

The Effects of Voice-based AI Chatbots on Korean EFL Middle School Students' Speaking Competence and Affective Domains

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Abstract

This study examines the effects of voice-based AI (Artificial Intelligence) chatbots on Korean EFL middle school students' speaking competence and their related affective domains: level of interest, belief, motivation, and perceived anxiety. Participants were 44 freshmen students from one Korean middle school who took part in this study. The students divided into one control group and one experimental group. During the ten-week experimental period, the students engaged in 10 chat sessions with the voice-based AI chatbot 'Echodot.' To take an examination of the effects on the students' speaking competence, they took the NEAT speaking test as pre- and post-tests. As for the affective factors, structured questionnaire surveys were conducted before and after the treatment to find out if there are any changes in their affective domains. Findings reveal that the AI chatbot effectively contributed to an improvement in speaking ability among EFL students. The survey results indicate that the students' affective aspects of AI chatbot-assisted English learning changed positively over time. Accordingly, this study provides valuable insight into the use of AI chatbots in English learning in EFL environments, suggesting that EFL teachers should try to integrate AI chatbots into their classrooms.

Keywords: AI Chatbot, Speaking Competence, Affective Domains, EFL Students

1. Introduction

As the 4th Industrial Revolution has emerged as a societal buzzword, and access to diverse and vast knowledge is growing more than ever, there is an increasing demand for changes in the traditional paradigm of school education which is teacher-centered knowledge transfer education. In the case of English education, the recent rapid development of AI-based translation technology and the release of similar applications are also having a considerable impact on the English education field. Thus, it is inevitable to explore the direction of English education in the future.

With the development of virtual assistants and AI technologies, closer attention to the use of AI chatbots for EFL (English as a foreign language) learners has been paid. The chatbot, also

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known as a chatterbot or conversational bot, is a software system that can chat with a human user using a natural language such as English[1]. It is difficult to provide authentic opportunities for foreign language learners to improve their speaking competence in EFL context. However, they can interact with the chatbot through not only text input and text output but also via voice input and voice output.

Considering that speaking competence has been regarded as the most necessary part in the EFL contexts[2], it is required to investigate the effects of voice-based AI chatbots on Korean EFL middle school students' speaking competence. Also, this study is to explore the effects of English learning through voice-based AI chatbots on their affective domains, including levels of interest, belief, motivation, and perceived anxiety.

Therefore, the purpose of this study is to examine the effects of English learning through voice-based AI chatbots on the English speaking competence of Korean EFL middle school students. Second, the purpose of this study is to measure the effects of task-based instruction with the chatbots on the affective domains of the students, especially interest, attitudes, motivation, and foreign language learning anxiety.

Research questions are as follows:

- 1) Do AI chatbots affect Korean EFL middle school students' speaking competence?
- 2) Do AI chatbots affect Korean EFL middle school students' affective domains (interest, belief, motivation, and anxiety) toward English learning?

2. Literature Review

In language education, the majority of works addressed many aspects of human-robot interaction that assist students' learning of a target language. The human-robot interaction approaches have two effects on language education. First, students reduce anxiety through classroom interaction with robots. Previous research showed that human-robot interaction provides students with comfort in language learning[3], improved confidence and motivation[4][5], and increased learning efficiency through social supportive behavior[6]. Second, students can utilize their knowledge and social interests while interacting with robots. The students feel comfortable around robots and voluntarily interact with them[7]. Besides, robots help students learn target languages by acting as social assistance, teachers, or peers[8].

AI chatbots, a kind of robot, also called chatterbots or talking bots, are artificial intelligence programs that can communicate with humans[9]. While it is possible to predict that the chatbot will be able to act as a human-like speaker in the future, there are no chatbots with the ability

to communicate like humans as of now. However, in addition to having a fixed dialog conversation with someone other than a native speaker, AI chatbots can be a great English language learning tool for EFL students who have difficulty in English learning and speaking.

The influence of foreign language learners' dispositions on language acquisition and learning has long been well known[10]. They can reduce language learners' negative feelings increasing positive emotions such as interest and motivation in target language learning, and more importantly, improve speaking ability[11][12]. Brown introduced personal dispositions related to language acquisition into affective domains[13]. Representative affective factors impacting language acquisition and learning include self-esteem, motivation, willingness to communicate, risk-taking, inhibition, anxiety, and so on. Among these affective factors, this study focuses on the change of belief, increasing motivation according to the interest that can be caused in the interaction with the AI chatbot, and reducing the foreign language learning anxiety that is expected to have a significant effect on the verbal output.

