies are likely to be learned in in-class English learning, hence limiting the add-on value of informal digital activities. However, the limited association might also be biased by the language proficiency level of the research participants in this study, as they were of intermediate-mid to intermediate-high proficiency level and might have already mastered a high proportion of these vocabularies. The finding might be different for learners with lower language proficiency levels.

Furthermore, this study uncovered that the relationship between informal digital activities for information purposes and high-frequency vocabulary size was contingent upon participants' strategic use of digital resources. Thus, the contribution of digital activities for information purposes to high-frequency vocabulary size was not fixed, but rather depended on how the learners interacted with the resources, specifically their strategic and deliberate use of digital resources in ways that support vocabulary learning. The finding adds to existing arguments that emphasize the significance of strategic engagement in informal digital activities for vocabulary development (e.g. Lai *et al.*, 2023; Nation, 2015; Shin *et al.*, 2023) by demonstrating that strategic engagement serves not only as a direct predictor of vocabulary knowledge but also as a moderator of the relationship between informal digital activities and vocabulary knowledge. It indicates that deliberate and mindful behaviors that maximize vocabulary development are critical to informal digital activities that demand greater cognitive attention, specifically those related to information purposes. Thus, encouraging learners to engage in digital activities for information purposes per se may not contribute to vocabulary development. Rather, it is essential to encourage and support learners to engage in strategic interaction behaviors, such as dual attention to meaning and form, simultaneous attention to multiple medium sources, and deliberate attention to and processing of lexical information, to augment the association of this digital experience with vocabulary.

7. Conclusion

This study uncovered the complexity of the associations of informal digital activities for different purposes with receptive vocabulary knowledge. Specifically, it revealed a direct contribution from digital activities for socialization purposes, a mediated contribution from digital activities for entertainment purposes, and a moderated contribution from digital activities for information purposes. It further found that the purpose of informal digital English activities played a more significant role in low-frequency vocabulary knowledge, while its contribution to the high-frequency vocabulary knowledge was contingent upon participants' strategic and deliberate use of digital resources for vocabulary learning.

The findings suggest that examining media use purposes provides valuable insights into the relationship between informal extramural digital English activities and vocabulary knowledge at a

nuanced level. Given the observed differences in the link between digital activities for different purposes and vocabulary knowledge, future research could delve deeper into how these activities contribute to various motivational and cognitive factors that are crucial for vocabulary development. This would help uncover the mechanisms behind the varying impact of different digital activities on vocabulary development. Moreover, the findings underscore the significance of strategic use of digital resources in augmenting the relationship between informal digital activities and vocabulary knowledge, particularly in the context of digital activities for information purposes, as well as for high-frequency vocabularies. It is essential to raise learners' awareness of different aspects of strategic use of digital resources that can facilitate vocabulary development.

The study has a few limitations. First of all, the research findings might have been biased by the specific context in which the study was conducted, which involved undergraduate intermediate EFL learners in China. The contribution of digital activities for socialization purposes might have been magnified, while the contribution of digital activities for entertainment purposes might have been underestimated in the Chinese cultural context. Furthermore, learners of varying age levels and language proficiency levels may choose different digital resources, engage with them in distinct ways, and prioritize different aspects of the linguistic information, even when engaging in activities with the same media use purpose (De Wilde *et al.*, 2022; Lai *et al.*, 2018; Swanborn & de Glopper, 2002). Additionally, the linguistic distance between one's native language and English has been found to impact incidental vocabulary learning from informal digital activities (Puimège & Peters, 2019). As a result, the contributions of digital activities for different purposes to high-frequency and low-frequency vocabularies might manifest differently in different research contexts. Thus, it is crucial to investigate this research issue in other research contexts. Second, this study only examined written receptive knowledge of individual words. Digital activities for different purposes might have varying effects on other aspects of vocabulary knowledge, such as formulaic expressions, oral receptive vocabulary knowledge, and productive vocabulary knowledge. Therefore, conducting in-depth investigations into the relationship between media use purposes and these different facets of vocabulary knowledge is necessary.

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