

Exploring the Effects of Automatic Speech Recognition Technology in EFL Students' Speaking Performance

Hui-Wen Liu, National Taipei University of Technology, Taiwan
Pei-Shan Tsai, National Taipei University of Technology, Taiwan

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Abstract

This study examined the impact of Automatic Speech Recognition (ASR) technology, specifically Sensay, on the speaking performance and anxiety levels of 110 non-English major students, including 86 males and 24 females. Using the Foreign Language Classroom Anxiety Scale (FLCAS), students were grouped into "low anxiety," "medium anxiety," and "high anxiety" clusters. The results showed that low anxiety students initially outperformed the other groups. Furthermore, ASR technology significantly improved fluency across all anxiety levels, highlighting its effectiveness in providing repetitive practice opportunities. Notably, high-anxiety students, particularly those with high levels of Test Anxiety (TA), Fear of Negative Evaluation (FNE), and Communication Apprehension (CA), experienced a reduction in their anxiety levels after using ASR technology. These findings suggest that ASR technology can help reduce anxiety, potentially enhancing performance. The study underscores the potential of ASR in EFL education as a tool for educators to reduce students' anxiety and improve their speaking performance. The study concludes with a discussion of pedagogical implications and recommendations for future research.

Keywords: English Speaking, Automatic Speech Recognition (ASR), Foreign Language Classroom Anxiety

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Introduction

English, recognized as the global lingua franca, has become one of the most widely studied foreign languages (Walker, 2021). Its status as a universal medium for communication across varied linguistic and cultural backgrounds underscores the importance of mastering the four key language skills: listening, reading, speaking, and writing. Among these skills, speaking English is particularly valued as it enables immediate and effective communication (Akhter et al., 2020). However, English as a Foreign Language (EFL) learners often face significant challenges in acquiring proficient speaking abilities due to the language's complexity and dynamism. These challenges are further intensified by negative emotions such as nervousness, fear, and anxiety, which are frequently elicited by the daunting task of articulating thoughts and ideas in a non-native language. Such emotions can provoke physiological reactions, like trembling and sweating, indicative of stress, and pose a substantial barrier to language learning. Anxiety is strongly correlated with speaking performance (Fitri et al., 2021); however, Young (1990) highlighted the necessity of considering variables like language skills for a more comprehensive understanding of the relationship between anxiety and learning outcomes. Research has identified several contributors to EFL learners' speaking anxiety, including the fear of making grammatical or pronunciation errors, adverse past experiences, pressure from peers or teachers, and a lack of confidence (Nurilahi & Suhartono, 2022). Pronunciation, in particular, has been emphasized as vital for effective communication, with clear and understandable pronunciation greatly enhancing communication success. The causes of speaking anxiety are diverse, but a common factor among EFL learners is the reported lack of practice. Alnahidh & Altalhab (2020) observed that insufficient speaking practice leads to increased speaking anxiety, underscoring the need for more opportunities to engage in speaking activities within EFL learning environments.

Educators in the EFL field have continuously devoted efforts to instructional methodologies and interventions aimed at alleviating speaking anxiety and enhancing spoken language proficiency among learners. A variety of teaching methods and learning strategies have been employed to create conducive environments for EL speaking practice (Yesilçinar, 2019), supplemented by the introduction of technological tools and resources designed to bolster EFL learners' speaking abilities (Fathikasari et al., 2022). These endeavors highlight the transformative potential of innovative pedagogies and technology-assisted language learning in positively influencing EFL learners' speaking, especially in the fundamental domain of pronunciation. In the pursuit of refining EFL learners' pronunciation, the necessity for targeted pronunciation training is inevitable. Feedback from teachers plays an important role in improvement (Akhter et al., 2020); yet, traditional approaches, often characterized by repetitive listening and speaking exercises without tailored feedback, fall short in fostering learner autonomy and fail to equip them with the ability to independently identify and rectify their pronunciation errors (Cucchiaroni & Strik, 2019;). Addressing this challenge, the adoption of Automatic Speech Recognition (ASR) technology, a sophisticated application of Artificial Intelligence (AI) technology based on Machine Learning, has gained acceptance. This innovative approach has illuminated the integration of various ASR-based tools into classroom settings to facilitate EFL speaking training and practice.

This study aimed to investigate the impact of the possible clusters of students' foreign language classroom anxiety on their learning processes and outcomes. Therefore, this study aimed to explore the following research questions: (1) What kinds of foreign language classroom anxiety exist when students participated in AI supported learning activities? (2)

How did the different foreign language classroom anxiety related to the students' learning processes and learning outcomes?

Methods

Participants

The study involved 110 participants, aged 18-19, enrolled in three intermediate-level English classes at a Taiwanese university of technology. Freshman English, a mandatory course, aims to enhance students' language proficiency, focusing on grammar, essential language skills development, and fostering cross-cultural communication, with placement based on English entrance exam scores.

Experimental Procedure

Throughout the 18-week semester, three sections (50 min for each) of each English class were conducted each week, during which participants received lecture-based instruction in line with the university's curriculum and objectives. All three classes were taught by the same instructor, who was also one of the researchers. In the second week, participants were required to take a speaking test as the pre-test, involving video-recording their responses, and subsequently upload these files to Padlet for analysis. Following the pre-test, participants completed the Foreign Language Classroom Anxiety Scale (FLCAS) questionnaire.

Instruments

In this study, the Foreign Language Classroom Anxiety Scale (FLCAS) developed by Horwitz et al. (1986) was utilized. FLCAS is designed to assess the level of anxiety learners experience in foreign language classrooms. The scale consists of 33 items rated on a 5-point Likert Scale, including 24 positively worded and 9 negatively worded statements.

