

# Enhancing Language learning Through Generative Artificial Intelligence in Blended Learning: An empirical study on Productive and Receptive of Informal Digital Learning English

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## Abstract

This study investigated the role of generative AI tools in facilitating informal digital English learning activities among second language (L2) learners in a Chinese context. It explored how factors like learners' ideal L2 self-imagination, international posture, and perceptions of information quality influence their engagement with productive (e.g. writing, speaking) and receptive (e.g. reading, listening) informal digital learning activities mediated by generative AI. Drawing from theories of consumption values and self-determination, the research model examined relationships between these variables.

The findings suggest that while generative AI holds promise for informal digital language learning by facilitating imagination of an ideal multilingual self, there are opportunities to enhance functionality for L2 contexts. Nurturing an international mindset through interventions may also promote informal learning across genders. Adapting informal digital learning resources based on factors like information quality perceptions could increase engagement. This study provides insights into harnessing generative AI effectively for blended language learning solutions.

**Keywords:** Generative AI, Informal digital language learning, Ideal L2 self, International Posture, Perceived Information Quality, Perceived Value

## 1. Introduction

Language learning is crucial for personal and professional development, and cultural exchange. Generative Pre-trained Transformer technology, designed to provide human-like responses to natural language prompts, which enhance personalized language learning with immediate assistance by advancing technology (Esmailzadeh, 2023; Feuerriegel, Hartmann, Janiesch, & Zschech, 2023). By incorporating these additional factors into the existing literature on formal language education and informal instruction approaches like ChatGPT as blended educational learning solutions to enhance students' engagement, learning outcomes (Sánchez-Ruiz, Moll-López, Nuñez-Pérez, Morano-Fernández, & Vega-Fleitas, 2023).

This research aims to perform a thorough assessment of Generative Artificial Intelligence (AI) and its potential advantages for individuals learning a foreign language. We will explore the performance, capabilities, and effects of Generative AI on user experiences, specifically its contribution to improving language production, delivering personalized learning, providing instant language support, exposing learners to real-life language usage, and promoting motivation and engagement (Holstein & Alevan, 2022).

It is imperative to underscore that although Generative AI exhibits potential in assisting second language learners, it should not supplant interpersonal relationships and instruction with traditional pedagogy in classroom setting. Generative AI should be employed as a

supplementary tool in a blended-learning strategy, merging the benefits of AI technology along with classroom's pedagogy and technology advancement (Duong & Solomon, 2023).

Through this extensive evaluation of Generative AI, the research objective is to contribute of the expanding research field on Generative AI of foreign language informal learning platform . We seek to provide valuable insights into the effective use of this novel technology in supporting second language students throughout their learning journey.

## 2. Literature review

This study focuses on the internal and external factors influencing second language (L2) learners' proficiency in English. It posits that a learner's envisioned fluent self, or the Ideal L2 Self, acts as a significant driver in language acquisition, fostering a global mindset and readiness for international engagement (Yashima, 2009). Emotional responses, including both the pleasure of learning and the anxiety it may induce, are acknowledged as pivotal in this educational journey (Jiang & Dewaele, 2019; Lee & Lee, 2021; MacIntyre & Gardner, 1994). Given that conventional educational settings may fall short in providing sufficient practice, this framework emphasizes the role of digital resources, such as ChatGPT, as convenient and effective avenues for informal digital English learning.

L2 learners' international posture, within a socio-educational context, aims to explore how it can enhance their independent interaction and communication with native speakers and integration into the target language community (Gardner, 1985). English, being a widely spoken language globally, is associated with a greater inclination towards international matters, travel, and work abroad, as well as openness to cultural diversity (Yashima, 2009). The international stance serves as a motivating factor for English learners, strongly linked to language competency, willingness to communicate, and the L2 Motivational Self System (J. H. Lee, 2018; Peng, 2015; Yashima, 2002).

The "Ideal L2 self" concept refers to language learners' envisioned future selves (Markus & Nurius, 1986). In various L2 environments, an international stance correlates with the desired L2 self. Adopting an international perspective enables learners to develop a distinct English-speaking identity in the global era, promoting language learning behaviours online and offline (Botes, Gottschling, Stadler, & Greiff, 2020; Murray, 2011, 2013). L2 learners benefit from a socially conceivable future, offering diverse identities and learning paths beyond the classroom (Cui & De Costa, 2022; Kanno & Norton, 2003).

The roles of emotions in L2 learners experience both positive emotions like enjoyment and negative emotions like anxiety during English education. Research has explored L2 anxiety (communication apprehension, test anxiety, fear of evaluation) which can discourage willingness to communicate. However, informal digital learning reduces L2 anxiety by allowing unmonitored English practice. Positive emotions like enjoyment in digital environments enhance engagement and willingness to communicate. Current literature recognizes the holistic role of both positive (enjoyment) and negative (anxiety) emotions in L2 acquisition, with positive emotions having a greater impact on improving L2 learners' communication abilities (Barcelos, 2015; Horwitz, Horwitz, & Cope, 1986; MacIntyre, 2017; MacIntyre & Gardner, 1994).

Digital technologies have opened up numerous opportunities for students to engage in innovative language learning and usage across various contexts. The digitalization and mobility of Informal Digital Learning of English (IDLE) involves engaging in English activities

autonomously in informal digital environments driven by personal interests. These activities occur outside the classroom, reflecting real-life situations and lacking a rigid structure.

Productive Informal Digital Learning of English (IDLE) is referring to learners actively engaging in digital activities outside formal education, where they produce language output in English, such as writing, speaking, or creating content. These self-directed activities are driven by learners' interests and often involve the use of various digital platforms, including social media, forums, blogs, online discussions, chat rooms, content creation, online gaming, language learning apps, and websites (Peters & Webb, 2018; Puimège & Peters, 2019).

Receptive Informal Digital Learning of English (IDLE) involves consuming English language content in an informal digital context like digital gameplay, watching English audio-visual content, listening English song, and reading in English. These receptive IDLE activities significantly contribute to L2 English vocabulary acquisition (Sundqvist & Wikström, 2015).

L2 learners engage in both productive and receptive informal learning practices to refine their language skills. The perceived value of these digital tools is critically assessed by learners, taking into account the quality of content, emotional resonance, cost-effectiveness, and social validation (Sweeney & Soutar, 2001). Perceived value refers to the assessment of benefits compared to costs, and it can be measured through dimensions such as functional, emotional, social, conditional, and epistemic value (Sweeney & Soutar, 2001; Zeithaml, 1988). Informal digital learning activities provides tangible benefits, immediate language support, versatility, and personalized feedback, enhancing learners' perception of value and promoting engagement and achievement (Du Boulay, 2016).

The judgment made by an individual regarding the content of information is referred to as perceived information quality. User perception encompasses the assessment of the credibility, reliability, relevance, and utility of the information. Numerous variables affect this perception, including the information's origin, its manner of presentation, and the setting in which it is employed (Feitosa de Moura, Alexandre de Souza, & Noronha Viana, 2021). Understanding and enhancing the perceived quality of information in online learning environments is essential for institutions and educators seeking to optimize blended learning courses.