AI Chatbots are new and attractive to foreign language learners. The learners are inclined to be more comfortable and less threatened to communicate with the chatbots than with a human[14]. The chatbots simulate human communication using natural language via textual or auditory methods[15]. Engaging in a human-like conversation, they provide language learners with actual opportunities to practice the target language. Their potential role as a language tutor or facilitator has consistently been reported in the computer-assisted language learning area[15]. Particularly, learners can interact with chatbots on an individual basis by tailoring them for their own pace of language learning[15][16]. AI Chatbots also never get bored or lose patience even though the learners practice and repeat the same material endlessly and limitlessly. By providing synthesized speech and text, they allow learners to hone both reading and listening skills. AI chatbots also provide chances for the learners to practice diverse vocabulary and sentence composition that they would not have the opportunity to use in their real situations.

3. Method

3.1 Participants

The study aimed to investigate the effects of AI chatbots on Korean EFL middle school students' speaking competence and affective domains. 44 middle school students in Korea participated in this study. All students were freshmen. They divided into one experimental

group and one control group, and finally, these two formed: student-AI chatbot group (n = 22) and student-student voice chat group (n = 22). They were engaged in different types of chat sessions during the ten-week experimental period. The chat sessions were to be conducted in English.

3.2 Research Instrument

The AI chatbots used in this study is a device called 'Echodot', a voice recognition AI speaker developed by Amazon.com. It connects to a voice-controlled virtual assistant that responds to the call 'Alexa,' and the activation word can be changed to 'Echo,' 'Amazon' and 'computer' by the user. Not only does the user activate the device with a single call command but also may state "Alexa, Let's Chat!" to switch to social bots, enabling natural communication. In addition, with the chatbots, human users can set alarms, play audiobooks, play music, stream podcasts, create to-do lists, and check the weather, traffic, and other information. Although it was not made for learning English in mind, the basic language is English, so the commands are carried out only in English, not in Korean.

3.3 Procedure

This study adopted a "pre-test-treatment-post-test" design to investigate the effectiveness of chatbot-assisted language learning for Korean EFL students. The major independent variable, the AI chatbot type used, represents the treatment of the experiment. The whole study lasted for the duration of after-school classes for one semester of the 2018 academic year at a middle school in Korea. The experimental group engaged in chats with the AI chatbot and practiced conversational skills. After the English teacher provided the basic guidance on the use of the chatbot, the students were asked to have a chat with the voice-based AI chatbot freely. Participants in the control group (student-student chat group) randomly divided into several groups, and they engaged in an oral interaction with the group partners during the experimental period. Participants were engaged in a 20 minute voice chatting once a week for the duration of the experiment. This consisted of 10 chat sessions in total, with topics relating to the curriculum's textbook and students' daily lives, including school life and other classmates. For data collection, all participants were asked to take speaking tests before and after the experiment respectively to take an examination of its effects on the participants' speaking competence. Students chose two of the ten topics that they want to discuss. The

Students had 2 minutes to think about the topic they were talking about, and then communicated with the teacher about two topics of their choice for 6 minutes, 3 minutes for each topic. It took about 10 minutes, and the scores ranged between 0-120 (pronunciation 30, fluency 30, language use 30, and task completion 30) in total. The participants' responses were recorded, submitted to the researcher of the current study, and scored by trained raters following the scoring guides based on specific evaluation criteria. As for comparing the group differences and changes in students' affective factors toward English learning, structured pre- and post-test surveys were undertaken.

3.4 Data Analysis

Data for this study were collected from quantitative methods. First, data was collected for the change in speaking competence, which compared the pre- and post-test scores. Then, data from pre- and post-surveys were analyzed to find out if there were any changes in the students' affective domains. The scores of the pre- and post-tests and the surveys were analyzed utilizing SPSS 23.0. Descriptive statistics, as well as paired samples t-tests, were reported to identify how the synchronous chat sessions affected the differences between the two tests and the surveys.

4. Results and Discussion

4.1. Effects on EFL Middle School Students' Speaking Competence

The main purpose of this study was to investigate the effects of voice-based AI chatbots on Korean EFL middle school students' speaking competence. To explore the changes in the mean scores of pre- and post-tests, statistical methods adopted were paired samples t-tests. [Table 1] shows the descriptive statistics and t-test results concerning pre- and post-test mean scores.

