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The Influence of AI Tools on Pronunciation Anxiety: A Comparative Case Study of Students at the National University of Science and Technology

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ABSTRACT

Pronunciation anxiety is a common challenge in second language learning, impacting several learners' performance. This study examines the difference in pronunciation anxiety between students who utilize AI-powered language tools and those who do not. For this purpose, a quantitative case study design is employed by students at the School of NUST, i.e., the Institute of Environmental Science and Engineering (IESE). The data is collected from 30 students through a structured questionnaire measuring pronunciation anxiety. The collected data is analyzed using descriptive statistics and an independent t-test in SPSS software. The findings reveal that there is a statistical difference in pronunciation anxiety between students who use AI language tools and those who do not, i.e., $t(28), p < 0.01$. In addition, Cohen's d is found to be extremely large, indicating a substantial difference between the two groups. These results highlight the influence of AI learning assistance in language. It plays a role in reducing affective filters associated with second language acquisition. The study contributes to the growing body of research on the practical implications of technology across the educational context.

Introduction

Background Study

With the advancements in technology, specifically the adoption of AI-powered tools, our lives have changed. AI has impacted every aspect of our day-to-day activities, whether for work or educational purposes. Artificial Intelligence has created vast opportunities to foster our learning experiences (The American University in Cairo AUC, 2026). The use of AI-powered tools like ChatGPT-5 has impacted students' learning. Due to its high usage, it has created a sense of dependency upon it. Leading educational institutions discourage its use and rely on an individual's novelty and creativity. The anxiety surrounding the use of AI-powered tools has been perceived from the teacher's perspective. However, if used wisely, it is the most powerful tool. It has become essential to use these technologies to foster successful educational learning (Li & Mee Thein, 2025). These AI-powered tools provide features, i.e., pronunciation fluency and speech recognition. It provides a supportive environment for learning to the students. They do not fear making mistakes (Jones, 2018).

Anxiety has become one of the factors that impacts our daily life, and it is studied across different domains from psychology, education, to linguistics. Anxiety has been considered a key emotional factor influencing our language learning capabilities. Many have defined kinds of anxiety in their own manner, such as anxiety of listening comprehension (Kim, 2005). Baran Lucarz is the most prominent figure in this field. She has defined pronunciation anxiety as follows:

"It is a multifaceted variable comprising uneasiness and fear affecting learning, specifically by non-native speakers, stemming from negative psychological aspects such



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as low self-esteem or worry (Baran-Lucarz, 2014).”

Baran-Lucarz (2014) describes that the basis for pronunciation anxiety is a psychological framework of anxiety. It depicts how one internalizes things which we consider a threat to the ego. Moreover, it also focuses on how we cope with situations of fear or uncertainty (BARAN-ŁUCARZ & HO LEE, 2021). It specifically reflects a set of beliefs we possess about pronunciation expectations. Our expectations are to be met for effective communication. It includes meeting standards of pronunciation, including speaking fluency (Baran-Lucarz, 2014).

Problem Statement

We know that English is primarily used for communication across professional settings around the globe. In most countries, English is acquired as a second language. Consequently, language learners face many challenges. In most cases, they face difficulty in speaking and pronunciation. However, AI-powered language tools facilitate language learning. It can be hypothesized that these tools help in reducing pronunciation anxiety. Limited research has explored this relationship previously. Therefore, this study aims to determine the influence of the usage of AI-powered tools on pronunciation anxiety in educational settings.

Research Objectives

This study aims:

To investigate the influence of using AI language tools on pronunciation anxiety among university students.

To compare pronunciation anxiety between students who use AI language tools and those who do not.

To find out the level of pronunciation anxiety among university students.

Research Questions

This research aims to answer the following research questions:

Is there a significant difference in pronunciation anxiety between students who use AI language tools and those who do not?

What is the level of pronunciation anxiety among university students?