The culmination of these experiences is expected to build the learners' confidence and willingness to communicate in English, an outcome referred to as L2 Willingness to Communicate (Yashima, 2002; Yashima, Zenuk-Nishide, & Shimizu, 2004). This research aims to elucidate the complex interplay between these elements and provide a comprehensive understanding of the ways in which ChatGPT can bolster the language learning process. The Willingness to Communicate (WTC) model examines how individual characteristics impact using second language (L2) for communication. Research indicates that both internal traits (e.g., confidence, anxiety) and external factors (e.g., interaction partners, classroom atmosphere) affect L2 WTC in face-to-face classroom settings (Dewaele & Dewaele, 2018; MacIntyre, Clément, Dörnyei, & Noels, 1998).

### 3. Theoretical frameworks

This research utilizes two complementary theoretical frameworks—the Theory of Consumption Values (TCV) and the Self-Determination Theory (SDT)—to investigate the impact of generative AI on second language learners' self-imagination and engagement in the learning process.

The Self-Determination Theory (SDT) offers a framework for comprehending the motivational elements that propel language learners' participation in learning activities. Three inherent psychological needs—autonomy, competence, and relatedness—influence the motivation and well-being of individuals. The aspiration for self-determination and validation in one's behaviours is referred to as autonomy. Effectiveness and a sense of capability are both components of competence. Relatedness concerns the human desire for affiliation and inclusion in social groups. (Ryan & Deci, 2017).

Consumer decisions, according to the Theory of Consumption Values, are influenced by the following five values: functional, social, affective, epistemic, and conditional. First, functional value relates to the perceived utility and performance of a product, such as the platform's effectiveness in supporting language acquisition. Second, social value involves the ability to enhance self-concept or status through connections with a community of learners. Third, emotional value encompasses the feelings evoked by the platform, such as enjoyment or excitement. Fourth, epistemic value satisfies curiosity and provides novelty through engaging learning experiences. Fifth, conditional value reflects situational factors influencing perceived value, such as the platform's alignment with the learner's specific contexts (Sheth, Newman, & Gross, 1991).

By integrating SDT and TCV, this study aims to offer insights into how generative AI can support learners' psychological needs, consumption values, and overall engagement in language learning, ultimately contributing to the development of more effective and engaging blended learning solutions.

#### 4. Research framework

Our research framework, as shown in Fig. 1, there are two factors as student's ideal second language self-imagination (ideal L2 Self) and student's international posture (IP) that play a role of the purpose for enhance English skills. Perceived information quality and perceived value from Generative AI as informal learning platform could influence individuals' attitudes and motivate their behaviour when it comes to language acquisition from productive and receptive of informal digital learning English. Ultimately, this influence has an impact on their level of proficiency in English.

The advent of generative artificial intelligence (AI) tools like ChatGPT presents exciting opportunities for enhancing blended language learning solutions, particularly in the realm of Informal Digital Learning of English (IDLE) activities. By integrating these AI-powered tools, educators can create personalized, efficient, and sustainable learning environments that cater to diverse learner needs.

Self-Determination Theory (SDT) asserts that when fundamental psychological requirements for autonomy, competence, and relatedness are fulfilled, individuals are more motivated and engaged. In accordance with their objectives, generative AI tools may grant learners authority over their learning process and decisions, thereby fostering autonomy. By providing low-stakes practice environments with immediate feedback and direction, these tools can boost English communication confidence and promote proficiency. Moreover, AI companions have the potential to foster a sense of connectedness by providing individualized attention and facilitating collaborative dialogues with peers and communities.

The notion of the ideal L2 self, derived from Higgins's self-discrepancy theory (1987), serves as a powerful motivational force in second language acquisition by envisioning a future self

that learners aspire to achieve through enhanced language proficiency and integration into specific linguistic communities. This concept is dynamic, evolving with learners' goals and aspirations, thereby reducing the gap between their real and ideal selves.

H1a: The Ideal second language Self is positively related to the engagement in Productive Informal Digital Learning of English activities.

H1b: The Ideal second language Self is positively related to the engagement in Receptive Informal Digital Learning of English activities.

In the context of second language acquisition, International Posture is a novel concept that has been devised to replace the traditional concept of integrativeness. It is the learners' aspiration to engage in communication with a conceptual international community as opposed to a particular language community. Since its inception by Yashima in 2002, this concept has garnered growing interest in light of the English language's emergence as a global language and the growing necessity for cross-border correspondence (Yashima, 2002, 2009; Yashima et al., 2004). International Posture is a revised form of integrativeness (Gardner, 1985), updated to reflect the current globalized world. Positive relationships exist between this motivational variable and desirable outcomes in language acquisition, including the desire to communicate, the conception of the ideal second language self, and language proficiency.

H2a: Students' International Posture is positively related to participation in Productive Informal Digital Learning of English activities.

H2b: Students' International Posture is positively related to the participation in Receptive Informal Digital Learning of English activities.

The perceived information quality comes into play when learners interact with these AI-generated materials. If the materials are relevant, engaging, and appropriately challenging, learners will perceive the information quality as high. A platform that consistently delivers high-quality content, customized to individual learner needs, and capable of evolving through user feedback, embodies the functional value that is central to the Theory of Consumption Values. The perceived information quality comes into play when learners interact with these AI-generated materials. If the materials are relevant, engaging, and appropriately challenging, learners will perceive the information quality as high. This can enhance their learning experience, making them more likely to continue using the platform and improve their English skills. It is a key determinant in the success and attractiveness of IDLE activities, where the quality of information directly contributes to learner satisfaction and educational outcomes. This could provide valuable insights into how perceived information quality can influence the effectiveness and Generative AI as IDLE for L2 learners.

H3a: There exists a beneficial relationship between involvement in Productive Informal Digital Learning of English activities and perceived information quality (PIQ).

H3b: There exists a beneficial relationship between involvement in Receptive Informal Digital Learning of English activities and perceived information quality (PIQ).

The Perceived Functional Value (PFV) of Generative AI platforms is a critical determinant in second language learners' engagement with Productive and Receptive Informal Digital Learning of English. In the present context, functional value refers to the practical utility of these AI tools and the degree to which they can facilitate the process of language acquisition

in an efficient and effective manner. While these platforms do provide considerable advantages for text-based learning, their current functional value in fostering the development of speaking and listening skills is restricted. This drawback arises from the fact that these platforms are inherently text-based, which restricts their capability to perform conversational evaluations and offer feedback regarding pronunciation and auditory comprehension.

For instance, an L2 learner might use Generative AI platforms to practice writing and grammar, which the platform can support with instant feedback and suggestions for improvement. This direct text-based interaction aligns with the functional value the learner seeks in improving written proficiency. However, when the same learner seeks to enhance speaking skills, the functional value of the AI diminishes, as it cannot offer real-time spoken dialogue or correct pronunciation errors. The implications of this gap are significant. The Theory of Consumption Values suggests that learners will naturally gravitate towards products or services that provide the highest functional value for their specific needs. Since speaking and listening are critical components of language proficiency, L2 learners may reduce their use of current Generative AI tools for IDLE activities that require these skills. Instead, they might turn to alternative resources like language tutoring services, conversation practice apps, and listening comprehension programs that offer higher functional value in these areas.

