Interactive Learning Environments

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/nile20

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To cite this article: Tzu-Yu Tai & Howard Hao-Jan Chen (2023) The impact of Google Assistant on adolescent EFL learners' willingness to communicate, Interactive Learning Environments, 31:3, 1485-1502, DOI: 10.1080/10494820.2020.1841801

To link to this article: https://doi.org/10.1080/10494820.2020.1841801

INTERACTIVE LEARNING ENVIRONMENTS
2023, VOL. 31, NO. 3, 1485–1502
https://doi.org/10.1080/10494820.2020.1841801

Routledge
Taylor & Francis Group

The impact of Google Assistant on adolescent EFL learners' willingness to communicate

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ABSTRACT

Willingness to communicate (WTC) is considered to be an important factor contributing to successful foreign language learning. Many studies aim at finding effective tools for enhancing WTC. With the support of AI and Automatic Speech Recognition technology, intelligent personal assistants (IPAs) seem to have potentials in improving foreign language learners' WTC. However, few empirical studies focus on the possible impact of IPAs on learners' WTC. This study was conducted to investigate the potentials of an IPA, Google Assistant, for developing adolescent EFL learners' WTC and their perceptions of IPAs for EFL learning. This study recruited 112 eighth-grade EFL learners *who engaged in* Google-Assistant-language-learning activities for two weeks. Two WTC questionnaires were administered at *the beginning and end* of the intervention. The results demonstrated that Google Assistant significantly promoted EFL learners' WTC, enhanced communicative confidence, and reduced speaking anxiety. Analyses of interviews revealed that participants enjoyed playing games with Google Assistant and talking to chatbots, which helped them feel less anxious and motivated to use English for real and meaningful communication. The findings indicated that IPA-based interaction provided a less threatening environment, in which learners displayed higher levels of engagement, motivation, confidence, and, in turn, their WTC in the target language.

ARTICLE HISTORY
Received 23 April 2020
Accepted 21 October 2020

KEYWORDS
Intelligent personal assistant (IPA); willingness to communicate (WTC); Google Assistant; EFL learning; automatic speech recognition (ASR)

1. Introduction

The prevalence of English as a world language has compelled its learners to enhance communicative competence. Today's EFL classrooms are challenged with limited classroom time and lack of input, and output practice in a stress-free environment. Many learners are reluctant to speak in English for fear of making mistakes in front of peers and receiving negative peer evaluation. Hence, to promote EFL learners' willingness to communicate (WTC) has been an enduring challenge for many EFL instructors (Peng, 2019). According to MacIntyre et al. (1998, p. 547), WTC in L2 refers to learners' "readiness to enter into discourse at a particular time with a specific person or persons, using a L2." L2 learners with high levels of WTC are more likely to take risks using L2 in authentic communication (Peng, 2019), acquire higher levels of fluency and improve communicative skills (MacIntyre, 2017) *to* achieve greater language proficiency (Zhang et al., 2018). Accordingly, L2 WTC has been regarded as a top priority among *the* goals of L2 pedagogy because willingness to communicate can lead to actual communication behavior, which in turn contribute to successful L2 interaction and, ultimately, L2 acquisition (Dörnyei et al., 2015).

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Research into L2 WTC has been thriving and *has* revealed many factors that promote L2 learners' WTC (e.g. interlocutors, task, teachers, etc.). As today's EFL students are increasingly involved in practicing English in a range of digital settings, recent studies have provided important insights into how L2 learners use technology to facilitate WTC such as computer-mediated communication (Sampson & Yoshida, 2020) and digital wilds (Sauro & Zourou, 2019). While a number of factors have been found to affect L2 learners' WTC, it should be noted that to date L2 WTC research has been mainly premised on human-to-human interaction in non-digital contexts, with only a few exceptions explicitly or indirectly addressing L2 WTC in relation to CALL (Liu, 2018).

With the emergence of AI and Natural Language Processing technology, Intelligent Personal Assistants (IPAs; e.g. Apple's Siri, Amazon's Alexa, or Google Assistant) are able to produce quality input and interact with users. Some researchers (Dizon, 2017, 2020; Kessler, 2018; Underwood, 2017) have suggested that IPAs have great potential for second language learning, especially in speaking and listening. Moreover, since IPAs are able to respond to users' commands and requests quickly, they also have great potential in enhancing learners' WTC. The possible contributions of IPAs on L2 appears to be an important but unexplored research area. Therefore, this study attempts to investigate the impact of IPAs (i.e. Google Assistant) on adolescent EFL learners' WTC in English and learners' perceptions of the use of IPAs for language learning. The findings should be able to make substantial contributions to our limited understanding about the potential of IPA for second/foreign language learning.

2. Literature review

2.1. IPAs and L2 education

The rapid development of AI and Automatic Speech Recognition (ASR) technology has opened up an attractive and convenient new arena for language learning. Particularly, IPAs offer potential advantages in foreign language learning (Moussalli & Cardoso, 2019). IPA refers to the *voice-controlled* services connected to a smart speaker (e.g. Apple's HomePad, Amazon Echo, and Google Home) that can perform concierge-type tasks or provide information based on a combination of user input, location awareness, and online sources.

Kessler (2018) highlighted ASR in IPAs, which provides L2 learners ample opportunities to practice speaking, engages learners in various forms of interaction and also develops their communicative competence. Furthermore, Barcomb et al. (2017) found IPAs facilitate listening and speaking because the accessibility, familiarity and practicability of IPAs allow learners to access learning content easily and ubiquitously. Serving as a virtual peer to instantly retrieve and provide personalized responses, IPAs could foster students' self-directed learning and increases the degree of control, motivation, and personalized learning (Moussalli & Cardoso, 2019). In Dizon's (2020) study on the impact of *Alex* on EFL learners' listening and speaking development, he compared the speaking and listening gains of learners receiving a 10-week learner-IPA treatment with those of learners without IPA interaction. Although there was no significant difference between the two groups' listening gains, learners with IPA interaction made significantly more gains in their speaking proficiency than their counterpart.

