

# Design of a Foreign Language Conversation Learning System Using Machine Learning

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Many studies have been conducted on foreign language training, but it is difficult to speak a foreign language naturally because there is little or no speaking time for the learner, compared to the teaching time. As a change in the foreign language speaking education method is applied using smart devices, it is necessary to develop a new user-centred speech learning system and education model. To develop a user-centred speech learning system using machine learning and speech recognition technology to improve speech fluency, we designed a user-centred speech training system and analysed the speech patterns of users using existing speech learning programs. We developed machine learning-based adaptive learning algorithms for recommending speaking areas. We designed user and instructor applications for speech learning and experiments that can be applied in real-life education. Based on the designed and developed method, we developed and evaluated the education model using the speech training system through a non-real-time foreign language speech training system similar to a real-time learning setting. After using the system with actual students, we analysed the students' learning satisfaction and academic achievement and found that students' motivation and practice time influenced foreign language learning.

**Key words:** *Foreign language speaking, Language learning system, Correlation analysis, Academic achievement, Machine learning.*

## Introduction

Recent developments in technology are changing the way we teach. Advanced speech processing technology using big data can recognise various languages more accurately and

use them for communication in various fields. A variety of AI-based products include voice control smartphones, TVs, radios, and speakers.

Conventional methods of teaching foreign languages emphasise mutual communication between the instructor and the learner. However, this learning effect is inferior because the learner has minimal speaking time during the total learning time in situations where several people learn together (Gilakjani and Ahmadi, 2011). It is necessary to increase the speaking time of learners during the teaching time, thereby increasing the time that the learner is exposed to actual language use (Cocerhan and Bradley).

When learning a language, speaking is much more complicated and requires various language skills compared to other functions of language, such as listening, reading, and writing. Consequently, it takes a lot of time and effort to improve language skills. This is because learning to speak a foreign language requires an individual to learn not only language skills, such as pronunciation, grammar, and conversational skills, but also complex skills that require both definitional and social skills in order to express learners' thoughts and emotions (Ratnaningsih et al., 2019).

Although it is difficult to analyse nonverbal expressions of speech, systems and teaching methods for learning correct text-based word representations can be aided by AI-based speech processing technology (Mukammal et al.,). In addition, it would be helpful to increase the speaking time of learners compared to the teaching time (Leong and Ahmadi, 2017; Rahman and Deviyanti, 2018). Smart devices that are convenient and accessible to learners should be used and the concept of a foreign language learning system based on big data and machine learning should be embraced, as this is expected to grow (Ahn and Lee, 2016; Cochrane, 2014).

In this study, we designed a user-centred foreign language education system to suit global trends. We also proposed an education model for using it. To verify the proposed model, we designed a speech-learning app and a learning management system (LMS), and we examined the applicability of the proposed system by applying a speech education system to an actual educational site using a non-real-time foreign language speech learning system similar to a real-time learning setting.

## **Related Works**

Generally, there are many challenges in learning a foreign language, yet speech is one of the most important means of communication and its effectiveness must be improved (Bozorgian, 2012). Many foreign language learners struggle to express words after partaking in a foreign language course (Dincer and Yesilyurt, 2013; Efrizal, 2012). This is

because expressing one's thoughts in words is not easy without much practice (Mazouzi). Therefore, a language learner needs to practice expressing his or her ideas effectively.

Speaking is one of the basic skills necessary to learn a foreign language. Speaking is when a speaker uses language to convey his or her thoughts or messages. Harris defines speech as an encoding process that conveys ideas, thoughts, and feelings verbally (Harris and Silva, 1993). A person tells someone what he or she needs and tries to accomplish what others demand. Therefore, speaking is one way to communicate one's thoughts, information, and feelings to others.

To improve one's speaking skills, an individual must practice speaking continuously and assessment should be conducted based on natural speaking. However, the assessment of speaking is often ineffective because of limited speaking time and concerns about objective evaluation. Therefore, there is a need for a complementary tool that teachers can use to develop students' speaking skills through simple questions and short conversations with students in the classroom.

The Mobile English Speaking Assessment Convergence System Model Validation Study developed a speech learning and assessment app for mobile devices and prepared an evaluation procedure to fit the specified content (Ahn and Lee, 2016; Cochrane, 2014). To process the speech evaluation, the app was stored as a voice file and provided to the learner, and the speech evaluation was performed by the instructor.