Research Significance

This research aims to explore how using AI-powered language tools impacts students' pronunciation anxiety. It specifically focuses on the students at the National University of Sciences and Technology. It compares students who use AI-powered language tools and those who do not. Therefore, aiming to determine its influence on pronunciation anxiety. Whether it reduces their anxiety and promotes confidence in speaking English or not.

Literature Review

Past Studies

With advances in technology, our day-to-day functions lead us to adapt to new changes. In recent years, research has revealed that several psychological factors influenced second language learning. Psychological factors, such as anxiety, affect learners' speaking abilities in educational contexts (e.g., language-learning classrooms) (Horwitz et al., 1986).

Baran-Lucarz (2013) conducted a preliminary study that explored phonetic learning



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anxiety among phonetic classes and how it affects learners' pronunciation performance. The study focused on Polish university students. The study utilized quantitative instruments, the Phonetic Learning Anxiety Scale and the Pronunciation Attainment Tests.

The results of this study showed that anxiety influences pronunciation performance. Several factors, such as self-image, self-efficacy, beliefs about difficulty, and fear of negative evaluation, affected pronunciation performance. The shortcomings include cultural and linguistic homogeneity and a small sample size. The focus of this study was mainly on Polish university students (Baran-Łucarz, 2013).

For individuals who acquire a second language, learning correct pronunciation is one of their challenges. Learners often experience anxiety when they make efforts to learn a second language. According to Derwing and Munro (2015), learners are self-hesitant while speaking a foreign language, leading them to avoid communication. Thereby, impacting the process of learning. Studies conducted on computer-assisted language learning showed improved language pronunciation. Learners who practice these AI-powered tools daily exhibited high confidence. These findings propose that AI tools do play a role in reducing pronunciation anxiety. However, limited evidence exists to support this conclusion (Derwing & Munro, 2015). Hence, leaving room for future studies.

Wardat and Akour (2025) investigated the influence of AI-powered language learning tools on speaking anxiety among Jordanian university students. The research was quantitative in nature. For this purpose, data was collected from 200 students using a structured questionnaire. Statistical analysis, i.e., t-test, was used to compare students who use AI tools and those who do not. This study's findings suggested that the use of AI tools reduced academic pressure. However, it did not significantly identify the underlying psychological construct of language anxiety. Due to constrained technological opportunities, the influence and usage of AI tools could not be fully understood. The limitations of this research include self-reported data and a cross-sectional design that prevents generalizability. Moreover, this study applies to the Jordanian context as well.

Wang and Wen (2025) conducted a mixed-method study examining the impact of AI tools on Chinese learners' speaking skills and anxiety. The research involved a pre-test and post-test quantitative design with 147 Chinese students. They participated in language learning activities for over ten sessions. Standardized and validated questionnaires, including proficiency tests. They were administered to measure students' anxiety, motivation, and language proficiency. The results of the study were analyzed using statistical analysis, i.e., paired sample t-test. Research findings showed improved pronunciation and a decrease in anxiety level. However, the study had some limitations, including the absence of a control group for better comparisons. In addition, its findings cannot be generalized as it is limited to the Chinese cultural context.

Another study was conducted by Nadeem et al. (2025) to determine the impact of Artificial Intelligence on speaking anxiety. This study employed a mixed-methods quasi-experimental design, with a sample of 60 learners (students). Quantitative findings were interpreted using statistical tests, including the paired sample t-test and ANOVA. Its results revealed a significant decrease in speaking anxiety and improvement in the learners' proficiency. Qualitative findings revealed positive perception regarding the use of AI-powered tools that increase confidence. However, this study has its limitations, including a small sample size and a shorter intervention period. Moreover, it focuses on a single institution, which limits the generalizability of the findings.



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Theoretical Framework

Affective Filter Hypothesis

This model proposes that several factors act as barriers that influence the mechanism of second language acquisition. Krashen uses the term '*affective filter*' to refer to those psychological barriers that disrupt the language acquisition itself. These affective filters include factors such as motivation, anxiety, and self-confidence. Therefore, some factors act as high filters and some as low filters. The high filter includes the influence of anxiety, low self-confidence, and motivation on second language acquisition. It prevents the learner's processing level.