In addition to L2 acquisition, other major benefits of IPAs are in the affective domain. For example, In Moussalli and Cardoso's (2016) pilot study on four intermediate English learners' perceptions of *Alexa*, they found that the participants had comfortable and enjoyable interactions with *Alexa*. They were motivated to speak and listen in a less threatening environment. Similar results were also reported in Underwood's (2017) study on primary age EFL learners' perception toward AI language assistants (e.g. Amazon's *Alexa* and Apple's *Siri*). The findings indicated that learners actively participated in the interaction and had positive attitudes, claiming that IPA-based interaction was motivating and enjoyable. Furthermore, Sandeep (2019) found that the AI chatbot, *Alexa*, was helpful as it was viewed as a non-threatening conversational partner. The learners felt less nervous *when talking*

to Alexa than having conversations with real people since it was a private companion. The learner-centered interaction and reduced inhibition improved their communicative confidence.

From the literature reviewed above, IPAs appear to *be a solution to* the obstacles that the face-to-face EFL classroom confronts, such as a lack of language use in a less threatening atmosphere, individualized learning, and interactions. However, most of the literature is exploratory, limited in scope with small sample sizes, and *focus* on exploring the characteristics of IPAs, rather than their effects on language interactive process (Zhang et al., 2018). Relatively little is known about the impact of IPAs on EFL learners' WTC.

2.2. WTC in L2 learning

L2 WTC has been suggested by scholars (e.g. MacIntyre, 2017; Mystkowska-Wiertelak & Pawlak, 2016) as a top priority among *the goals* of L2 pedagogy because willingness and intention to communicate can lead to actual communication behavior, which in turn contribute to higher oral proficiency. To date, L2 WTC studies have been theorized based on MacIntyre et al.'s (1998) model, from two dimensions: (1) a trait-like dimension in which L2 WTC has been investigated in relation to L2 self-confidence (Kang, 2005), anxiety (Liu, 2018; Yan et al., 2018), and motivation (Dörnyei et al., 2015; Lee & Hsieh, 2019); (2) a dynamic and situated dimension that examines joint influences of personal and contextual factors, such as interlocutors (Cao, 2014), topics (Mystkowska-Wiertelak & Pawlak, 2016), tasks (Eddy-U, 2015), and teachers (Peng, 2019).

With the rapid advancement of digital media and communication technologies, today's EFL students are increasingly involved in practicing English in a range of digital settings. Recent studies have been conducted to establish the link between L2 WTC and CALL, for example, online-chatting (Sampson & Yoshida, 2020), digital games (Reinders & Wattana, 2014), digital wilds (Sauro & Zourou, 2019), and self-directed use of technology for language learning (Lai et al., 2016). In addition, Computer-Mediated Communication (CMC; human-to-human communication via technology) has also been shown to play a potential role in developing WTC (Sampson & Yoshida, 2020).

Although a number of factors have been found to affect L2 learners' WTC, it should be noted that current L2 WTC research has been mainly premised on human-to-human interaction in non-digital contexts, with only a few exceptions explicitly or indirectly addressing L2 WTC in relation to CALL (Liu, 2018). Lee and Drajati (2019) further pointed out that despite the attention for the role of CMC in increasing the levels of L2 WTC, less effort has been expended on investigating other digital media and communication technologies. For example, the study of human interactions with bots or other smart virtual agents who do not represent other individuals, such as Apple's Siri, Amazon's Alexa, or Google Assistant, presents a new research agenda with potentially critical impact on language learning (Kessler, 2018; Moussalli & Cardoso, 2019). The relationship between L2 WTC and IPA-learner interaction (human-machine communication) seems to be an important but unexplored research area. Thus, our study takes this perspective further by looking at the potential of IPAs for EFL learners' WTC in English and *exploring* learners' perceptions toward the use of IPAs for language learning. The study was guided by the following three research questions:

(1) Does Google Assistant significantly promote the adolescent EFL learners' WTC in English? If so, what factors contribute to learners' WTC?
(2) What are adolescent EFL learners' favorite Google Assistant language learning activities that enhance WTC?
(3) What are the adolescent EFL learners' perceptions of Google Assistant for English learning?

3. Method

3.1. Participants

The participants were 112 eighth graders, 58 male and 54 female students, recruited from a junior high school in Taiwan. The participants were all native Chinese speakers; none of them had studied in an English-speaking country *before*. They were aged 15–16 years and had undergone 8–9 years of formal English education. They had five regular English classes every week. They had different English language proficiency levels, ranging from elementary to intermediate, based on their English grades from the previous academic year. Their use of English, especially speaking, was limited in the English classroom. Their English teacher, one of the *researchers*, found *that* many students were reticent when communicating in English. They attributed it to the following reasons: fear of making mistakes, low English proficiency, lack of confidence, lack of oral communication, peer pressure, and personality variables (e.g. introverted, reserved, or shy). Hence, the teacher *conducted* extracurricular learning activities and *adopted* self-designed learning materials to *compensate* for students' lack of oral practice after each monthly exam in *their* regular English class.

3.2. Google assistant language learning (GALL) activities

Eight GALL activities were designed to *stimulate* spoken communication between Google Assistant and the participants, as shown in Table 1 (see Appendix 1 for detailed description). There were two pedagogical objectives to the GALL activities First, the activities fitted the curriculum mandated by the Ministry of Education in Taiwan, with the attempt to give participants opportunities to review the course material. *Second, ample opportunities* were provided for interactive, self-paced, individualized oral practice of English. Each GALL activity consisted of two parts: an interactive activity selected from Google Assistant can-do lists (https://assistant.google.com/learn/) *and* a written worksheet (Appendix 2). In the first three activities, the participants worked in groups. They were free to talk to Google Assistant and peers, *which provided* opportunities for collaboration and social interaction. In the *next* three activities, *participants* were randomly paired. They had more opportunities to interact with Google Assistant. In another two activities, they had to interact with Google Assistant to complete the activities by themselves. In the final two activities, they found a partner/partners and interacted *with* Google Assistant on any topics they were interested in together.