In studies on improving speaking by listening to and repeating words and sentences, there is little research on speech evaluation after converting speech into text (Nachoua, 2012; Oberg and Daniels, 2013). We analysed the case studies of mobile English learning and related learning programs with the aim to improve speaking function through learning, recording, and submitting English speaking assignments (Hadijah, 2014; Suparsa et al., 2017; Adaniyah, 2017).

Through experimental research, one study has revealed that mobile devices are effective for learning English because they offer learners both accessibility and high levels of intimacy (KIM, 2013). Research on mobile language learning has been conducted regarding speaking learning for the four language functions (reading, writing, speaking, and listening). Foreign language learning using mobile devices is especially effective for listening and speaking, while the portability and accessibility of such devices helps learners to develop their speaking skills (KUKULSKA-HULME and SHIELD, 2008).

Learners are given both more time and more opportunities to speak by learning through a mobile device than in a traditional classroom environment. A related study has shown that

an increase in speaking time also has a positive effect on improving the speaking ability of learners (LYS, 2013). Furthermore, mobile learning is also effective for learning English expressions, and research results have reported that this approach has various effects on learners (RUCHTER et al., 2010).

To adopt this approach, it is necessary to utilise new technologies, such as speech recognition, and to use mobile applications that can be used anytime and anywhere (SANDBERG et al., 2011). As both the accuracy and scalability of artificial intelligence have developed rapidly to an advanced level, it is becoming possible to process speech recognition more accurately through artificial intelligence and machine learning (SEO and CHOI, 2014).

One study found that if you use the pronunciation feedback function through voice recognition, you can see a learner's overall understanding of their target language and fluency, as well as the effect of correcting the learner's pronunciation (Myers, 2000).

In addition, if speech recognition is repeatedly practiced by individual learners, with feedback provided accordingly, corrections to their pronunciation can be made successfully. As a result, the corrections made to a learner's pronunciation will make their expression of the target language more accurate and fluent (Miangah and Nezarat, 2012).

This pronunciation improvement effect can be seen, generally speaking, in all learners. However, in the context of foreign language learning, a more significant effect can be seen in beginner group learners. Such a speech recognition function can improve the accuracy of learning a foreign language, such as by improving pronunciation and also improving speaking ability in that language (Anderson, 2008).

We used the Google speech recognition function to display simple sentences. This paper analysed the usefulness and effectiveness of a language learning program app. Conversational situations that are appropriate for actual learners' skills are not automatically recommended, and there is a lack of analysis of correlations with actual academic performance.

## **System Design**

This paper identified the following requirements for designing the proposed foreign language learning system:

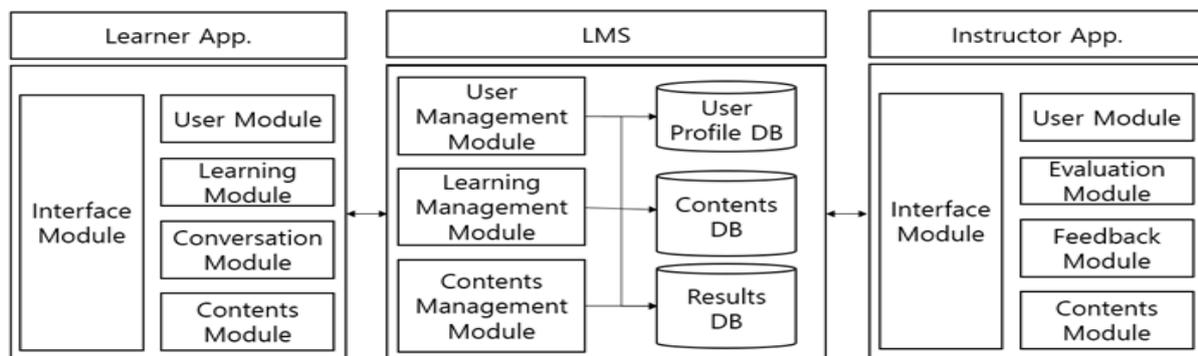
- Transcribing a user's speech into text and then sending it to the LMS;
- Determining the correct answer in the transcribed text using machine learning;

- Transmitting the result of the system and evaluating the feedback;
- Learner profile management for foreign language learning type, number of repetitions, time, etc.;
- Carrying out a morphological analysis according to a speaking pattern;
- Customising a learning service according to an individual's speaking level.