[Table 1] Paired-samples T-tests for Changes in Speaking Competence

Group	Category	Pre-test		Post-test		t	P
		M	SD	M	SD		
Experimental Group (N = 22)	Pronunciation	13.18	4.767	16.36	7.267	-2.628*	.016
	Fluency	13.64	4.924	17.73	8.691	-3.250**	.004
	Language Use	12.73	4.558	18.64	9.409	-4.161***	.000
	Task Completion	12.83	4.558	19.09	9.715	-4.107**	.001

	All Categories	13.0682	4.290	17.9545	8.403	-4.025**	.001
Control Group (N = 22)	Pronunciation	12.27	5.284	12.73	6.311	-.568	.576
	Fluency	11.36	4.676	12.27	5.284	-1.449	.162
	Language Use	10.91	4.264	11.82	5.011	-1.449	.162
	Task Completion	11.36	4.676	12.27	6.119	-1.000	.329
	All Categories	11.4773	4.27194	12.2727	4.49266	-2.084	.050

*Note: *p<.05, **p<.01, ***p<.001

Findings of the paired-samples t-tests indicate that voice-based AI chatbots can yield positive results for the students who converse with the chatbots. There were significant mean differences between the pre- and post-tests on English speaking competence. That is, the voice-based AI chatbot leads to the improvement of the students' speaking competence. To be specific, in terms of pronunciation ($t = -2.628$, $p < .05$), mean scores were 13.18 on the pre-test with 16.36 on the post-test. The result of fluency also showed significant positive changes ($t = -3.250$, $p < .01$), with the mean scores of 13.64 on the pre-survey and 17.73 on the post-survey. Regarding the language use, a significant mean difference was found between pre- and post-tests ($t = -4.161$, $p < .001$). The mean scores were 12.73 on the pre-test while 18.64 on the post-test, indicating that the students in the experimental group use relatively accurate vocabulary and grammar after chatting with the AI chatbot. In addition, their task completion level jumped from 12.83 on the pre-survey to 19.09 on the post-survey, and it was considered highly significant ($t = -4.107$, $p = < .01$). Accordingly, given that speaking competence has been claimed to be the most necessary part in EFL contexts, great advantages in AI chatbot technologies have been found in that for individual tutoring they give the students realistic opportunities to improve their communicative competence. Meanwhile, as for the control group, there was no significant mean difference between the pre- and post-surveys related to the pronunciation ($t = -.568$, $p > .05$), fluency ($t = -1.449$, $p > .05$), language use ($t = -1.449$, $p > .05$), and task completion ($t = -1.000$, $p > .05$).

4.2 Effects on EFL Middle School Students' Affective Domains

Another purpose of this study was to examine the effects of voice-based AI chatbots on EFL students' affective domains towards English learning. In order to compare the changes between pre- and post-surveys, paired-samples t-tests were conducted before and after the treatment. [Table 2] and [Table 3] show the descriptive statistics and paired-samples t-test results

regarding pre- and post-surveys.

[Table 2] Paired-samples T-tests for Changes in Affective Domains towards English Learning

Group	Category	Pre-survey		Post-survey		t	P
		M	SD	M	SD		
Experimental Group (N = 22)	Interest	2.94	1.026	3.36	1.041	-2.998**	.007
	Belief	2.74	.972	3.25	1.051	-2.575*	.018
	Motivation	3.06	1.090	3.56	1.119	-2.439*	.024
	Anxiety	2.78	.686	2.20	.835	2.770*	.011
	All Categories	2.78	.647	3.10	.677	-2.751*	.012

*Note: *p<.05, **p<.01

As for the experimental group, there were significant mean differences between pre- and post-surveys regarding interest, belief, motivation, and anxiety. The students' affective domains towards English learning changed positively as time passed. In particular, regarding the students' interest in English learning, the significant mean difference was found between the pre- and post-surveys ($t = -2.998$, $p < .01$). The mean scores were 2.94 on the pre-survey while 3.36 on the post-survey, indicating that the students in the experimental group became more interested in English learning after chatting with the voice-based AI chatbot. Students' belief about the improvement of speaking competence also showed significant positive changes ($t = -2.575$, $p < .05$), with the mean scores of 2.74 on the pre-survey and 3.25 on the post-survey. That is, the students involved in chatting with the AI chatbot believed that they were improving their speaking competence more effectively than before. Moreover, their motivation level jumped from 3.06 on the pre-survey to 3.56 on the post-survey, and it was considered to be extremely significant ($t = -2.439$, $p = < .05$). This indicates that the EFL students were more motivated to acquire English speaking competence as a result of having a conversation with the voice-based AI chatbot. Finally, as for the levels of anxiety, a significant mean difference was found between the pre- and post-surveys ($t = 2.770$, $p < .05$). This shows that human-AI chatbot interaction reduces EFL learners' level of anxiety in English class.