To investigate EFL learners' engagement with technology and their adoption of new approaches, "Sensay," an ASR-based language learning tool, was introduced within a college setting. Sensay employs artificial intelligence to generate audio files and instantly evaluate pronunciation, fluency, and accuracy.

The scores of learning processes result from the evaluation of the learning process. It was based on three speaking tasks selected from a total of ten.

Data Analysis

The data analysis of this study was performed in three steps. First, an exploratory factor analysis (EFA) with varimax rotation was performed to clarify the structural validity of the FLCAS questionnaire. Second, a k-mean clustering analysis was conducted to classify the students with similar degree of foreign language anxiety into groups. To compare the three clusters in terms of foreign language anxiety, Kruskal-Wallis tests and Mann-Whitney U Tests were conducted. Finally, the impact of the different clusters' foreign language anxiety on their learning processes and learning outcomes was also examined.

Results

K-means cluster analysis was conducted on the three factors to classify the students with similar degree of foreign language classroom anxiety into homogeneous groups, involving communication apprehension (CA), test anxiety (TA), fear of negative evaluation (FNE). As shown in Table 1, students in cluster 1 (n=27) have lower anxiety in CA and NE than students in other clusters. Students in cluster 2 (n=48) have higher anxiety in CA, TA and NE than students in other clusters. Students in cluster 3 (n=35) have lower anxiety in TA than students in other clusters.

Table 1: Cluster Analysis of Students' Foreign Language Classroom Anxiety

Factors	Cluster 1 (n=27)	Cluster 2 (n=48)	Cluster 3 (n=35)
CA	2.44	3.55	3.16
TA	2.90	4.19	2.87
FNE	2.13	4.18	3.60

Furthermore, the results of Mann-Whitney U tests showed that significances existed in the CA, TA, FNE except in the following case: the TA factor (cluster 1 vs. cluster 3). In sum, these indicated that the degree of CA and FNE in cluster 1 are significantly lower than those in other clusters. It is thus proposed to label cluster 1 as “low anxiety.” On the contrary, the degree of CA and FNE in cluster 2 are significantly higher than those in other clusters. It is thus proposed to characterize cluster 2 as “high anxiety.” The degree of CA and FNE in cluster 3 are significantly lower than those in cluster 2 and higher than those in cluster 1. Hence, cluster 3 was labelled as “medium anxiety.”

To examine whether the students had similar speaking skills among the three clusters before participating in the ASR-supported learning activities, Kruskal-Wallis tests and Mann-Whitney U tests were employed in this study. The results revealed that the students had similar speaking skills among the three clusters, including F (χ^2 (2, N=110)=2.19, $p=0.33$), P (χ^2 (2, N=110)=0.30, $p=0.86$), and I (χ^2 (2, N=110)=1.73, $p=0.42$). Pairwise Mann-Whitney U tests also revealed that there were no differences among the three clusters in all comparisons. Thus, it may be inferred that students in the three clusters had similar speaking skills before they joined in the learning activities.

Furthermore, Kruskal-Wallis tests and Mann-Whitney U tests were also employed to investigate whether the students attain different scores of learning outcomes among the three clusters. The results showed significant effects of the three clusters on the learning outcomes in the dimensions of P (χ^2 (2, N=110)=60.90, $p < 0.05$), of I (χ^2 (2, N=110)=10.57, $p < 0.01$). Pairwise Mann-Whitney U tests indicated significant differences between “low anxiety” and “high anxiety” in the dimensions of P ($U=429.50$, $z=-2.51$, $p < 0.05$), and of I ($U=377.00$, $z=-3.13$, $p < 0.001$). Significant differences between “low anxiety” and “medium anxiety” in the dimensions of P ($U=328.50$, $z=-2.12$, $p < 0.05$), and of I ($U=303.00$, $z=-2.54$, $p < 0.05$). These findings revealed that students with “low anxiety” outperform those students with “medium anxiety” or “high anxiety” in the dimensions of P and I. However, there is not significant difference among the three clusters in the learning outcomes of F (χ^2 (2, N=110)=5.68, $p=0.06$). This finding showed that ASR-based technology help students with “medium anxiety” and “high anxiety” attain scores in dimensions of fluent as well as those with “low anxiety.”

Conclusion

The study offers empirical evidence that ASR technology aids in reducing anxiety. It was observed that students with high levels of anxiety experienced a reduction in their learning anxiety during ASR speaking tasks, covering CA, TA, and FNE. This indicates a decrease in overall anxiety levels for this group, notably in communication anxiety. Such results suggest that students who started with higher levels of anxiety saw a significant reduction in their speaking-related anxiety, thanks to the intervention. This underscores the effectiveness of ASR technology in mitigating speaking anxiety, particularly CA, in students with initially high anxiety levels. This outcome aligns with research showing that ASR technology can alleviate speaking anxiety and that technology assistance enhances EFL learners' oral performance (Bashori et al., 2022; Tai & Chen, 2023) and offers a flexible learning environment to cater to diverse learning styles. These features lead to more effective and personalized learning outcomes (Hsu, 2016; Liu et al., 2022). As mentioned above, communication apprehension, or anxiety, is a major barrier that makes learners more reluctant to speak in a foreign language context; therefore, the deployment of ASR-based tools emerges as a promising solution to reduce this anxiety, creating a more relaxed and supportive environment for communication among EFL learners (Tai & Chen, 2023).

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