H4a: Learning outcomes will be adversely affected by the Perceived Functional Value (PFV) of Generative AI in Productive Informal Digital Learning of English activities.

H4b: Learning outcomes will be beneficially affected by the Perceived Functional Value (PFV) of Generative AI in Receptive Informal Digital Learning of English activities.

Individuals' personal characteristics such as age and gender significantly shape their motivations, perceptions, and behaviours in foreign language learning, influencing how they engage with language learning tools like generative AI for informal digital learning of English (IDLE) activities. Research highlights that gender not only affects learners' attitudes and self-concepts but also moderates the relationship between key constructs like the ideal second language self-imagination and international posture. Specifically, studies indicate that female learners often show a stronger connection between these constructs and their engagement in IDLE, typically exhibiting more positive attitudes and higher self-concepts related to language learning compared to their male counterparts. These gender-based differences underscore the importance of considering personal characteristics when analyzing motivational dynamics and engagement strategies in second language acquisition (Baker & MacIntyre, 2000).

H5a: The relationship between the ideal second language self and the productive informal digital learning English activities is moderated positively by gender.

H5b: The relationship between the ideal second language self and the receptive informal digital learning English activities is moderated positively by gender.

H5c: The relationship between international posture and the productive informal digital learning English activities is moderated positively by gender.

H5d: The relationship between international posture and the receptive informal digital learning English activities is moderated positively by gender.

In regard to the perceived productive and receptive value of Generative AI as an informal digital learning of English instrument, age can significantly moderate the relationship between

ideal second language self, international posture, and age. Younger language learners might demonstrate a more pronounced relationship between their perceived value of utilizing Generative AI platforms for informal digital learning English activities and their imagined ideal multilingual self and international orientation. As they grown up with technology being an intrinsic component of their educational experiences, are typically more acquainted with and proficient in digital learning environments (Lee & Lee, 2021).

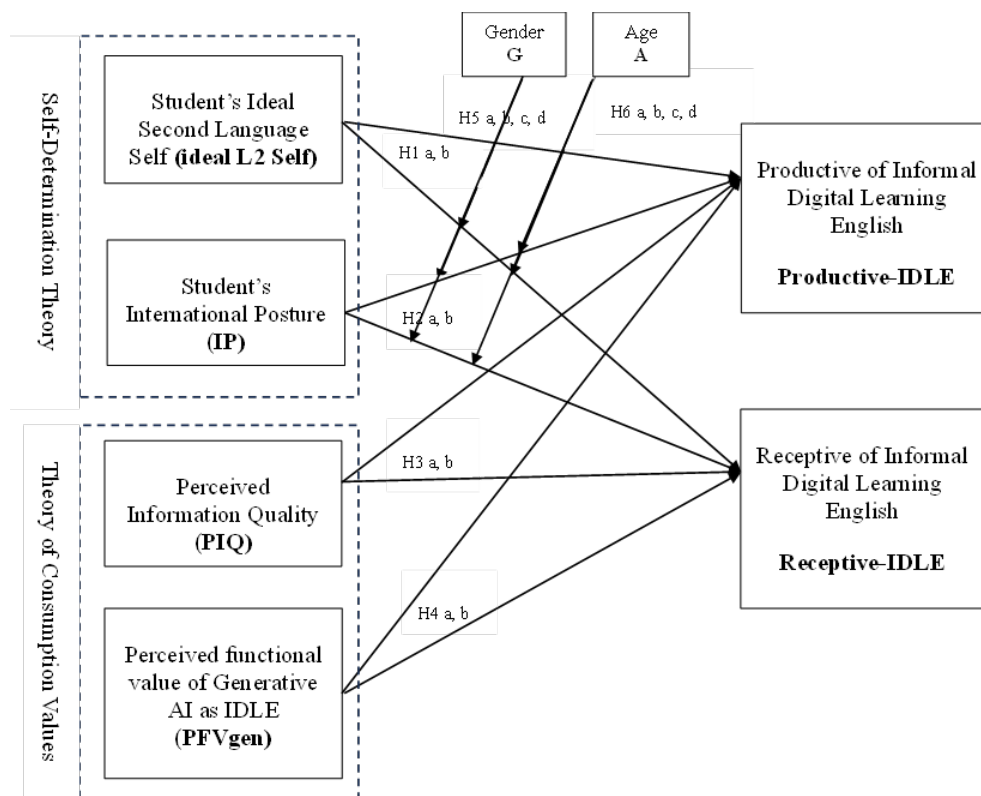
H6a: The relationship between the ideal second language self and the productive informal digital learning English activities is moderated negatively by age.

H6b: The relationship between the ideal second language self and the receptive informal digital learning English activities is moderated negatively by age.

H6c: The relationship between international posture and the productive informal digital learning English activities is moderated negatively by age.

H6d: The relationship between international posture and the receptive informal digital learning English activities is moderated negatively by age.

Figure 1- Hypothesis model



### Data collection and analysis

The survey items for measurements were modified from pre-existing scales in order to accommodate the latest technological developments for ongoing and prospective use scenarios. This process was operationalized in a manner consistent with previous investigations. On a five-point Likert scale, responses to each item ranged from 1 (indicating "strongly disagree") to 5 (indicating "strongly agree"), with 2 ("disagree"), 3 ("neutral"), and 4 ("agree") falling between. Ten school instructors, the researcher, and the thesis supervisor of the questionnaire

examined the survey to ensure that every measurement item was unambiguous. Table 1 summarizes the constructs we adapted in the questionnaire and highlights their sources.

Table 1- Samples Items in the Questionnaire

Constructs/ Source of references/ # of items	Sample items
Student's Ideal Second Language Self-Imagination (L2 Self)/ (Dörnyei, 2009)/ 6 items	Whenever I think of my future career, I imagine myself using English.
	I can imagine a situation where I am doing business with foreigners by speaking English.
	I can imagine myself speaking English with international friends or colleagues.
	I imagine myself as someone who is able to speak English.
	I can imagine myself speaking English in the future with foreign friends in informal settings.
	I can imagine myself living or travelling abroad and having a discussion in English.
Student's International Posture (IP)/ (Yashima, 2009)/ 6 items	I make friends with international students studying in western countries (e.g., USA, Canada, UK).
	I often read and watch news about foreign countries.
	I often talk about situations and events in foreign countries with my family and/or friends.
	I'm interested in an international career.
	I share with people from other parts of the world.
I participate in a volunteer activity to help foreigners living in the surrounding community.	
Perceived Information Quality (PIQ)/ (Feitosa de Moura, Alexandre de Souza, & Noronha Viana, 2021)/ 6 items	Generative AI content is of high quality.
	Generative AI content is relevant.
	Generative AI content is updated.
	Generative AI content is well structured.
	Generative AI content is suitable for my level of understanding.
	Generative AI is very knowledgeable about the topic.
Perceived functional value of Generative AI as Informal Digital Learning of English (PFVgen)/ (Zeithaml, 1988)/ 5 items	Gratuity of Generative AI is an important factor that can be used in learning English.
	Generative AI aids effective English learning time.
	I consider that the use of Generative AI in the subject contributes significantly to learning English process.
	Learners perceive Generative AI's high functional value for learning.
	Learning English using Generative AI make the learning process excellent.
Productive of Informal Digital Learning of English (Productive IDLE)/ (Benson, 2011; Lee & Lee, 2021)/ 5 items	I post English-related content via social media (e.g., Facebook, TikTok, Xiaohongshu).
	I chat with others in English via messaging apps (e.g., WhatsApp, WeChat, etc).
	I send an email to others in English.
	I use video conferencing apps to connect with native speakers of the language (e.g., British, American).
	I use video conferencing apps to connect with non-native speakers of English all over the world (e.g., Japanese, Korean).
Receptive of Informal Digital Learning of English (Receptive IDLE)/ (Benson, 2011; Lee & Lee, 2021)/ 6 items	I listen to English songs or news programs online or on TV.
	I browse English or English-related content through social media (e.g., Facebook, TikTok, Xiaohongshu, WeChat, etc.).
	I take the initiative to work on my English-reading skills through apps on my phone or computer after class.
	I take the initiative to work on my English-listening skills through apps on my phone or computer after class.
	I take the initiative to work on my English-writing skills through apps on my phone or computer after class.
	I watch English movies or TV series with subtitles.

