

Stephen Lambacher, Hisayo Kikuchi, Hiroyuki Obari

Aoyama Gakuin University, Tokyo, Japan

steve.lambacher@gmail.com, hisayod@gmail.com, obari119@gmail.com

Exploring the impact of AI on EFL teaching in Japan

Bio data



Stephen Lambacher is a professor in the School of Social Informatics at Aoyama Gakuin University in Japan. His research and teaching interests include ELT, CALL, and applied linguistics.



Hisayo Kikuchi is a professor in the School of Global Studies and Collaboration at Aoyama Gakuin University in Japan. She specializes in media literacy, TESOL, and applied linguistics.



Hiroyuki Obari is Professor Emeritus at Aoyama Gakuin University. He presently teaches part-time in the Faculty of Law at Waseda University and the Tokyo Institute of Technology graduate school. He specializes in worldview studies, ICT/CALL, and TESOL.

Abstract

This study investigates the use of digital personal assistants (also known as smart speakers) as part of a blended-learning (BL) environment to increase the English ability of native Japanese undergraduates. Three case studies are presented to evaluate the use of artificial intelligence (AI) smart speakers to help improve the English skills of native Japanese undergraduates by enhancing the socialization and personalization of their learning. The primary objective of the three case studies was to evaluate the efficacy of a training program that included the AI smart speakers Google Home Mini and Amazon Alexa in assisting the students in improving their English proficiency. TOEIC was utilized as a metric to ascertain if the students' English abilities improved and assess the training program's overall efficacy. Within a flipped learning (FL) environment, the case studies also incorporate 21st-century learning skills for developing international cultural awareness. Overall, mean TOEIC scores improved considerably, demonstrating that AI smart speakers helped to enhance the participants' overall English proficiency. Post-training survey results also revealed that the participants felt that using a smart speaker was a fun, easy-to-use, and practical way to improve their English speaking and vocabulary skills.

Introduction

AI-enabled wireless smart speakers are voice-activated devices with artificial intelligence. Voice assistants utilize a cloud-based architecture because data must be transmitted to centralized data centers. Because AI smart speakers are intended to be simple, the majority of computation and artificial intelligence processing occurs in the cloud and not on the device itself. Smart speakers are the most prevalent device with voice assistants, and they have recently begun to be used contextually in schools and institutions for advanced-level learners. The user makes a request using a voice-activated device, which is transmitted to the cloud, where the voice is converted into text. The request is then transmitted to the backend, which processes it and returns a text response. Finally, the text response is sent to the cloud, where it is converted to voice and sent back to the user (Terzopoulos & Satratzemi, 2019).

There are commands built into smart speakers that may be useful for language learners. Amazon Echo Dot, for example, can be used as a dictionary by asking "Alexa, what is the definition of...?" or "Alexa, how do you spell...?" with a given word. By asking "Alexa, what is a synonym for...?" accompanied by a word, the Echo can be used as a thesaurus or translator. There are also additional language learning skills available. Most commonly occurring are flashcard-style services, which typically link to well-known websites such as "Quizlet" or "Chegg." Moreover, Echo devices can play audio files for listening comprehension or music for relaxation or quiet study time (Davie & Hilber, 2018).

Dizon (2020) investigated whether Alexa could improve EFL listening comprehension and speaking skills. AI speakers enhanced students' speaking skills, but not their listening skills. The results of the speaking tests showed that, while the experimental group made a slight improvement, the control group did worse on the post-test than on the pretest. The author believes that improvement in L2 speaking demonstrates the potential of AI speakers to enhance foreign language development and confirms the advantages of dialogue-based CALL for language learners (see also Bibauw et al., 2019). This interaction is essential for students learning a foreign language, as they are likely to have few opportunities to speak outside the classroom.

The present study evaluates the use of digital personal assistants as part of a blended-learning environment to enhance the English language skills of native Japanese undergraduates. Three case studies are presented to ascertain the effectiveness of using AI smart speakers to improve their English proficiency and enhance the socialization and personalization of the learning. As part of a flipped learning (FL) environment, the case studies also incorporate 21st-century learning skills for fostering global cultural awareness. In each case study, pretest and post-test TOEIC scores and post-training survey results were used to evaluate the BL-training program's overall effectiveness.

Methods (Case Study 1)

The main objective of the first case was to evaluate the efficacy of a training program that incorporated the AI smart speakers Google Home Mini and Amazon Alexa to improve the English proficiency of native Japanese undergraduates. The first case study was conducted over two academic semesters (April 2018 to January 2019). Twenty-four students, all native Japanese and third-year economics majors at a private university in Tokyo, participated in the study. As part of a flipped learning environment, it incorporates 21st-century learning skills for cultivating international cultural awareness. Post-training survey results and pre- and post-test TOEIC scores were used to evaluate the overall effectiveness of the training program.

Two research questions were targeted in Case Study 1:

a. Could participants' English proficiency and understanding of 21st-century skills improve after participating in AI/BL/FL activities?

b. Did the use of AI/mobile learning and content & language integrated learning (CLIL) enhance the English skills of the native Japanese participants?