3.3. Instruments

The instruments used in the study were Google Assistant app, Google Home Hub, WTC questionnaires, and interviews.

3.3.1. Learning devices

Google Home Hub and its associated app, Google Assistant, were employed as the learning devices for the study. The Google Assistant app was downloaded from Google Play. Based on the necessity in

Table 1. GALL activities.

Activity/Day	Topic
1	Let's play a game!
2	100 things to know Google Assistant
3	Play Akinator!
4	Tell me __!
5	Play Jungle Adventure!
6	Let's play SongPop!
7	Talk to chatbots (e.g. Pandora Vince, Julie)
8	Talk to Cool English coach!
9	(Free talk with Google Assistant)
10	(Free talk with Google Assistant)

promoting WTC in teaching EFL learners for oral communication, Google Assistant was chosen for its accessibility and practicability, which provided sustainable learning by allowing the learner to *access the learning content easily*. Furthermore, it can interact with users in human-like communication.

3.3.2. A background questionnaire

A background questionnaire with six items was used to gather demographic data and other information concerning the participants' previous language learning experience and exposure to the technology such as IPAs.

3.3.3. WTC in English questionnaire

Two sets of WTC in English questionnaires (see Appendices 3 and 4) were adapted from MacIntyre et al.'s (2001), Carrell and Menzel's (1999), Reinders and Wattana's (2014), and Lee and Drajati's (2019) WTC scales to survey the participants' WTC in the conventional classroom and during GALL activities. Carrell and Menzel's (1999) and MacIntyre et al.'s (2001) WTC scales were specifically designed to examine WTC in a classroom context, which portrays typical classroom situations. Furthermore, Reinders and Wattana's (2014) and Lee and Drajati's (2019) WTC scales were developed for measuring EFL learners' WTC in digital and non-digital EFL contexts.

The two sets of WTC questionnaires covered (1) WTC in English and (2) communicative self-confidence, with the latter covering anxiety and communicative competence, which have been found to be crucial for prediction of L2 WTC. The participants were required to rate the items on a 5-point Likert scale, anchored by the end points *strongly disagree* (1) and *strongly agree* (5). The overall reliability of the questionnaire was considered to be good ($\alpha = .85$)

The first questionnaire was administered prior to the first GALL activity in order to gauge the participants' WTC in English for communicating in the conventional *classroom*. The second questionnaire was administered after the last GALL activity in which participants were asked more specific questions relating to their WTC in English *when interacting with Google Assistant*. A comparison between participants' WTC in the conventional class and during GALL activities was made to examine any differences and thus determine whether Google Assistant played a significant role in EFL learners' WTC.

3.3.4. A semi-structured interview

A semi-structured interview was conducted with the participants to obtain more in-depth insights on their attitudes toward the effectiveness of Google Assistant on WTC and English learning. The two questions are: (1) What is your favorite GALL activity(ies) that promote WTC? (2) How do you feel about Google Assistant for English learning?

3.4. Data analysis

A mixed-methods design was applied. Means and standard deviations were computed to determine *the* WTC levels; the paired-samples *t* test was calculated to detect whether *there were* any significant differences between learners' WTC in English in the classroom *and* their WTC in English while interacting with Google Assistant. The participants' answers to the open-ended questions were analyzed and then subjected to open coding to identify *the* causes for WTC and effects of Google Assistant.

3.5. Procedure

The study was carried out during normal English class hours for two weeks immediately after the midterm exam. As shown in Figure 1, two weeks prior to the intervention, all the participants completed *a* background questionnaire, and the WTC questionnaire after receiving an explanation of the research objective. One week before the intervention, the participants were introduced to the operation of Google Home Hub and functions of Google Assistant app. In addition, to enable the

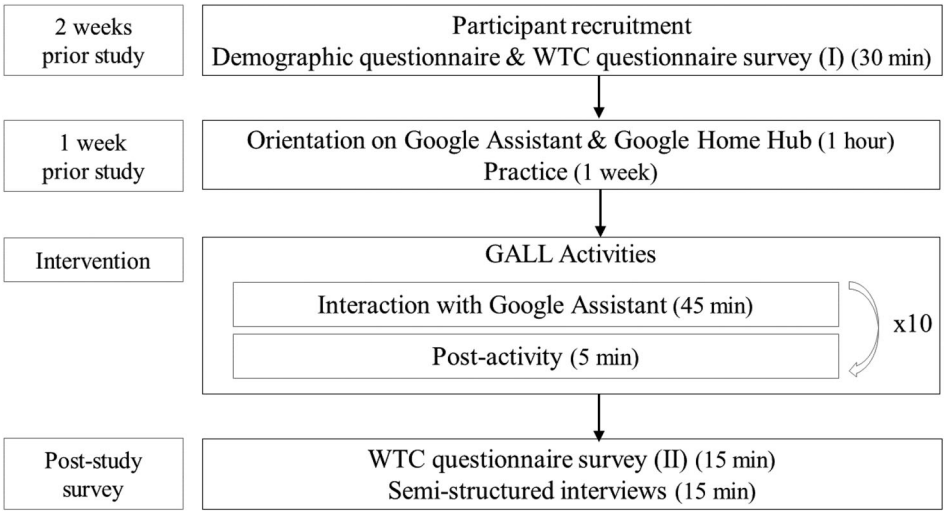

Figure 1. The experimental procedure of the study.

participants to readily engage in the interaction with Google Assistant, training and technical support were provided to them for one week. Then, the eight GALL activities were administered to the participants. A 5-minute briefing session was given before each activity. Participants were informed of the objectives, how to accomplish the activity and the contents to be learned. Following the treatment, the participants completed a WTC questionnaire and were *then* interviewed.