The target population consists of Chinese adolescents aged between 12 and 24 and above, who are enrolled in secondary and postsecondary education. These students attend high school to bachelor's degree programs. Admission to these schools requires meeting local English language proficiency criteria. The research project specifies an appropriate sample size of 1,600 students. This size is determined based on statistical considerations, such as achieving adequate statistical power and precision.

We have contacted the school supervisor, who is my DBA classmate. He oversees a high school “School 1” in Beijing and introduced me to another high school “School 2” in Beijing. To increase the sample size, I also relied on another classmate who is the associate dean of the education group from Shandong. The group operates a high school “School 3” and a vocational training school “School 4” in Shandong.

The research has not yet obtained official sanction from the Ministry of Education of the People's Republic of China due to the constrained resources at this time. In order to advance the research, it will be necessary to document the participating institutions and their representatives in an anonymous manner. By implementing this protocol, the confidentiality of the institutions and individuals conducting the research is maintained at all times.

We used email and follow-up online meetings to introduce the research objectives and questions. Each school nominated two representatives for survey collaboration. The eight nominated representatives are certified English teachers by the government. Since survey respondents may not fully understand the questionnaires in English, we invited two Chinese language teachers for simplified Chinese translation and review by two nominated teachers fluent in both languages.

I hosted online meetings with the eight teacher representatives for survey operation, respondent feedback, and performance during the survey period. The preliminary estimation of the sample size exceeded 1,000 pupils. Based on my analysis, the most optimal time to administer the questionnaire would be in January 2024, coinciding with the commencement of the second semester of the academic year 2023/2024.

The survey was made available online via Microsoft Form. I prepared a cover letter with the survey background, introduction, and purpose of the study. The survey was accompanied by a Quick Response (QR) code and included my email and WeChat contact for inquiry purposes. Subsequently, under the guidance of the teacher representatives affiliated with the institution in question, the online survey was disseminated to the enrolled students, who were then introduced to the concept of IDLE and granted the opportunity to access and peruse the accompanying questionnaire. Prior to responding to the survey, it was explicitly communicated that engagement in this study was entirely voluntary. In the event of any ambiguity regarding specific items, it was mandatory for individuals to seek guidance from their instructors or myself before proceeding. The present investigation was a preliminary study.

In each school, eight students were selected at random to participate in a pilot study. Assessing the feasibility and comprehensibility of the questionnaire for the target demographic was the objective of this pilot study. A request for their feedback was extended to the chosen students in order to assess their level of understanding regarding the items in the questionnaire. Throughout the pilot study, participants were provided with explicit instructions to carefully peruse and furnish answers to the questionnaire, with the researcher diligently monitoring their comprehension level and documenting any challenges encountered. In the event that participant feedback suggested that particular English language elements required alterations to enhance clarity and comprehension, the questionnaire was revised accordingly for the primary investigation, with particular attention paid to its legibility for the student participants. In addition, the researcher was able to determine the time required for students to accurately complete the survey through the pilot study. As a whole, the pilot study was instrumental in improving the accuracy of the questionnaire and making the necessary adjustments to ensure its clarity and usability. The information gathered from the participants improved the instrument's validity and reliability by providing valuable insights into the level of comprehension of the target demographic.

The initial survey phase commenced on January 8, 2024. I accompanied the questionnaire delivery with a cover letter that elaborated on the survey's significance and objectives. For any inquiries, my contact information, including my WeChat and email addresses, was included in the cover letter. The respondents could return the questionnaire through the online survey system developed by Microsoft Forms in order to increase the response rate. 800 students were selected at random from 400 high school seniors and 400 students enrolled in vocational training programs. In order to streamline the response collection process, pupils who failed to respond were duly notified via email on January 10 and January 12, 2024. In the three reminders, the significance of their responses and the survey as a whole was briefly emphasized. As stated by Chisnall (2007), employing diverse media platforms can effectively inspire

participants to collaborate. Thus, we maintained repeated communication with non-respondents via email and WeChat message for one week following the second reminder until the completion of the first phase of the survey on January 18, 2024. A total of 123 questionnaires were returned, representing a 16.63% response rate. This finding is similar to the majority of mail surveys utilized in prior research, which exhibited a response rate range of 12.2% to 22.4% (Chisnall, 2007; Cycyota & Harrison, 2006).

The commencement of the second survey phase occurred on January 29, 2024. I proceeded in the same manner as the initial phase. 800 students were selected at random from 400 high school seniors and 400 students enrolled in vocational training programs. In order to facilitate the collection of responses, non-responding students were duly notified via email, text message, and direct message on January 31, February 2, and February 5, 2024. In all three reminders, the significance of their responses and the objective of the survey were succinctly outlined. Thus, we maintained repeated communication with non-respondents via email and WeChat message from February 9, 2024, five days after the third reminder, until the completion of the second phase of the survey. A total of 146 questionnaires were received, representing a response rate of 17%. After assessment, 246 sets of the 269 returned questionnaires were deemed legitimate for data analysis, while 23 sets were deemed incomplete. As a result, the survey garnered an estimated 16.8% of responses. Table 2 is the summarizes of descriptive statistics of the respondents.

Table 2- Descriptive Statistics of the Respondents

Category		Number	Percentage
Gender	Males	110	45%
	Females	136	55%
Age	15 - 18	91	37%
	18 - 21	130	53%
	21 - 24	25	10%
Education	Senior High School	91	37%
	Undergraduate or equivalent	123	50%
	Master	4	2%
	Others	28	11%

Participants are divided into two groups (early respondents, and late respondents) with the objective to examine the nonresponse bias. 107 respondents who completed and returned the questionnaires within the first ten days of distribution are considered early respondents, while 139 respondents in the last ten days before the survey's closure are regarded as late respondents. We used independent t-test, a nonresponse analysis was performed to compare the means of the main variables. We have compared the means of all major variables between the early respondents and late respondents, the differences were all similar with minor variations with the range from -0.152 to 0.144. Based on these results, I conclude that the two groups (i.e. early respondents and late respondents) were similar. Nonresponse bias was not observed in this study.