In order to improve speaking fluency, it is necessary to develop a learner-centred speaking learning system based on machine learning. An important aspect when designing a learner-centred speaking learning system is to analyse a user's speaking pattern through an analysis of existing speaking learning programs. Based on the analysed pattern, it is necessary to induce repetitive learning by outlining the areas that the learner needs to practice and improve. To do so, it is necessary to develop an algorithm that can offer adaptive learning based on machine learning for learner diagnosis, pattern analysis, and content recommendations.

Figure 1 shows the structure of the proposed foreign language learning system based on these requirements.

**Figure 1:** Proposed System Architecture



The proposed system consists of a user's app, an instructor's app, and an LMS that can manage the activity status of all users. The user's app consists of a user interface, a user module, learning module, contents module, and an English conversation module. When the user (learner) logs in, he or she is tested. If the result of the test is not satisfactory, the learner should try again. The diagnosis test can be repeated if desired by the user, and learning content is recommended according to the test result.

The learner who finishes learning repeats the sentence presented for evaluation and confirms the result converted into text. If the user accepts the text and the system recognises it correctly, the sentence is stored temporarily. If necessary, the learner can repeat the speech training.

After completing the study and the evaluation of the recommended content, the results are sent to the LMS. The transmitted results show the results automatically generated by the machine learning system and are presented so that the instructor can check the app or LMS for the final evaluation.

Table 1 shows the machine learning items that need to be applied to improve the performance of the proposed system.

**Table 1:** Machine Learning Factors to be Considered

Item	Content
Pattern analysis design.	<ul style="list-style-type: none"> <li>• Development of a Stemming Analyser for analysis of Noon Answer Pattern in collected text.</li> <li>• Designing Word2Vec models for deep learning-based semantic analysis.</li> <li>• Third-party implementation design with Word2Vec embedding extraction.</li> </ul>
Adaptive learning algorithm based on machine learning.	<ul style="list-style-type: none"> <li>• Recommended learning using network embedding and pre-learn embedding.</li> <li>• Adjusting the embedding weights of the pre-training model.</li> </ul>
Simulation and verification of the designed algorithm.	<ul style="list-style-type: none"> <li>• Simulation and verification of an existing speaking learning content by applying the designed algorithm.</li> </ul>
Develop algorithm simulation and performance evaluation.	<ul style="list-style-type: none"> <li>• Applying the developed algorithm to verify existing speech learning content, simulation, and performance evaluation.</li> </ul>
Development and evaluation of the education model applying the speech training system to significantly increase the learner's learning time.	<ul style="list-style-type: none"> <li>• Developing training methods and educational models based on the significant increase in the learner's learning time and evaluating them through actual effect verification.</li> </ul>

A learner's speech learning content should be converted into text, with the speaking pattern then analysed. The system collects the converted text and transmits it to the learning management system. We should design and develop algorithms and systems that perform user pattern analysis and offer adaptive learning recommendations by analysing the entire process. This should be done from the moment the user starts learning to speak to situations in which they receive the teacher's evaluation and feedback after the end of learning.



Personalising an individual's learning history is essential for analysing their progress and recommending content. Elements necessary for personalising the individual's learning history should store the history of their speech training level, the number of repetitions, etc. The system should also record the learning results, along with the morpheme analysis, according to the learner's speaking patterns.

Repetitive learning and recommendations for future learning should be conducted and expressed based on machine learning by linking customised learning services according to the respective level of an individual learner. It is necessary to develop an algorithm for adaptive learning based on machine learning that offers similar forms of learning to those taught by the instructor. The system analyses and compares the results scored by the instructor, each learner's progress in learning, and their levels of learning as individual profiles in order to manage them. Individual user profiles should be extracted and applied in order to present learning content suitable for the current level of learners. The proposed system builds a database according to the integrated learner model by extracting user profiles and learning histories while also collecting personal information on speaking learning.