A non-native speaker may feel anxious to speak English phrases in a non-coherent form. Their high anxiety prevents them from speaking the language properly. This is groomed in supportive environmental factors where the learner or speaker is neither judged nor motivated. It helps determine how quickly we can learn a language (Avi, n.d.). This framework explains why we differ in language competency, as we are influenced by filters differently. These 'affective filters' are defined by Krashen as:

"The filter that is a part of internal processing dynamic perceives the processing of language through the psychological lens known as the effect of the learner. Therefore, referring to the learner's needs, motivation, attitudes, and other emotional states (Avi, n.d.)."

Research Gap

Recent studies have explored the relationship between pronunciation anxiety and second language learning. However, limited research has been done in the field of linguistics with reference to the influence of artificial intelligence. Most studies primarily focused on how AI helps with language proficiency and accuracy. With the rapid growth in technology, there is a need to investigate how these AI-powered tools impact speaking anxiety. This study aims to contribute to existing linguistic research.

Research Methodology

Research Design

This study adopts a quantitative comparative case study design. It aims to investigate the relationship between AI-powered language tool usage and pronunciation anxiety among university students. It targets a single educational institute, i.e., the National University of Science and Technology. It consists of a comparison between two groups, i.e., students who use AI language tools and those who do not. It compares the levels of pronunciation anxiety of these two groups.

Population

The population is the entire group of people who are the subject of a research study. The targeted population of this study involves National Science and Technology students.

Sample Size

For this study, a sample of 30 students from the School of NUST, i.e., the Institute of Environmental Science and Engineering (IESE). These students are enrolled in different program degrees, including BS, MS, and PhD. Moreover, they study English as an elective subject.



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Sampling Method

The sampling method used was non-probability or non-random sampling. The data is collected through a combination of both convenience and purposive sampling techniques.

Method of Data Collection Instrument

In this study, data were collected using a structured questionnaire administered through physical and online methods. A structured questionnaire is a set of fixed and pre-planned questions that all participants answer in the same way. They use a Likert Scale (i.e., 1 = Strongly Disagree to 5 = Strongly Agree). The scale used to measure students' pronunciation anxiety is the **Pronunciation Anxiety Scale (PAS)**. It measures how anxious learners feel when pronouncing words in a second language.

Method of Data Analysis

The data collected is analyzed using software, i.e., Statistical Package for Social Sciences. It is commonly used for quantitative analysis. It helps in organizing the data, running statistical tests, and interpreting the results for this study.

The primary statistical test used for this study is the **Independent Sample t-Test**, which compares the anxiety levels between two groups. This test is conducted to compare pronunciation anxiety between students utilizing AI-powered language tools and those who do not.

Research Hypothesis

The research hypothesis for this research is as follows:

H0 (Null Hypothesis)

There is no significant difference in pronunciation anxiety between students who utilize AI tools and those who do not.

H1 (Alternative Hypothesis)

There is a significant difference in pronunciation anxiety between students who utilize AI tools and those who do not.

Results

Table 1

Demographics of Participants

Characteristics	Category	Frequency	%
Gender	Male	16	53.3%
	Female	14	46.7%

Table 2

Psychometric Property of Pronunciation Anxiety Scale

Scale	M	SD	Range	Cronbach Alpha
PA	2.975	11.26	0.333	0.974

Note: PA = Pronunciation Anxiety. M = Mean. SD = Standard Deviation.



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The internal consistency of the scale was measured. Therefore, Cronbach’s alpha is calculated. Its value for the Pronunciation Anxiety Scale is 0.974, showing good internal reliability.