In examining the relationship between various factors and outcome variables related to language learning, the results of the statistical analysis lead to different conclusions regarding

the null hypotheses posed. For the Ideal Second Language Self (ideal L2 self), with a p-value of 0.138, the data does not provide sufficient evidence to reject the null hypothesis, thus suggesting that the ideal L2 self is not significantly related to the outcome variable(s). In contrast, the International Posture (IP), with a p-value of 0.001, demonstrates a statistically significant relationship with the outcome variable(s), leading to the rejection of the null hypothesis for this factor. Similarly, the Perceived Information Quality (PIQ) and Receptive Informal Digital Learning English (IDLE) both show significant effects, with p-values of 0.004 and 0.003 respectively, prompting a rejection of their null hypotheses. On the other hand, the Perceived Functional Value of Generative AI (PFVgen) and Productive IDLE, with p-values of 0.378 and 0.177, do not meet the threshold to reject their respective null hypotheses, indicating no significant relationship with the outcome variables in these areas. Table 3 is the summarizes of Statistics between two group.

Table 3- Statistics Between Early Respondents and Late Respondents

		ideal L2 Self	IP	PFVgen	PIQ	Receptive IDLE	Productive IDLE
Early Respondents Group N=107	mean	3.400	3.086	3.566	3.799	3.729	3.400
	SD	0.959	0.921	0.832	0.844	0.982	1.184
Late Respondents Group N=139	mean	3.329	3.237	3.525	3.661	3.585	3.309
	SD	0.889	0.879	0.797	0.976	1.026	1.153
	P-value	0.138	0.001	0.378	0.004	0.003	0.177

In table 4 is the summaries of items factor loading results indicates that its value is greater than 0.7. A high degree of correlation among items of a construct is generally indicated when the AVE exceeds the minimum threshold of 0.50 (Bagozzi, Yi, & Nassen, 1999). Consequently, each item is considered reliable. Furthermore, convergent validity is established as both AVEs of the constructs exceed the variances attributable to measurement errors.

Table 4 - Rotated Component Matrix

	1	2	3	4	5	6
ideal L2-Self-2	0.209	0.115	<b>0.791</b>	0.252	0.018	0.206
ideal L2-Self-3	0.102	0.001	<b>0.755</b>	0.321	0.154	0.133
ideal L2-Self-4	-0.094	0.125	<b>0.694</b>	0.129	0.259	0.341
ideal L2-Self-5	0.000	0.095	<b>0.804</b>	0.245	0.120	0.282
ideal L2-Self-6	0.143	0.022	<b>0.747</b>	0.266	0.082	0.273
IP-2	0.045	0.235	0.271	<b>0.698</b>	0.012	0.122
IP-3	0.096	0.169	0.111	<b>0.722</b>	0.091	0.218
IP-4	0.025	0.137	0.263	<b>0.759</b>	0.121	0.171
IP-5	-0.020	0.068	0.229	<b>0.743</b>	0.109	0.219
IP-6	0.061	0.019	0.199	<b>0.730</b>	0.104	0.225
PFV-Gen-2	0.186	-0.042	0.314	0.217	0.097	<b>0.758</b>
PFV-Gen-3	0.080	-0.066	0.275	0.249	0.142	<b>0.831</b>
PFV-Gen-4	0.097	-0.016	0.233	0.304	0.028	<b>0.808</b>
PFV-Gen-5	0.113	-0.003	0.326	0.314	0.021	<b>0.755</b>
PIQ-1	<b>0.831</b>	0.169	0.077	0.065	0.217	0.106
PIQ-2	<b>0.852</b>	0.090	0.061	0.129	0.162	-0.048
PIQ-3	<b>0.802</b>	0.078	0.060	0.090	0.234	0.078
PIQ-4	<b>0.823</b>	0.148	0.053	-0.013	0.194	0.088
PIQ-5	<b>0.775</b>	0.217	0.060	-0.009	0.148	0.041
PIQ-6	<b>0.727</b>	0.254	0.051	-0.036	0.219	0.255
Productive-IDLE-1	0.173	<b>0.697</b>	0.177	0.099	0.377	0.021
Productive-IDLE-2	0.222	<b>0.695</b>	0.121	0.167	0.366	-0.023
Productive-IDLE-3	0.213	<b>0.828</b>	0.078	0.157	0.179	-0.042
Productive-IDLE-4	0.198	<b>0.823</b>	-0.019	0.155	0.183	-0.060
Productive-IDLE-5	0.145	<b>0.885</b>	0.007	0.057	0.147	0.010
Receptive-IDLE-2	0.275	0.266	0.246	0.051	<b>0.692</b>	0.048
Receptive-IDLE-3	0.286	0.370	0.147	0.194	<b>0.753</b>	0.038
Receptive-IDLE-4	0.386	0.335	0.117	0.100	<b>0.727</b>	0.044
Receptive-IDLE-5	0.368	0.266	0.089	0.112	<b>0.719</b>	0.174
Receptive-IDLE-6	0.419	0.250	0.078	0.137	<b>0.670</b>	0.121
Extraction Method: Principal Component Analysis.						
Rotation Method: Varimax with Kaiser Normalization.						
Notes: Student's Ideal Second Language Self Imagination (ideal L2 Self), Student's International Posture (IP), Perceived functional value of Generative AI as IDLE (PFVgen), Perceived Information Quality (PIQ), Productive of Informal Digital Learning English (Productive-IDLE), Receptive of Informal Digital Learning English (Receptive-IDLE)						

A term used to describe a quality or characteristic that is devoid of errors and yields consistent outcomes is reliability. To assess the internal consistency of multi-item scales, Cronbach's alpha was utilized in this endeavour. As shown in Table 5, all items were well correlated with each

other as the value of Cronbach's alphas of all the constructs were over 0.7 (Bagozzi & Nassen, 1999). As such, all data are deemed reliable. Moreover, since all the constructs were adapted from previous studies, they were representative in terms of construct validity.

Table 5 - Correlation Matrix

Construct	Cronbach's alpha	AVE	ideal L2-Self	IP	PFVgen	PIQ	Productive-IDLE	Receptive-IDLE
ideal L2-Self	0.906	0.577	0.760					
IP	0.862	0.534	.597**	0.731				
PFVgen	0.919	0.622	.641**	.573**	0.789			
PIQ	0.923	0.644	.236**	.191**	.259**	0.802		
Productive-IDLE	0.914	0.623	.244**	.334**	0.074	.455**	0.789	
Receptive-IDLE	0.922	0.508	.390**	.351**	.283**	.648**	.658**	0.713

\*\* Correlation is significant at the 0.01 level (2-tailed).