Designing a Word2Vec model is done by extracting learner-speaking learning information to implement machine learning through the established database. When performing machine learning, based on the existing Word2Vec model, network embedding is used to ensure optimal learning content recommendations for learners. A learner's profile is updated based on both the instructor's evaluation results and automatic scoring based on speech recognition and machine learning for the learner's learning.

Based on the results of the profiling process, which combine the grading results of the system and the evaluation results of the instructor, decisions are made to present optimised learning content to learners. Based on the speech recognition technology, we developed a system that can automatically detect the elements of the learner's speech errors while also providing both the word segmentation function and the word scoring and sentence scoring functions. This enables the instructor to easily provide feedback regarding a learner's speech correction.

At this time, it is necessary to provide both personalised learning content and a correction service through voice recognition in accordance with the speaking ability of each learner. In addition, the recommended content learning completion result and learning level are taken together with the scoring result. These are then stored and managed as individual profiles. We suggest offering a learning course suitable for an individual's learning level by applying their managed user profile.

The learner profiling process can be roughly divided into three steps. This process involves creating a profile for a target person, collecting related personal information, building an integrated database, checking their profile, and automatically making decisions using the profiling results. When collecting information by profiling, it can then be divided into association rules, classification techniques, clustering, and prediction types. The history of a learner's level of understanding, the number of repetitions of speaking learning, and the learner's experience area are stored with the personal history data. This is then analysed and used for personalisation by analysing the machine learning algorithm.

## Experimental Results

### *Analysis Method*

To analyse the results of the actual class application of the proposed foreign language learning system, we used the system with fourth graders (13 male and 10 female) from elementary schools in Seoul, Korea, for two weeks. We performed data analysis using SPSS version 18.

### *Analysis of the System's Applicability*

The correlation analysis between the scores generated by the system and the students' prior conversation ability is shown in Table 2.

**Table 2:** Correlation Analysis Results

		Conversation Ability	Score
Conversation Ability	Pearson Correlation	1	
	p		
	N	23	
Score	Pearson Correlation	.611**	1
	p	.002	
	N	23	23

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

There was a highly significant correlation between students' speaking abilities and the actual academic score of .611 ( $p < 0.05$ ). The correlation between students' speaking skills and the results of the evaluation using the actual conversation learning system mean that the proposed system can assess the students' levels accurately. Additionally, based on this result, if one learns continuously using the proposed system, they are likely to improve their speaking abilities.

Therefore, the results of the regression analysis to determine the effect of using the system proposed in this paper are shown in Table 3 and Table 4.

**Table 3: Model Summary**

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	.611*	.373	.343	7.089

**Table 4: ANOVA<sup>b</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	627.904	1	627.904	12.495	.002 <sup>a</sup>
	Residual	1055.314	21	50.253		
	Total	1673.217	22			

a. Dependent variable: speaking ability

b. Predictors: score

As shown in the correlation analysis, this study found that using the system to diagnose and suggest actual speaking ability had a significant effect on the actual speaking test scores ( $F = 12.495, p < 0.05$ ).

## Conclusion

This paper proposes an English conversation learning system that uses speech recognition and machine learning to improve speaking skills in foreign language learning. In order to determine the effectiveness of the proposed system, we developed a user interface app for learners and instructors and built an LMS to analyse the actual results of the learners. In addition, in the process of developing and applying LMS, we extracted and suggested elements for applying machine learning.

As a result of applying and analysing the proposed system in a real education setting, the learners' satisfaction was generally high and there was a highly significant correlation between their speaking ability and their actual academic score ( $r = .611, p < 0.05$ ). In addition, the results of using the proposed system according to the self-assessed speaking ability, which were shown in the correlation analysis, showed a significant effect on the actual speaking test scores ( $F = 12.495, p < 0.05$ ).

Based on these results, if an individual understands their speaking ability using the conversation training learning system and uses the proposed system to learn, they can



increase their motivation for learning. In addition, the use of the language conversation training system using speech recognition technology can significantly increase the speaking time in foreign language learning, thereby contributing to the improvement of the natural language speaking ability.

The proposed system will be able to train individuals to speak in various foreign languages and they will be able to self-direct anytime, anywhere, and as much as they want. Future studies should analyse the improvement of students' speaking abilities by supplementing the content of the system and introducing machine learning techniques so that many students can use the proposed model and receive more feedback.

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