Training procedure

The technologies included Google Home Mini (Figure 1), Amazon Alexa (Figure 2), ATR CALL Brix, Facebook, Twitter, Line, and other language learning programs. TOEIC was used to determine if students' English skills improved and to evaluate the overall efficacy of the BL/FL program utilizing AI smart speakers. TOEIC was administered in April 2018 and January 2019 as a pretest and post-test, respectively.



Figure 1: Google Home mini



Figure 2: Alexa Echo Dot

Participants were divided into eight subgroups during training, with half of the groups using Google Home Mini and the other half using Amazon Alexa. Over the four-month training period, the AI smart speakers were integrated into the participants' daily lives. A timer was regularly set while interacting with the AI speakers to practice English listening, speaking, pronunciation, and vocabulary skills using a variety of software applications. For example, some groups used Google Home Mini to improve their English listening and speaking skills using the following software applications: "Best Teacher," "Travel English," "Let's play around with English," and BBC/CNN news, "Kikutan," "English Quiz" by Arc, "Liberty English," and "Kindle."

Participants recorded short video clips of their learning experiences using the AI smart speakers and uploaded them to Facebook. In addition to keeping written diaries containing their observations regarding the content and duration of their studies, participants periodically recorded their thoughts using a smartphone. After the training period, participants from each of the eight subgroups presented their impressions of the BL/FL lesson training using AI speakers. The majority indicated that the training activities positively impacted their English learning experiences.

Results (Pretest/Posttest TOEIC)

The students improved both their TOEIC listening and reading scores. Their listening mean scores increased from 185 (SD:55) to 313 (SD:76) on the pretest and post-test, respectively, and their reading mean scores also increased from 237 (SD:74) to 304 (SD:57). Pretest and post-test overall TOEIC results of Case Study 1 (n=24) during the ten-month training period (April 2018 to January 2019) increased from a mean score of 422 (SD:115) or equivalent to A1 CEFR level to 617 (SD:114) or equal to B1 CEFR level. The mean score improved by 195 points from pretest to post-test. These pre-/post-test

TOEIC results were analyzed using a series of t-tests, indicating the differences were statistically significant ($p < .01$).

Post-training questionnaire

A post-training survey was administered to 24 students to ascertain their overall impressions of the BL/FL program using AI smart speakers. Responses to a few of the survey questions are summarized as follows ($n=24$):

- (Q1) The online lectures were beneficial in improving my English proficiency: 88% agreed.
- (Q2) SNS (Facebook, Line, Twitter) helped me learn English: 92% agreed.
- (Q3) This program helped me learn 21st-century skills: 90% agreed.
- (Q4) Campus Crusade for Christ (CCC) members helped change my worldviews through face-to-face discussions: 88% agreed.
- (Q5) Collaborative work helped improve my learning and English proficiency: 94% agreed.
- (Q6) AI speaker helped improve my English skills: 76% agreed.
- (Q7) AI speaker helped improve my listening skills: 87% agreed.
- (Q8) AI speaker helped improve my speaking skills: 57% agreed.
- (Q9) AI speaker helped improve my reading skills: 13% agreed.
- (Q10) AI speaker helped improve my writing skills: 4.3% agreed.
- (Q11) Presentation practice with PowerPoint helped improve my English proficiency: 100% agreed.

Method (Case Studies 2 and 3)

Two additional case studies were carried out to replicate the first case study, which revealed the benefits of using AI smart speakers in L2 learning. The second case study was conducted over two semesters (April 2019 to January 2020). Fifty-nine undergraduates participated, all native speakers of Japanese. Participants were divided into two groups: The experimental group ($n=30$) used a smart speaker during the training period, while the control group ($n=29$) did not use a smart speaker. Case Study 3 included a separate group of Japanese participants ($n=23$). As in Case Study 1, TOEIC was used as a measure in the additional case studies to determine if the students' English skills improved and to help ascertain the overall effectiveness of the BL/FL program. TOEIC was administered to both groups as a pretest in April 2019 and a post-test in January 2020 to determine any differences in improvement.

Training procedure

The technologies utilized in training included Amazon Alexa and Google Home Mini, ATR CALL Brix, and the mSNS programs Facebook, Twitter, and Line. During training, the experimental group participants used Amazon Alexa at home with numerous applications and filmed and kept diaries about their studies. As in Case Study 1, the AI smart speakers were integrated into their daily lives over the ten-month training period. A timer was set while interacting with the AI speakers to practice English listening, speaking, and vocabulary skills using various software programs. The control group used ATR CALL Brix online learning materials at home, focusing on listening, reading, and vocabulary learning. Therefore, the main difference between both groups was whether participants had used an AI speaker or ATR CALL Brix online materials. Pedagogical activities for both groups were nearly identical in that they studied World Heritage sites and worldviews.