Notes: Student's Ideal Second Language Self Imagination (ideal L2 Self), Student's International Posture (IP), Perceived functional value of Generative AI as IDLE (PFVgen), Perceived Information Quality (PIQ), Productive of Informal Digital Learning English (Productive-IDLE), Receptive of Informal Digital Learning English (Receptive-IDLE)

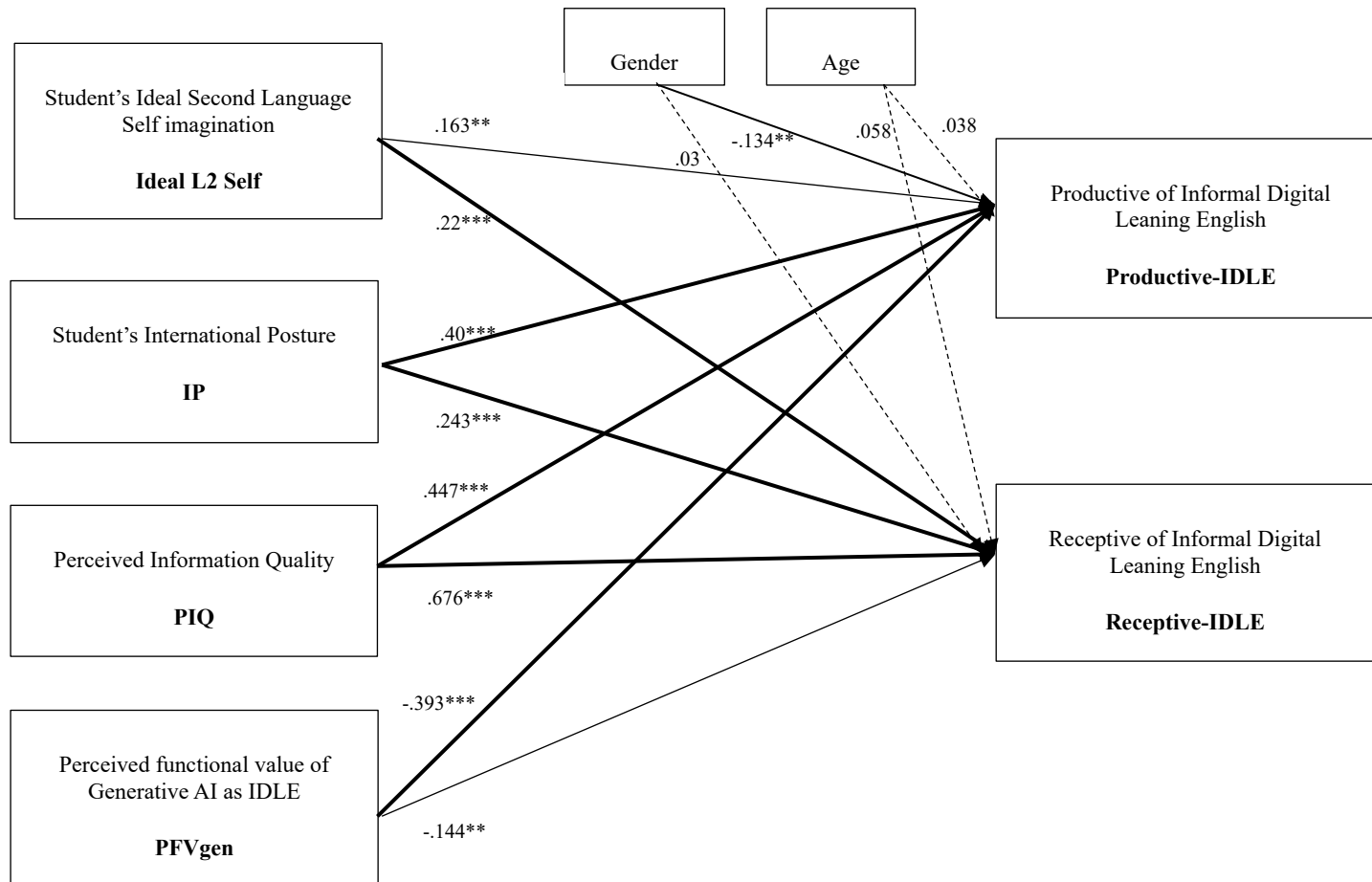
This research was carried out through the utilization of surveys based on a self-reported closed-end questionnaire, which introduces the important consideration of common method bias's numerous sources (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Evaluating if common technique bias was a serious concern in this study is crucial. Based on a prior investigation, We conducted the Harman one-factor analysis (Podsakoff & Organ, 1986). The result of the total variance obtained from the exploratory factor analysis indicate that no single factor, with a dominant value of 36.748% accounts for most of the covariances.

The study controls for gender and age to assess their impact on receptive and productive informal learning activities, aiming to uncover how these demographic factors might differentially affect participation and benefits among various groups. The hypothesis suggests that gender and age may influence the use and outcomes of these activities.

We utilized AMOS for the data analysis and evaluates internal relationships with a nonparametric approach, the structural equation model accounts for the variance of the results. It is highly advantageous for our research due to its ability to withstand the challenges posed by comparatively small sample sizes and non-normal distribution data. The proposed hypotheses were evaluated by employing path analysis in AMOS 24.0 with a bootstrap of 246 samples at 95 Cis.

Figure 2 - Path Analysis Results provides a detailed analysis of the route coefficients in the structural equation model, highlighting the interconnectedness of variables as defined by AMOS. The R<sup>2</sup> is 0.329 indicates that the relationship between the dependent and independent variables explains 32.9% of the variability of the dependent variable under investigation.

Figure 2 - Path analysis results



The notion of model fit is of paramount importance within the domain of structural equation modelling (SEM) (Kline, 1998). An adequate representation of the interrelationships among the variables and congruence between the hypothesized model and the observed data are characteristics of a decent model fit (Hu & Bentler, 1999).

Table 6 - showed that a good structural model fit with key indicators

<b>Model Fit Summary</b>		
<b>Key indicators</b>	<b>Default model</b>	<b>Desired level</b>
CMIN/DF	3.371 (acceptable)	A lower value under 3 is preferred
Comparative Fit Index (CFI)	0.821 (acceptable)	CFI should be close to or above 0.90
Root Mean Square Error of Approximation (RMSEA)	0.098 (acceptable)	RMSEA should be close to or below 0.08
PRATIO (Parsimony Ratio)	0.915 (Reasonable)	Closer to 1
ECVI (Expected Cross-Validation Index)	7.112 (acceptable)	Lower values are preferred
HOELTER (Sample Size Requirement for Stability)	81 (sufficient)	Higher values are preferred

Our analysis indicates that, ideal L2 Self has a significant positive effect on both Productive-IDLE ( $\beta = 0.163^{**}$ ) and Receptive-IDLE ( $\beta = 0.22^{***}$ ), thus supports hypothesis H1a, b. And, International Posture (IP) also shows a significant positive effect on both Productive-IDLE ( $\beta = 0.4^{***}$ ) and Receptive-IDLE ( $\beta = 0.243^{***}$ ), thus supports hypothesis H2a, b. In line with the result, Perceived Information Quality (PIQ) has a significant positive effect on both Productive-IDLE ( $\beta = 0.447^{***}$ ) and Receptive-IDLE ( $\beta = 0.676^{***}$ ) and Perceived functional value of Generative AI as IDLE (PFVgen) has a significant negative effect on both Productive-IDLE ( $\beta = -0.393^{***}$ ) and Receptive-IDLE ( $\beta = -0.144^{**}$ ), thus the result validates hypotheses H3a, b and H4a, b.