However, in the case of the control group, there was no significant mean difference between the pre- and post-surveys concerning the participants' interest ($t = -.721$, $p > .05$), belief ($t = .526$, $p > .05$), motivation ($t = .077$, $p > .05$), and anxiety ($t = .391$, $p > .05$). This seems to be because there is still a considerable amount of anxiety or fear due to students' poor English speaking skills and introversion in the context of speaking in front of other classmates.

[Table 3] Paired-samples T-tests for Changes in Affective Domains towards English Learning

Group	Category	Pre-survey		Post-survey		t	P
		M	SD	M	SD		
Control Group (N = 22)	Interest	2.74	.694	2.78	.756	-.721	.479
	Belief	2.60	.922	2.56	.3830	.526	.605
	Motivation	3.24	.825	3.23	.878	.077	.939
	Anxiety	3.30	.252	3.25	.615	.391	.700
	All Categories	2.97	.561	2.96	.467	.251	.804

*Note: *p<.05, **p<.01

Overall, survey responses of the participants in the chatbot group positively changed. That is, integrating chatbots into foreign language learning is effective in promoting interest, increasing EFL students' beliefs, enhancing their motivation, and decreasing FLCA. Findings of this research are in accordance with a number of previous researches[11]. The students who experienced chatbot-assisted language learning had great fun and believed that they were learning English more effectively with the chatbot. Also, the students' anxiety about speaking in English, tests, and negative evaluations gradually diminished during speaking activities with the chatbot. Consequently, it allowed the students to increase their motivation and interest in foreign language learning while also simultaneously decreasing their anxiety making beneficial effects on the improvement of overall communicative competence.

5. Conclusion

The major findings of this study are as follows: First, voice-based AI chatbots can effectively contribute to the improvement of speaking competence among Korean EFL middle school students. A voice-based AI chatbot enables the students to practice speaking (and/or utterances), engaging in oral communication between interlocutors. They now provide EFL students a means of practicing English without regard for time and location. Consequently, these speech-enabled interactive programs allow EFL students to participate in meaningful interaction, which can be helpful for improving their oral output. That is, negotiation of meaning, a particular way of interaction which helps the students improve their language skills, can now take place during oral interaction with AI chatbots. Given that the improvement of speaking competence is essential for effective foreign language learning, it can be suggested that chatbot-assisted language education can result in successful foreign language learning for EFL students. Also, the results of the surveys on the affective domains indicated that

integrating AI chatbots into foreign language learning can be effective in improving EFL students' beliefs, enhancing their motivation, promoting interest, and decreasing anxiety surrounding English conversation.

Findings of the present study provide empirical evidence for the use of AI chatbots in improving learners' positive attitudes toward English learning. In particular, the present study provides insight into the use of voice-based AI chatbots in a foreign language classroom in that they positively influence learners' interest, belief, and motivation while decreasing anxiety levels. This suggests EFL teachers should design the most efficient types of AI chatbot-based tasks for their pedagogical goals when they attempt to integrate AI chatbots into their classrooms. They need to consider AI chatbots as an interesting and new technology and apply them to educational environments, specifically in learning and teaching a foreign language.

The limitations and suggestions for future studies are also offered. The main limitation was that the experimental and control group involved in the present study featured only 44 middle school students, which means that this study is limited by the small size and lack of generalizability. Therefore, follow-up study should attempt to examine the effects of the chatbot with a larger number of participants. This study was not designed to examine the effects in English proficiency differences of group communication. Learner variables such as learning styles, aptitude, and familiarity with new technology might affect the use of AI chatbot and should be accounted for in future research. Accordingly, future research should consider other variables more carefully when forming groups or pairs.

Finally, this study shows the possibility of using AI chatbots as a source of new language input and facilitating output in an EFL educational environment with limited opportunities for authentic input and output for real interaction. First, cutting-edge technologies can contribute to reducing barriers to learning English as a foreign language and the cost of private tutoring. Second, they can ultimately contribute to reducing foreign language communication barriers. For example, the technology lowered the students' affective filters to acquiring productive language skills and practicing speaking English. In this sense, it can contribute to overcoming the social and institutional constraints faced by English education in EFL contexts.

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