Table 3

Descriptive Statistics for Pronunciation Anxiety

Characteristics	n	M	S.D
AI Tool Use			
Yes	14	13.0	1.46
No	16	33.25	6.27

Note: M = Mean. S.D = Standard Deviation

The results show that students who do not use AI-powered language tools reported higher pronunciation anxiety (M = 33.25). On the other hand, students who used AI-powered tools reported lower pronunciation anxiety (M = 13.0).

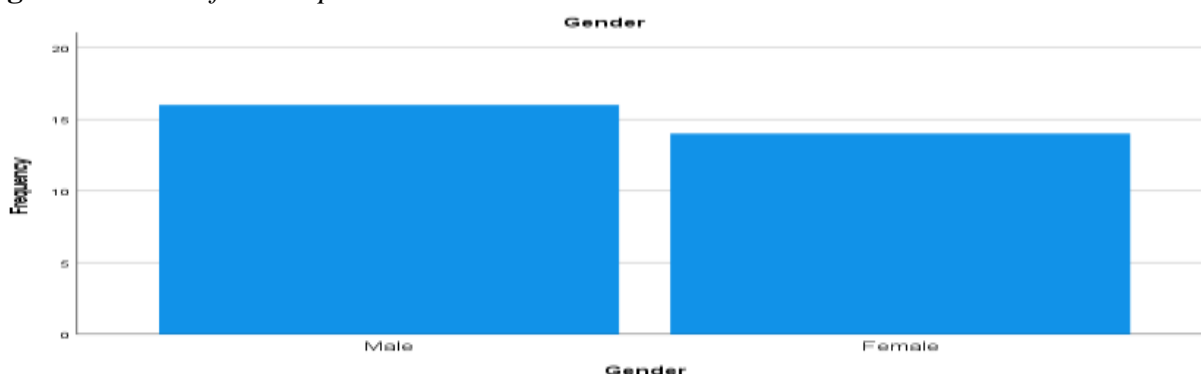
Table 4 *Pronunciation Anxiety Differences Between Students with respect to AI-Tool Usage*

Variable	AI-Tool Use		AI-Non-User		t(28)	p	Cohen’s d
	M	SD	M	SD			
AI-Language Tool	13.0	1.46	33.25	6.27	11.77	<0.01	4.7

Note: M = Mean. SD = Standard Deviation.

An independent t-test was conducted to find out the difference in pronunciation anxiety between students who use AI tools and those who do not. Students who did not use AI language tools reported higher pronunciation anxiety (M = 33.25, SD = 6.27) as compared to the students who used them (M = 13.0, SD = 1.46). Levene’s test indicated that the assumption of equal variances was met (F = 2.97, p = 0.096). The results indicate a statistically significant difference between these two groups, t(28) = 11.7, p <0.001. The effect size was extremely large (Cohen’s d = 4.7), demonstrating a substantial difference in pronunciation between the groups. Therefore, the null hypothesis was rejected.