4. Results

4.1. WTC in English during the conventional class time

The first section of the first set of WTC questionnaires asked participants to rate their perceptions of WTC in the communication activities that they engaged in during conventional class time. As shown in Table 2, the mean of 2.23 with a standard deviation of .65 indicated that participants perceived that they were unwilling to engage in communication activities in the English classroom. The participants showed a low level of WTC in English as they were unwilling to communicate ideas, feelings, and opinions with their classmates ($M = 2.10$, SD = .89), to talk to their classmates about a class assignment ($M = 2.21$, SD = .91) or clarify a question ($M = 2.21$, SD = .94). They would listen to the activity description before they started an activity ($M = 2.37$, SD = .86). They held neutral opinions about listening to what their classmates talked about ($M = 2.25$, SD = .85) and *when reading* activity instructions ($M = 2.37$, SD = .86).

The second section of the questionnaire measured participants' anxiety levels and communicative competence degrees to show their communicative self-confidence. The participants showed high levels of communicative anxiety, as indicated by the low averaged scores of the four items ($M = 2.02$, SD = .57), indicating that they were anxious while communicating in a conventional classroom. They were worried about making mistakes ($M = 1.59$, SD = .65). Anxious students were likely to perceive their competence to be low ($M = 2.00$, SD = .85), which was also shown in their low averaged scores for communicative competence items ($M = 1.86$, SD = .51). They felt uneasy expressing their ideas, feelings, or opinions in English with their classmates ($M = 1.82$, SD = .91). Furthermore, participants were worried about their comprehension when they did not understand their classmates' English ($M = 1.87$, SD = .93).

Participants perceived that communicating in English was difficult ($M = 2.38$, SD = .84) because they could not say what they wanted to say in English ($M = 1.83$, SD = .68) and they did not know

Table 2. Participants' WTC during conventional class time and GALL activities.

Statements	Conventional class		GALL activities		
	M	SD	*M*	SD	*p*
Willingness to communicate					
1. Talk to classmates/Google Assistant about a communicate activity.	2.21	.91	4.04	.82	.00
2. Communicate ideas, feelings, and opinions.	2.10	.89	4.04	.79	.00
3. Ask for clarification when you are confused about a activity you must complete.	2.21	.94	4.01	.82	.00
4. Read activity description before you start completing.	2.37	.86	3.81	.84	.00
5. Listen to what classmates/Google Assistant says in English.	2.25	.85	3.98	.82	.00
Mean	2.23	.65	3.98	.68	.00
Communicative confidence					
Anxiety					
6. I am not worried about making mistakes.	1.59	.65	4.45	.66	.00
7. It is not difficult to communicate in English.	2.38	.84	4.14	2.98	.00
8. I am not worried that I will not understand what my classmates/Google Assistant says in English.	1.87	.93	3.97	.89	.00
9. I am not nervous about using English while participating in conventional class/GALL activities.	2.24	.91	4.42	.67	.00
Mean	2.02	.57	4.03	.69	.00
Self-perceived competence					
10. I can say what I want to say in English.	1.83	.68	3.98	.81	.00
11. I think my classmates/Google Assistant can understand me.	2.00	.85	3.79	.82	.00
12. I feel comfortable sharing my ideas, feelings, and opinions with my classmates/Google Assistant.	1.82	.91	4.27	.67	.00
13. I know the words required for each activity completion.	1.85	.77	3.96	.77	.00
14. In general, I find communicating in English in class/Google Assistant-mediated interactive situations relaxing.	1.81	.93	4.21	.81	.00
15. I think participating in class communicative activities/GALL activities develop my fluency.	1.75	.82	4.04	.82	.00
Mean	1.86	.51	4.41	2.97	.00
Overall mean	2.03	.49	4.06	.55	.00

the vocabulary ($M = 1.85$, SD = .77). When asked about their feelings about communication in class, they did not feel relaxed ($M = 1.81$, SD = .93), which corresponds with their high anxiety level while using English. The class activities could not promote their fluency ($M = 1.75$, SD = .51).

4.2. WTC in English during GALL activities

The first section of the second set of WTC questionnaires examined participants' WTC to interact in English while engaged in GALL activities. As shown in Table 2, participants' WTC was positive as they perceived that they were willing to use English for communicating their ideas, feelings, and opinions ($M = 4.04$, SD = .79), and received clarity when they were confused about an activity they must complete ($M = 4.01$, SD = .82). They were willing to listen to their friends ($M = 3.98$, SD = .82) and read activity instructions ($M = 3.81$, SD = .84).

The second section of the second questionnaire dealt with participants' communicative anxiety and confidence while interacting in English during the GALL activities. Participants were willing to use English during GALL activities. They were not anxious when communicating during GALL activities ($M = 4.03$, SD = .69). They were not afraid of making mistakes ($M = 4.45$, SD = .66) and nervous about understanding what was said ($M = 3.97$, SD = .89). By contrast, they felt relaxed in sharing their ideas, feelings and opinions with their friends ($M = 4.21$, SD = .81).

Furthermore, participants felt confident in their communicative abilities in completing the activities ($M = 4.41$, SD = 2.97). They believed that participating in GALL activities helped develop their fluency ($M = 4.03$, SD = .82). They believe they have the ability to say what they wanted to say ($M = 3.98$, SD = .81) and their English was not too poor to be understood ($M = 3.79$, SD = .82). The findings indicated that participants were willing to communicate in English in a Google Assistant-mediated communicative environment.

4.3. Statistical analyses of WTC in English during conventional class time and GALL activities

As shown in Table 3, the mean scores of participants' perceptions of WTC in English during conventional class time were significantly different from those they perceived during GALL activities ($t = -27.51$, $p = .00$).

Table 4 showed that participants had significantly lower levels of anxiety when communicating in English during GALL activities than they did during conventional class time ($t = -23.86$, $p = .00$).

Table 5 showed that participants' communicative confidence during GALL activities differed significantly from those during class time ($t = -8.82$, $p = .00$).