A speaking test was not used in Case Studies 1 and 2. However, the participants of Case Study 3 were administered the pre-TOEIC and OPIC speaking tests in April 2019 and post-TOEIC and OPIC speaking tests in January 2020, respectively. Participants of Case

Study 3 were divided into six subgroups. Half of the participants used Google Home Mini daily to improve their English listening and speaking skills using the following software applications: "Best Teacher," "Travel English," "Let's play around with English," and BBC/CNN news. The other half of the participants used Home Mini daily to improve their listening and speaking skills using the following programs: Kikutan, English Quiz by Arc, Liberty English, and Kindle. While studying with the AI speakers, participants recorded short movie clips of their learning experiences uploaded to Facebook, just like Case Study 1. Participants also kept written diaries with their observations about the contents and duration of their studies.

Results (TOEIC and OPIc Speaking test)

Mean TOEIC scores of the experimental group improved from 407 (SD:113) to 604 (SD:92), an increase of 197 points. Mean TOEIC scores of the control group improved from 447 (SD:93) to 598 (SD:147), an increase of 147 points.

The mean TOEIC scores in Case Study 3 improved from 461 (SD: 136) to 681 (SD: 141), an increase of 229 points, and the mean OPIc speaking test scores improved from 3.9 (SD: 0.9) to 4.7 (SD: 1.25). The pre-/post-test results in both case studies were analyzed using a series of t-tests, indicating that the differences in TOEIC scores between the experimental and control groups were statistically significant ($p < .01$).

Post-training survey (Case Study 3)

A post-training survey was administered at the end of their respective AI/BL/FL training to ascertain their overall impressions of the program. Responses to a few questions are summarized below:

- (Q1) AI speaker helped improve my English skills: 81% agreed (n=23).
- (Q2) AI speaker helped improve my listening skills: 87% agreed (n=23).
- (Q3) AI speaker helped improve my speaking skills: 65% agreed (n=23).
- (Q4) AI speaker helped improve my reading skills: 32% agreed (n=23).
- (Q5) AI speaker helped improve my writing skills: 26% agreed (n=23).

Conclusion

Mean TOEIC scores improved significantly over two semesters in each of the three case studies. The results of Case Study 2 demonstrated that the experimental group that utilized smart speakers as part of their training performed better on the TOEIC post-test than the control group that did not use smart speakers. The results of Case Study 3 also revealed that the integration of AI smart speakers and flipped learning helped the experimental participants improve their TOEIC scores by 229 points. The follow-up survey revealed that over 80% of participants agreed that the smart speaker improved their English skills, particularly their listening skills. The participants also felt that using a smart speaker was a fun, easy-to-use, and practical way to improve their English speaking and vocabulary skills. The smart speaker's ability to comprehend their commands instilled confidence in the participants, and they also enjoyed being exposed to authentic native pronunciation by listening to the news.

AI smart speakers appear helpful for developing speaking skills, particularly pronunciation (e.g., Dizon, 2020; Obari et al., 2020). Students can experience valuable listening and speaking practice outside of the classroom with the help of AI speakers, resulting in greater learner autonomy (Dizon & Tang, 2020). The findings of our three case studies support this assertion. Although interaction with a native speaker is preferable, some students may feel uneasy speaking the target language in front of others or have limited opportunities to converse with L2 speakers outside of formal settings. Consequently, an AI smart speaker could serve as an excellent

language-learning tool. Although research on the application of smart speakers for L2 learning is still in its infancy, further studies with more subjects and varied L2 learning contexts would be helpful. Another area of inquiry might focus on learner and teacher training in utilizing smart speakers more effectively.

References

- Bibauw, S., François, T., & Desmet, P. (2019). Discussing with a computer to practice a foreign language: Research synthesis and conceptual framework of dialogue-based CALL. *Computer Assisted Language Learning*, 32(8), 827–877. <https://doi.org/10.1080/09588221.2018.1535508>
- Davie, N., & Hilber, T. (2018). Opportunities and challenges of using Amazon Echo in education. *International Association for Development of the Information Society*.
- Dizon, G. (2020). Evaluating intelligent personal assistants for L2 listening and speaking development. *Language Learning & Technology*, 24(1), 16–26. <https://doi.org/10.1177/00336882211020548>
- Dizon, G., & Tang, D. (2020). Intelligent personal assistants for autonomous second language learning: An investigation of Alexa. *The JALT CALL Journal*, 16(2), 107–120. <https://doi.org/10.29140/jaltcall.v16n2.273>
- Obari, H., Lambacher, S., & Kikuchi, H. (2020, June). Utilizing AI smart speakers to improve the English skills of Japanese university students. Paper presented at the *JALTCALL 2021 Conference: Remote Teaching and Beyond*, Aomori, Japan.
- Terzopoulos, G., & Satratzemi, M. (2019, September). Voice assistants and artificial intelligence in education. In G. Eleftherakis, M. Lazarova, A. Aleksieva-Petrova, & A. Tasheva (Eds.), *Proceedings of the 9th Balkan Conference on Informatics* (pp. 1–6). Association for Computing Machinery. <https://doi.org/10.1145/3351556.3351588>