Moreover, our result reveals the presence of a moderating effect of Gender and Age on the relationship between ideal L2 Self/ international posture and Productive IDLE/ Receptive IDLE. These data suggest that there is an insignificant moderating effect in the strength of the relationship between the above variables among males and females or across different age groups. Therefore, H5a, b, d and H6a, b, are invalidated.

The data shown that there is significant Moderating Effects but inconsistent direction with base model, thus the result also consider invalidated for H6c, d.

There is only one moderating effect is significant, that is H5c. Gender moderates the relationship between international posture and Productive-IDLE activities varies between males and females ( $\beta = 0.101^{***}$ ), according to this finding.

As shown in Table 7 and 8 for the direct and moderating effect with independence variables and Productive / Receptive IDLE.

To calculate the moderating effect of Gender on the relationship between International Posture (IP) and Productive-IDLE, considering the constant value ( $\beta_0$ ) as a function of the other variables and their mean values. We can use the following equation:

$$\text{Productive-IDLE} = \beta_0 + \beta_1 \times \text{IP} + \beta_2 \times \text{Gender} + \beta_3 \times (\text{IP} \times \text{Gender})$$

Where:

$\beta_0$  is the intercept

$\beta_1$  is the main effect of IP on Productive-IDLE

$\beta_2$  is the main effect of Gender on Productive-IDLE

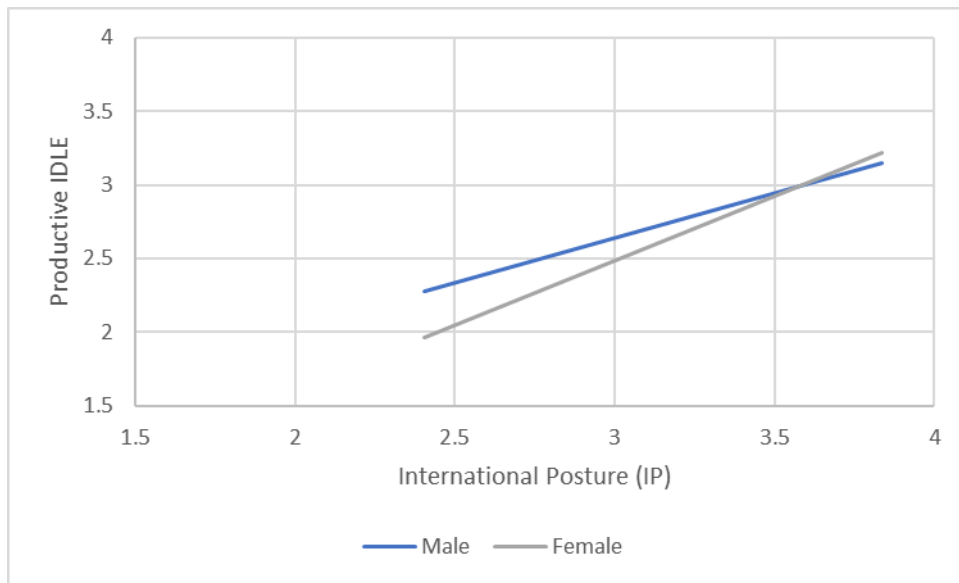
$\beta_3$  is the interaction effect of IP and Gender on Productive-IDLE

Given: considering the constant value ( $\beta_0$ ) as a function of the other variables and their mean values ( $\beta_0 = 0.821$ ).

We can use the equation to calculate the effect of IP on Productive-IDLE for males as (Gender = 0) and females as (Gender = 1). The difference in the effect of IP on Productive-IDLE between females and males can be calculated by subtracting the effect for males from the effect for females. Based on the provided data, we have  $\beta_1 = 0.606$ ,  $\beta_2 = -0.790$ ,  $\beta_3 = 0.101$ .

This means that for a one-unit increase in IP, the Productive-IDLE score for females is -0.475 units lower than for males when the result is negative. To plot the graphic for the moderating effect of Gender on the relationship between International Posture (IP) and Productive-IDLE, we'll calculate the Productive-IDLE scores for males and females at low (-1 SD) and high (+1 SD) levels of IP. (referral to Figure 3)

Figure 3 - Moderating effect of Gender



The image illustrates how gender affects the relationship between an individual's international posture and their productive-IDLE score. Both males and females have an upward relationship between International Posture and Productive-IDLE. This implies that when an individual's international posture improves, their Productive-IDLE score also tends to increase. The Female line has a steeper slope compared to the Male line, indicating that the effect of International Posture on Productive-IDLE is more pronounced for Females than for Males. In other words, as Females' international posture increases, their Productive-IDLE scores tend to increase more rapidly than those of Males with the same international posture level.

Table 7 - Direct and moderating effects with Productive IDLE

	Direct Effect	Moderating Effect (Gender)	Moderating Effect (Gender)	Moderating Effect (Age)	Moderating Effect (Age)
ideal L2 Self	<b>0.202**</b>	<b>0.214***</b>	<b>0.198**</b>	<b>0.198**</b>	<b>0.202**</b>
IP	<b>0.589***</b>	<b>0.606***</b>	<b>0.59***</b>	<b>0.596***</b>	0.588***
PIQ	<b>0.563***</b>	<b>0.571***</b>	<b>0.562***</b>	<b>0.564***</b>	<b>0.562***</b>
PFVgen	<b>-0.547***</b>	<b>-0.572***</b>	<b>-0.545***</b>	<b>-0.55***</b>	<b>-0.546***</b>
Age	0.042 (0.426)	0.056 (0.281)	0.04 (0.442)	<b>-0.121*</b>	0.017 (0.751)
Gender	<b>-0.222**</b>	<b>-0.790***</b>	-0.153 (0.056)	<b>-0.214<sup>#</sup></b>	<b>0.221**</b>
Gender x IP	-	<b>0.101***</b>			
Gender x ideal L2 Self			-0.011 (0.372)		
Age x IP				0.045**	
Age x ideal L2Self					0.006 (0.62)
R square	0.56	0.682	0.561	0.577	0.565
R square change due to interaction		0.122	0.001	0.017	0.005
<p><b>Bold number represent</b>  <sup>#</sup> might represent a significance level of <math>p &lt; 0.10</math>,  * might represent a significance level of <math>p &lt; 0.05</math>,  ** might represent a significance level of <math>p &lt; 0.01</math>,  *** might represent a significance level of <math>p &lt; 0.001</math>.</p>					