4.4. Participants' favorite GALL activities

The second research question explored the participants' favorite GALL activities that promote WTC. As shown in Table 6, *Play Jungle Adventure* (41.07%) was the most highly valued activity. *Let's Play a Game* (38.39%) ranked the second and then followed by *Talk to Chatbots* (37.50%), *Free talk with Google Assistant* (37.50%), and then *100 things to know Google Assistant* (36.61%). Around 30% of the participants *liked Play Akinator* (32.14%) and *Tell me* (27.68%) activities. The participants enjoyed playing games with Google Assistant, especially those *involving* interesting and interactive

Table 3. Results of the paired samples *t*-test of WTC during conventional class time and GALL activities.

Variable		*N*	Mean	SD	*t*	*p*	*d*
WTC	Conventional class	112	2.03	.49	−27.51	.00	.87
	GALL activities	112	4.06	.55			

***$p < .001$.

Table 4. Results of the paired samples *t*-test of Anxiety during conventional class time and GALL activities.

Variable		*N*	Mean	SD	*t*	*p*	*d*
Anxiety	Conventional class	112	2.02	.57	−23.86	.00	3.18
	GALL activities	112	4.03	.69			

***$p < .001$.

Table 5. Results of the paired samples *t*-test of communicative self-confidence during conventional class time and GALL activities.

Variable		*N*	Mean	SD	*t*	*p*	*d*
Confidence	Conventional class	112	1.86	.51	−8.82	.00	1.20
	GALL activities	112	4.41	2.97			

***$p < .001$.

Table 6. Summary of participants' responses to their favorite GALL activities for promoting WTC ($N = 112$).

Ranking	Activity	*N*	%
1	Play Jungle Adventure!	46	41.07
2	Let's Play a Game!	43	38.39
3	Talk to Chatbots (e.g. Pandora Vince, Julie)	42	37.50
4	Free talk with Google Assistant	42	37.50
5	100 Things to Know Google Assistant!	41	36.61
6	Play Akinator!	36	32.14
7	Tell Me __ !	31	27.68
8	Let's Play SongPop!	11	9.82
9	Talk to Cool English Coach!	7	6.25

elements. They also liked talking with chatbots, which helped *them* feel less anxious and motivated to use English for real and meaningful communicative purposes. However, due to unfamiliarity with the English songs provided by Google Assistant, less than 10% of the participants *enjoyed Let's Play SongPop*. In addition, *Talk to Cool English Coach* received the least support from the participants (6.25%) because it was similar to their regular classroom exercises in English class.

4.5. Participants' interview

The third research question explored the participants' perceptions of Google Assistant for English learning, including their communicative experience, their WTC in GALL activities, and future use of Google Assistant, as shown in Table 7.

The majority of the participants (80.36%) were motivated and excited while *engaging* in the GALL activities. They particularly liked ASR, which made the GALL activity more interactive and enjoyable because "it understood what I said and showed a different result according to what I said." ASR made the *interaction* more realistic and had the participants feel like they were talking with a real foreigner. In addition, by responding to the participants' utterances, ASR provided immediate feedback, and based on the responses, the participants became aware of their errors and modified utterances. The findings were in line with Sandeep's (2019) study, which confirmed that ASR increases student motivation in language learning and thus helps students become more eager and confident to speak.

Another key finding was that Google Assistant lowered anxiety for the participants (77.68%). One reason reported was that they felt Google Assistant encouraged supportive interaction and noted the absence of an open, public sphere. This gave them confidence in getting their message across without feeling nervous. For example, GA-80910, who did not talk much in English in class before, appeared to show increased participation, especially in L2 production. The relaxed and

Table 7. Summary of the participants' responses to interview questions ($N = 112$).

Category	*N*	%
Communicative experience with Google Assistant		
Motivated, engaging, and interesting	90	80.36
ASR system (e.g. interactive, realistic, immediate feedback)	61	54.46
WTC in GALL activities		
Reduced anxiety	87	77.68
Increased confidence	76	67.86
Risk taking	68	60.71
Active participation in group discussion (e.g. volunteer an answer, voice his/her view, ask questions, etc.)	67	59.82
Perceived language learning		
Speaking (e.g. express clearly, communicate effectively on general or familiar topics)	81	72.32
Listening comprehension	73	65.18
Pragmatics (e.g. respond appropriately)	69	61.61
Pronunciation	58	51.79
Vocabulary	26	23.21
Future use of Google Assistant		
Convenient, easy to use in class/out of the class	71	73.21
Application in daily life	58	51.79
Challenges in GALL activities		
Technical problems (e.g. Internet speed, ASR system)	27	24.11
Limited linguistic ability	20	17.86

open atmosphere in the GALL activities encouraged her to keep the communication going, rather than worry about grammatical errors.

> 我只要講英語就緊張, 怕同學會笑我的爛英文, 英語課時我都不講話。我喜歡Google, 和它互動輕鬆多了!不用擔心文法。它會提供選項, 有圖片也有發音, 我從只會說"Yes," "No," 或 "OK,"現在我會用簡單句子和它對話。很像和外國人講英語。 (GA-80910)

> I felt nervous if I had to speak English so I usually remained silent in English class. I feared that my classmates would laugh at me because of my poor English. I liked Google (Assistant). I could say anything freely. I became more relaxed without the evaluation from the teacher or classmates. I did not have to worry about the accuracy of the grammar so I was willing to try and interact in English. Furthermore, it provided learning support, such as suggested responses, pictures, and pronunciation. Therefore, unlike in the past, I had the chance to speak more English rather than just replying "Yes," "No," or "OK." Now, I can answer in a sentence. Talking with Google Assistant is like talking with foreigners.

Another participant indicated that Google Assistant bolstered his confidence to use English to interact with others. He could make himself understood and could understand Google Assistant and peers better. He said,

> 她人很好, 會教我, 給我很多次機會, 我比較不緊張, 也比較聽得懂, 這樣可以鼓勵我講英文, 小組討論時我也比較有信心。希望以後有更多機會講英語。 (GA-81336)

> She (Google Assistant) was friendly and supportive, giving me many opportunities to practice. I felt less anxious and thus comprehended more. This encouraged me to use English and increased my confidence in speaking English in group discussion. I look forward to more chances of speaking English.