Figure 1 *Gender of Participants*





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Figure 2

Program Degree of Participants

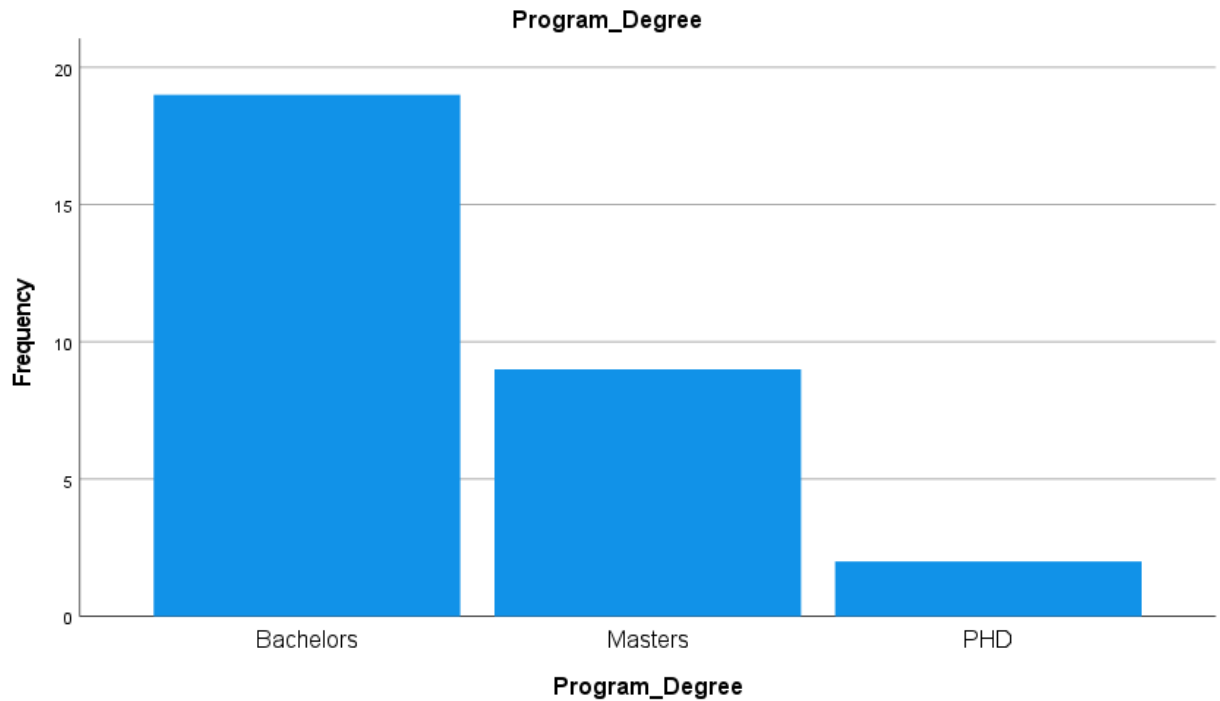
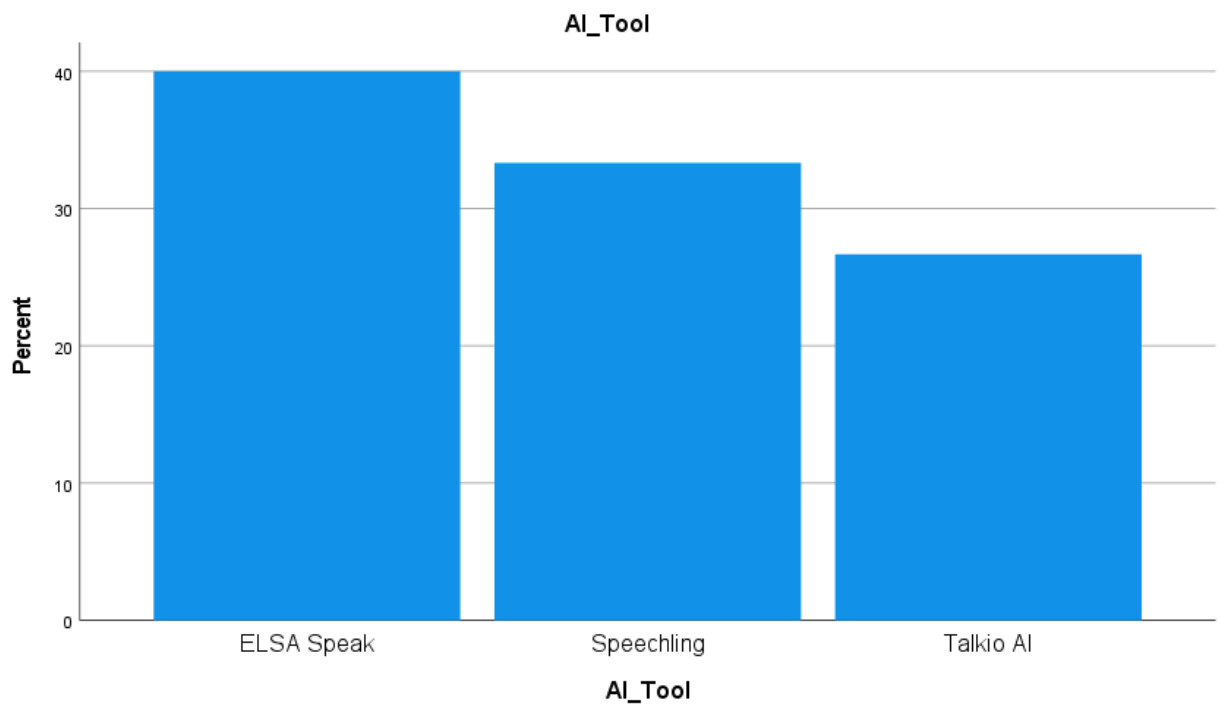