Table 8 - Direct and moderating effects with Receptive IDLE

	Direct Effect	Moderating Effect (Gender)	Moderating Effect (Gender)	Moderating Effect (Age)	Moderating Effect (Age)
ideal L2 Self	<b>0.218***</b>	<b>0.217***</b>	<b>0.202**</b>	<b>0.215***</b>	<b>0.218***</b>
IP	<b>0.287***</b>	<b>0.288***</b>	<b>0.589***</b>	<b>0.292***</b>	<b>0.287***</b>
PIQ	<b>0.682***</b>	<b>0.681***</b>	<b>0.563***</b>	<b>0.683***</b>	<b>0.681***</b>
PFVgen	<b>-0.161**</b>	<b>-0.16**</b>	<b>-0.547***</b>	<b>-0.163**</b>	<b>-0.16**</b>
Age	0.051 (0.218)	0.05(0.221)	0.042 (0.426)	<b>-0.078*</b>	0.036 (0.378)
Gender	0.039 (0.526)	0.055 (0.373)	<b>-0.222**</b>	0.046 (0.461)	0.04 (0.519)
Gender x IP		0.017 (0.112)			
Gender x ideal L2 Self			-0.003 (0.792)		
Age x IP				<b>0.036**</b>	
Age x ideal L2 Self					0.004 (0.716)
R square	0.589	0.595	0.589	0.602	0.591
R square change due to interaction		0.006	0	0.013	0.002
<p><b>Bold number represent</b>  * might represent a significance level of <math>p &lt; 0.05</math>,  ** might represent a significance level of <math>p &lt; 0.01</math>,  *** might represent a significance level of <math>p &lt; 0.001</math>.</p>					

## Discussion and findings

There has been empirical research on the incorporation of generative AI services in language learning, with a specific emphasis on their functional value and the relationship between that value and learners' participation in informal online learning with productive and receptive learning activities. This study sheds light on the somewhat paradoxical findings regarding the perceived functional value of Generative AI and its relationship with language learning activities.

Second language learner imagination themselves can speak fluent in English (ideal L2 Self), and Student's International Posture (IP) shows a significant positive relationship with both Productive and Receptive informal digital learning of English activities. This suggests that students who can imagine themselves speak with confidence in English (e.g., communicate with foreigner in English, living, or traveling abroad). They readiness to participate in the international community or affairs (e.g., discussing global affairs on social media platforms, reading, and watching news about foreign countries, and expressing interest in pursuing careers abroad) and desire to exchange ideas with individuals from different regions. These students tend to engage more in both productive and receptive informal digital learning of English activities.

The Perceived Information Quality (PIQ) has a significant positive effect on both Productive and Receptive learning activities. Students who perceived the information provided Generative AI as high quality (e.g., content is of high quality, relevant, updated, well structured, suitable for their level of understanding, and believe that Generative AI is very knowledgeable about the topic). Students would like to further engage and using the advance technology for language acquisition.

The novel findings of research between perceived functional value of generative AI tools and participation in informal online learning activities. It can be more comprehensively analyzed by considering the specific demographic of different education background with those Mainland Chinese students whom mother tone not English.

These learners require thorough instruction of all four language skills (speaking, listening, reading, and writing) in order to gain competency. However, the existing generative AI tools, only can provides essential support in domains such as writing and content creation. It does not adequately cater to the special requirements of individuals learning English as a Second Language who need interactive opportunities for speaking and listening practice.

The inability of generative AI like ChatGPT 4.0 to provide effective training for productive skills like conversational fluency and receptive skills like nuanced listening comprehension may have contributed to the perceived lower functional value among the student respondents. As a result, their motivation to incorporate these tools into their informal language learning practices across both receptive and productive IDLE activities decreased.

The other empirical findings on moderation effect with students' age group and gender. The relationship between the ideal L2 Self and Productive-IDLE showed negligible differences in strength across different genders and age groups, as evidenced by statistically insignificant. Similarly, for Receptive-IDLE, the moderating effects of gender and age on the relationships with international posture and ideal L2 Self were also found to be insignificant. These findings suggest a general consistency in the relationships across various demographic groups, indicating that the impact of these moderator variables is minimal.

The study explored the direct impact of international posture on Productive-IDLE and investigated how gender moderates this relationship. It found that gender significantly alters the influence of international posture on Productive-IDLE, indicating that the strength of this relationship varies between males and females. Specifically, the research demonstrated a positive and significant direct effect of international posture on Productive-IDLE, suggesting that higher levels of international posture related with increased engagement in Productive-IDLE activities. However, the impact of gender was significant and negative, indicating that males are less likely than females to participate in these activities. Females may experience L2 learning anxiety in the formal classroom, which reduces their willingness to communicate in English. Therefore, females favoured the informal learning approach for speaking and writing practice.

The findings of this study underscore the potential of generative AI tools in enhancing informal digital English learning for L2 learners, particularly in the Chinese context. However, the scope of this research can be expanded to include other language learning scenarios. For instance, future research could explore applying the proposed model to L2 French students from China. Given the increasing interest in French as a second language and the cultural and economic ties between China and French-speaking countries, understanding how generative AI can support Chinese learners in acquiring French would be valuable. This could involve examining similar factors, such as the Ideal L2 Self and International Posture, and their impact on productive and receptive informal digital learning activities. Additionally, it would be pertinent to investigate if there are unique challenges or advantages faced by Chinese learners of French compared to English, thus providing a more comprehensive perspective on the utility of generative AI in diverse language learning contexts.

By extending the research to include L2 French learners, we can gain deeper insights into the universal applicability of generative AI tools in language learning. It can also help tailor these AI-driven platforms to better meet the needs of learners across different languages and cultural backgrounds. Understanding the nuanced experiences of L2 French students from China will contribute to the broader field of language education and inform the development of more inclusive and effective AI-assisted learning environments.

## 5. Implications to theory

The theoretical contributions, ramifications, study limits, and suggestions for additional research are covered in this chapter. The results of this study have important consequences for language teachers and creators of educational technology. They suggest that enhancing the instrumental value and the quality of information of digital learning materials could notably boost learner engagement. Concurrently, for Generative AI tools to be more effectively integrated into language learning, their perceived shortcomings must be addressed, and the authenticity and human-like interactions of these tools need to be augmented.

## 6. Implication of commerce community

The findings suggest the need to consider gender differences when integrating Generative AI tools into the learning ecosystem. As the data suggests, males and females may engage differently in Productive and Receptive IDLE activities. Gaining a comprehensive understanding of these distinctions can assist educators and curriculum developers in creating learning activities that are more efficient in meeting the requirements of all learners.

## 7. Limitations and conclusion

Future research could incorporate longitudinal studies to observe changes over time and experimental designs to establish causality. Qualitative studies would also be beneficial for delving into learners' subjective experiences with Generative AI tools and IDLE activities.

The study could provide an extensive knowledge of the intricate connections between L2 learners' self-imagination, age, gender, perceived information quality, perceived functional value of Generative AI, and their desire to constantly utilize Generative AI as an informal digital learning English platform by including these additional factors. The results will collaborate with present studies on language learning and provide insights into instructional methods that employ Generative AI, such as ChatGPT to improve learners' involvement, learning achievements, and motivation to keep utilizing these tools.

## 8. Acknowledgements and Legal Responsibility

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article and conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors, and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed, or endorsed by the publisher.

## 9. Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT in order to proof reading After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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