Another finding was that Google Assistant encouraged risk-taking in speaking English. Nearly 60% of the students admitted to communicating in the first language (Chinese) with their partners, especially when they wanted to explain complicated ideas at the beginning of the intervention. As time went by, they reported increased participation in English. They felt more willing to communicate during the GALL activities, such as volunteering to an answer, voicing their views, and asking questions, as GA-80904 remarked,

> 有些活動需要和隊友溝通, 我相信我說的對完成活動有幫助, 我希望能和隊友多分享一些。 (GA-80904)

> Since some GALL activities required communication among group members, I believed that what I said during the activity was helpful to complete the activity. I wanted to share with my partners as much as possible.

Furthermore, over half of the participants (51.59%) remarked that they were willing to apply what they learned outside class, as GA-81008 stated,

> 很多話題都可以運用在日常生活裡。例如:出國時我們一定都會去吃國外的餐廳, 問答的內容都很實用。 (GA-81008)
>
> There were many topics that could be applied in daily life. For example, when we are abroad, we will go to a restaurant. The topics and dialogues are very useful and practical.

GA-81338 added Google Assistant motivated him to use English for realistic purposes. He explained to the researcher,

> 要活用英文嘛!會讓我想用英文和它聊天。是它自己問我還需要什麼?我才跟它要電話的。那真的是我想要的!做個朋友嘛! (GA-81338)
>
> Using English for real purposes! It (Google Assistant) motivated me to talk with it in English. It asked, "What else do you need?" So, I asked for its phone number, which was really what I wanted. I wanted to make a friend with it!

Regarding their future use of Google Assistant, most participants (73.21%) expressed a high degree of interest and willingness. Such kind of increased human-to-human interaction, application in daily life, and future use of Google Assistant provide evidence for transferability of higher WTC to context outside the use of IPAs.

When asked about the effects of Google Assistant on English learning, 71.43% of the participants confirmed that it could establish an authentic environment for meaningful communication, provide essential scaffolding and immediate feedback, and offer good spoken English examples, which were conducive to their English learning, especially in speaking, as GA-81338 stated,

> 感覺比較真實和外國人對話的感覺。習慣外國人講話的速度和樣子。有些用詞, 我能知道什麼時候用?怎麼用? (GA-71338)
>
> Google Assistant helped me get accustomed to native speakers' speed in talking. It was more authentic. I was able to find out when and how to use certain expressions in real life.

The results showed that Google Assistant assisted their understanding of language appropriateness. In addition, the participants who attempted to understand Google Assistant's messages were likely to correct *their* lexical errors. With the immediate feedback, the participants were encouraged to self-correct and voluntarily practice repeatedly, which provided them opportunities for repeated practice and thus enhanced their comprehension and language learning.

5. Discussion

The first research question investigates the impact of Google Assistant on EFL learners' WTC. The descriptive results from the first questionnaire showed that the participants had low WTC in English in the classroom. They were reluctant to interact in English because they felt anxious and worried about making mistakes. They felt uneasy to share their feelings and opinions. Furthermore, they reported low communicative competence because of their poor English. They did not believe that class activities facilitated their fluency. The findings revealed that learners had low WTC in human-to-human interaction in the conventional classroom. By contrast, they were more willing to interact in English during GALL activities, feeling more confident to talk to other students and ask for help. They also felt less anxious and were not as nervous about making mistakes. Regarding their self-perceived communicative competence, participants felt confident in their English ability and felt that interaction with Google Assistant helped them develop L2 fluency. Their responses *indicated their* preference for interacting with Google Assistant. The findings *corroborate* with prior research (e.g. Dizon, 2017; Kessler, 2018; Moussalli & Cardoso, 2019) that reported that IPAs had enabled learners to learn happily, reduced their anxiety, increased confidence, and consequently promoted their WTC and learning gains.

The second research question explores the participants' favorite GALL activities for WTC. The majority of the participants liked to play interactive games with Google Assistant, especially those that required them to express their opinions and offered them ample opportunities to ask questions. For example, they liked the relay story in *Play Jungle Adventure*. Talking with different chatbots was also fascinating to them, which provided a safe context for the participants to use English without worrying about making mistakes and *peers'* negative evaluation, as one participant mentioned that Google Assistant was funny, friendly, and supportive. The results support prior research (Sandeep, 2019; Underwood, 2017) that the human-machine interactive environment facilitate lowering of the affective barriers, eliminating the fear of "losing face", a typical obstacle for EFL learners when practicing speaking, and subsequently promote more opportunities for learners to become more willing to communicate. Furthermore, the implicit feedback given by Google Assistant could encourage the participants to improve their speech, rephrase or modify their pronunciation in order to successfully communicate with the IPA.

Nevertheless, it should be *noted* that not all the GALL activities *enhanced* learners' willingness to communicate. Two activities, *Let's Play SongPop* and *Talk to Cool English Coach* were not so welcomed by students. For SongPop, young students in general were unfamiliar with many English songs. They often listen to Chinese and Korean songs but not English ones. Therefore, it was difficult for them to guess the correct songs in the music game. As for *Talk to Cool English* Coach, it was similar to the sentence pattern practices and vocabulary learning in the conventional classroom. The findings were similar to Zhang et al.'s (2018) proposition that the thematic categories of topics influence L2 learners' WTC. Learners prefer topics that they are more familiar with and interested in, which might reduce the difficulty of the conversation and *increase* their confidence and WTC accordingly.