Figure 3

AI Language Tools used by Participants





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Discussion

Summary of Findings

This study examined whether the use of AI-powered language tools impacts students' pronunciation anxiety or not. It investigated pronunciation anxiety between those who use them and those who do not. Findings showed that a significant difference was found between these two groups. Such that those who utilized AI language tools exhibited lower anxiety than those who did not. An independent t-test confirmed the difference between the two groups as the p-value was found statistically significant ($p < 0.01$). In addition, the effect size was extremely large, suggesting the influence of AI tools on pronunciation anxiety is substantial. Overall, the results strongly show that AI language learning tools may reduce pronunciation anxiety.

Theoretical Implication

The findings support the theoretical framework in the linguistics field, i.e., the Affective Filter Hypothesis. According to this hypothesis, factors such as motivation, self-confidence, and anxiety act as a psychological filter that impacts language acquisition. In this study, the effects of anxiety on pronunciation were examined. When learners experience high anxiety, the affective filter becomes elevated, preventing effective language processing.

The results of this study support this theoretical framework. AI-powered language tools facilitate language learning by lowering the anxiety (affective filter). These tools provide opportunities to practice, receiving immediate feedback resulting in improved language performance. These findings incorporate the application of the affective filter hypothesis to technology-based methods for language learning.

Limitations

The research suggested strong evidence for determining the influence of pronunciation anxiety with respect to AI tools usage. However, it has several limitations. First, the sample size taken for this study is relatively small (only 30 participants from a single institution). Second, the study relied on data taken from a self-reported scale, which is subject to response bias. Third, the research only explored one dimension of language, i.e., pronunciation. Fourth, the study did not consider other variables, such as willingness to learn. Moreover, this is a case study targeting one university only, which limits its findings' generalizability.

Future Implication

Future research can work on this research's limitations. It could include larger and more diverse samples across several universities. Such that it could conduct a comparative study exploring other dimensions of language as well. Other dimensions like self-confidence, language proficiency, and academic performance could be explored in the context of AI-assisted language. Future studies could involve a mixed-method study. It can include qualitative techniques, such as interviews, to gain deeper insight into this topic. Moreover, future studies could focus on other languages besides English as well. Cross-cultural studies could also be done.

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Appendix

Demographics Form

Kindly fill in the required information.

Your Gender

Male

Female

Prefer not to say

Other

Your Program Degree

Bachelors

Masters

PhD

Do you use AI Language Tool for Pronunciation?

Yes

No

If yes, which AI language tool? _____

Pronunciation Anxiety Scale

Instruction: Please rate how much you agree with each statement. (1 = Strongly Disagree ... 5 = Strongly Agree)

5-point Likert scale (Linear scale 1-5):

Labels: **1 = Strongly Disagree, 5 = Strongly Agree**

I feel nervous when asked to pronounce words in front of others.

I worry about making pronunciation mistakes in the second language.

I avoid speaking because I fear being judged for mispronunciation.

I feel embarrassed when my pronunciation is corrected.

I get anxious when I have to speak spontaneously in the second language.

I fear that others will laugh at my pronunciation.

I hesitate to participate in oral activities because of pronunciation concerns.

My fear of mispronunciation lowers my confidence in speaking.