The third question concerns the participants' perception of Google Assistant for English learning. The participants displayed higher levels of engagement, motivation, confidence, and comfort as they interacted with Google Assistant. Although the study did not evaluate the actual improvement of the participants' speaking, the results, as revealed in the participants' questionnaire and interview, was promising as the expanded learning opportunities for English speaking and students' enjoyment of learning and heightened motivation were expected to ultimately lead to improvement of English-speaking ability. The majority of the participants confirmed that Google Assistant could establish an authentic environment for meaningful communication, provide essential scaffolding and immediate feedback, and offer good spoken English examples, which were conducive to their English learning. The positive results could be supported by MacIntyre (2017) that the combination of a low level of anxiety in L2 communication and a sufficient level of communicative competence are strong predictors of L2 WTC, which in turn *can* lead to higher oral proficiency and, ultimately, L2 learning. More importantly, the majority of the participants not only interacted with Google Assistant but increasingly used English to interact with one another. Some even consider the interactive experience useful and showed willingness to apply *it* in daily life.

There are some implications based on the findings. First, as suggested by Dörnyei et al. (2015), WTC is a facilitating factor in SLA so it is crucial to create an environment to encourage this. In an EFL context where learners have limited access to opportunities for English production, Google Assistant helps to create an environment which increases the opportunities to practice speaking in a meaningful, engaging, and less threatening way. They could follow their own pace, *engage in* interactive practice, and correct themselves when they receive immediate feedback from Google Assistant, which may promote learners' WTC using English. Furthermore, Google Assistant made learners feel more confident in their ability to use English. One possible explanation is that Google Assistant offered an environment that encouraged supportive interactions and provided individualized feedback. There was an absence of an open, public sphere in human-machine interaction, which helped learners feel less embarrassed. Finally, some introverted participants felt that Google Assistant contributed to their increase in English production and helped them become more involved and engaged in group discussion. One important reason for these findings may be

that the participants felt more comfortable to communicate and less worried about making mistakes, which was in accordance with Sandeep's (2019) and Underwood's (2017) findings that IPAs helped learners lower affective filter and encouraged them to take risks in using the target language.

6. Conclusion and limitations

The purpose of this study was to investigate the impact of the IPA (i.e. Google Assistant) on adolescent EFL learners' WTC in English and their perception of the IPA for English learning. The results demonstrate that the IPA positively promoted EFL learners' WTC in English, enhanced communicative confidence, and reduced speaking anxiety. Detailed analyses of the participants' interviews demonstrated that in addition to significantly increased L2 interaction, IPA-based interaction *also provided* a less threatening environment, in which learners displayed higher levels of engagement, motivation, and confidence, and promote more opportunities for learners to become willing to communicate in L2.

Nevertheless, this study has some limitations. The researchers acknowledge the major limitation of the study is that it did not measure the participants' actual improvements in speaking, only relying on their responses to the questionnaire and interviews. There might be a discrepancy between the participants' perceptions and actual learning outcomes. Hence, future studies need to conduct pre- and posttests to assess their improvement after using Google Assistant. In addition, future *studies* may be conducted to investigate their speaking WTC beyond the context of using IPAs. Another limitation of the study was the short-term duration of the treatment. The positive outcomes might be influenced by the novelty factor. Certain caution is therefore called for when interpreting the results. A longitudinal study is necessary to ensure long-term effectiveness of Google Assistant on learners' WTC in English. Last, future research could investigate the development of various language skills with the support of various IPAs. Each *IPA* might have its *own* strengths and limitations. These research directions would provide a more thorough understanding of the potentials of IPAs in promoting second/foreign language learning.

Acknowledgements

Funding for this research work is provided by Chinese Language and Technology Center of National Taiwan Normal University from The Featured Areas Research Center Program within the framework of the Higher Education Sprout Project by the Ministry of Education in Taiwan 109J1D0201.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

Funding for this research work is provided by Chinese Language and Technology Center of National Taiwan Normal University from The Featured Areas Research Center Program within the framework of the Higher Education Sprout Project by the Ministry of Education in Taiwan 109J1D0201.

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Appendices

Appendix 1

GALL activities

Activity	Topic	Description
1	"Let's play a game"	• Get familiar with Google commands • Play games (e.g. Guess number)
2	100 things to know Google Assistant	• Chat with Google Assistant (e.g. Ask random questions to find information about Google Assistant)
3	"Play Akinator."	• Think of a real or fictional character and Akinator will try to guess who it is.
4	"Tell me ___ !"	• Listening comprehension (e.g. A story, a poem, the facts) • Group sharing and discussion
5	"Play Jungle Adventure!"	• Relay story between Google Assistant and learners
6	"Let's play SongPop!"	• Listen to real music and guess as fast as you can in the hit music trivia game
7	Talk to chatbots (e.g. Pandora Vince, Julie)	• Free Talk with the chatbot
8	"Talk to Cool English coach!"	• Practice/Review vocabulary, language skills learned in the English course
9	(Free talk)	• Find a partner and interact with Google Assistant together
10	(Free talk)	• Find partners and interact with Google Assistant together

Appendix 2

Worksheets for Activities 1–8

Activity 1 Let's Play A Game!

Q: _____
• Ans: _____
• ☐Great ☐Good ☐So so ☐Not bad ☐Bad

Q: _____
• Ans: _____
• ☐Great ☐Good ☐So so ☐Not bad ☐Bad

Q: _____
• Ans: _____
• ☐Great ☐Good ☐So so ☐Not bad ☐Bad

Q: _____
• Ans: _____
• ☐Great ☐Good ☐So so ☐Not bad ☐Bad

Class _____ Numbrer _____ Name _____

Activity 2 100 things to Know Google Home Hub

1. Who is your hero?
2. If you could live anywhere, where would it be?
3. What is your biggest fear?
4. What is your favorite family vacation?
5. What would you change about yourself if you could?
6. What really makes you angry?
7. What motivates you to work hard?
8. What is your favorite thing about your career?
9. What is your biggest complaint about your job?
10. What is your proudest accomplishment?
11. What is your child's proudest accomplishment?
12. What is your favorite book to read?
13. What makes you laugh the most?
14. What was the last movie you went to? What did you think?
15. What did you want to be when you were small?
16. What does your child want to be when he/she grows up?
17. If you could choose to do anything for a day, what would it be?
18. What is your favorite game or sport to watch and play?
19. Would you rather ride a bike, ride a horse, or drive a car?
20. What would you sing at Karaoke night?
21. What two radio stations do you listen to in the car the most?
22. Which would you rather do: wash dishes, mow the lawn, clean the bathroom, or vacuum the house?

Activity 3 Okay Google, play Akinator.

Name of a real or fictional character in your mind: _____
Does Akinator guess right? ☐Yes ☐No
How do you feel about Akinator? _____

Activity 4: Hey, Google! Tell me a joke!

Direction: You can say, " Hey Google! _____"
☐ Tell me a joke!
☐ Tell me a poem!
☐ Tell me a story!

A Joke/Poem/Story:

Do you like ☐ the joke ☐ the poem ☐ the story?
Do you understand the joke/poem/story? ☐ All ☐ most ☐ some ☐ little ☐ No

Activity 5: Play Jungle Adventure!

Direction: You can say, " Hey Google! _____"
☐ Tell me a story!
☐ Tell me a poem!
☐ Tell me facts about sports!
☐ Tell me an entertainment news!
☐ Tell me the news!
☐ Tell me (someone's) story!
☐ Play Strngest Day Ever!
☐ Play Jungle Adventure!

Class _____ Number _____ Name _____

Activity 6 Let's play SongPop!

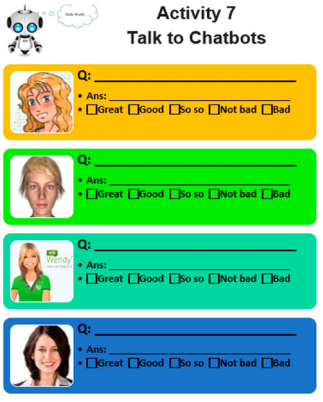
Listen to real music and guess as fast as you can in the hit music trivia game SongPop!

HINT 1: ASK YOUR ASSISTANT
Play song pop
Let's play SongPop
Play SongPop
Let's play song pop
Talk to SongPop

HINT 2: Choose Genres. You can say: Pop, Rock, 90s, 2010s ...
Choose Singers. You can say: _____
(e.g., Taylor Swift, Beyoncé, Carlie Puth, or Lady Gag)

Name _____ Name _____

☐ Correct ☐ Wrong ☐ Correct ☐ Wrong



Appendix 3

Willingness to Communicate Questionnaire (I)

Section 1

Instructions: Below you will read a number of different communication activities in which you might engage in the language classroom. Please put an " √ " in the box that describes the level of your willingness.

1	2	3	4	5
Very unwilling	unwilling	Neutral	willing	Very willing

Items	1	2	3	4	5
Willingness to communicate					
1. Talk to your classmates about a class assignment	☐	☐	☐	☐	☐
2. Communicate ideas, feelings, and opinions.	☐	☐	☐	☐	☐
3. Ask for clarification when you are confused about a activity you must complete.	☐	☐	☐	☐	☐
4. Read activity description before you start completing.	☐	☐	☐	☐	☐
5. Listen to what your classmates say in English.	☐	☐	☐	☐	☐

Section 2

Instructions: Please put an " √ " in the box that describes the level of your anxiety about communication and communicative competence when communicating in English in the classroom.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Items	1	2	3	4	5
Communicative self-confidence					
1. I am not worried about making mistakes.	☐	☐	☐	☐	☐
2. It is not difficult to communicate in English.	☐	☐	☐	☐	☐
3. I am not worried that I will not understand what my classmates say in English.	☐	☐	☐	☐	☐
4. I did not feel nervous about using English while participating in class activities.	☐	☐	☐	☐	☐
5. I can say what I want to say in English.	☐	☐	☐	☐	☐
6. I think my classmates cannot understand me because of my poor English.	☐	☐	☐	☐	☐
7. I feel comfortable sharing my ideas/feelings/opinions with my classmates.	☐	☐	☐	☐	☐
8. I know the words required for each task completion.	☐	☐	☐	☐	☐
9. In general, I find communicating in English in classroom situations relaxing.	☐	☐	☐	☐	☐
10. I think participating in class activities develop my fluency.	☐	☐	☐	☐	☐

Appendix 4

Willingness to Communicate Questionnaire (II)

Section 1

Instructions: Below you will read a number of different communication activities in which you might engage in Google Assistant language learning activities. Please put an " √ " in the box that describes the level of your willingness.

1	2	3	4	5
Very unwilling	unwilling	Neutral	willing	Very willing

Items	1	2	3	4	5
Willingness to communicate with Google Assistant					
1. Talk to Google Assistant about a communicate activity.	☐	☐	☐	☐	☐
2. Communicate ideas, feelings, and opinions.	☐	☐	☐	☐	☐
3. Ask for clarification when you are confused about an activity you must complete.	☐	☐	☐	☐	☐
4. Read activity description before you start completing.	☐	☐	☐	☐	☐
5. Listen to what Google Assistant says in English.	☐	☐	☐	☐	☐

Section 2

Instructions: Please put an " √ " in the box that describes the level of your anxiety about communication and communicative competence when communicating in English with Google Assistant.

1	2	3	4	5
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Items	1	2	3	4	5
Communicative self-confidence					
1. I am not worried about making mistakes.	☐	☐	☐	☐	☐
2. I find it difficult to communicate in English.	☐	☐	☐	☐	☐
3. I am worried that I will not understand what Google Assistant says in English.	☐	☐	☐	☐	☐
4. I feel nervous about using English while participating in GALL activities.	☐	☐	☐	☐	☐
5. I can say what I want to say in English.	☐	☐	☐	☐	☐
6. I think Google Assistant cannot understand me because of my poor English.	☐	☐	☐	☐	☐
7. I feel comfortable sharing my ideas/feelings/opinions with Google Assistant.	☐	☐	☐	☐	☐
8. I know the words required for each activity completion.	☐	☐	☐	☐	☐
9. In general, I find communicating in English in Google Assistant-mediated interactive situations relaxing.	☐	☐	☐	☐	☐
10. I think participating in GALL activities develop my fluency.	☐	☐	☐	☐	☐