

## ARTICLE

# Impact of Computer-Assisted Language Learning (CALL) on Pronunciation Proficiency Among ESL Learners

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## ABSTRACT

The integration of Computer-Assisted Language Learning (CALL) has transformed pronunciation skills and is no longer confined to traditional classrooms. The study aims to demonstrate the impact of Computer-Assisted Language Learning (CALL) materials on students' pronunciation skills and examine the ESL learners' perceptions of CALL tools. This study employed a quasi-experimental pre- and post-test design, complemented by Technology Acceptance Model 2 (TAM 2) survey with 119 participants in a single institution. Learners' pronunciation was evaluated across segmental accuracy, word stress, fluency and comprehensibility through performance test and their perceptions were assessed by TAM 2 model. The model, for its certain features, deals with the acceptance of technology among the users. Recent advancements of Computer-Assisted Pronunciation Training (CAPT) as a part of CALL, are rapidly increasing, focusing on the efficacy of second language acquisition among the English language learners. Incorporating CAPT in this study emphasizes its proven ability to facilitate accurate pronunciation. The current article investigates the impact of modern technologies and multiple language software packages including MyET, Pronunciation Coach and SpeakPipe to

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practice and improve pronunciation skills on language learning at the undergraduate level among students in Pakistan. The results indicate that CALL tools effectively enhance measurable pronunciation performance and learners' positive perceptions highlight the potential of CALL to complement traditional speaking instruction by fostering engagement, promoting learner autonomy and providing authentic computer-mediated opportunities for developing pronunciation skills. The study sheds light on practical implications for educators, institutions and policymakers in adopting CALL pronunciation tools to enhance pronunciation skills.

#### **Highlights:**

- Incorporated detailed discussion of underlying mechanisms such as multimodal feedback, repetition, and learner autonomy in CALL.
- Acknowledged key limitations, including the single-institution convenience sample, reliance on self-reported data, and the absence of long-term follow-up.
- Strengthened the theoretical foundation and aligned the discussion with recent studies in CALL and pronunciation research.

**Keywords:** CALL Applications; Computer-Assisted Pronunciation Training (CAPT); Students' Pronunciation; TAM2 Model; MyET; Pronunciation Coach; SpeakPipe.

## **1. Introduction**

In Pakistan, English is used as a foreign language and is progressing around the world. It enjoys a high status in the country. The role of this language in the core curriculum is rising in Pakistan. During the last few decades, the number of English language students has significantly increased, and many teaching approaches have been used in practice to evaluate the efficacy of the students' speaking accuracy and fluency. According to Mir and Afsar <sup>[1]</sup>, most of the ESL students still face difficulties in their learning progression due to multiple reasons. Among them, correct pronunciation is the key issue that can distract students' confidence throughout the span of their academic journey, even when they step into their professional matters. Hence, it is necessary to plan such learning strategies, which efficiently upgrade the students' communication skills to enable them to express themselves in public dealings.

Noor et al. <sup>[2]</sup> investigated in their study that the main source of learning English in Pakistan is the academic activity managed in classrooms, where teaching methods include English translation into Urdu version, Vocabulary, spelling, exercises, some forms of traditional grammar and definitions. In learning through such limited and traditional teaching methods, students often feel anxiety, which upsurges resentment towards the learning process of language skills. Students have fewer opportunities to speak English;

consequently, insufficient productive skills, particularly pronunciation skills by their side create difficulties for them. The examination system also focuses on grammar, spelling and translation only. For this reason, it is essential to concentrate more on student's speaking skills in the English language <sup>[3]</sup>. Similarly, Rahman <sup>[4]</sup> also debated that Pakistani students generally generate incorrect English pronunciation primarily. The main reason is that they have weak listening and pitiable speaking skills.

The investigation focusses on the practicality of learning and improving pronunciation skills through the practice of Computer-Assisted Language Learning (CALL) and Computer-Assisted Pronunciation Training (CAPT) in second language coaching for better understanding and to promote exact recognition of English language pronunciation for students. Similarly, English language pronunciation is an indispensable skill from the spoken aspect of language and plays a crucial role in effective conversation. In addition, sound competence in pronunciation enhances self-esteem and boosts learners' confidence level. Nevertheless, it is commonly taken as the most ignored productive skill <sup>[5,6]</sup>. Communicative competence can be defined by correct pronunciation skills <sup>[7]</sup>. Natural and correct articulation also generates an optimistic influence during any communication, not only influencing others but also making it easy and impressive for others to understand the envisioned meaning of a person speaking with correct

pronunciation. Zhang and Yin <sup>[8]</sup> throw light on the same aspect that sometimes students, in their everyday routine, make pronunciation errors and follow their own style of pronunciation. It is often noticed that non-native students tend to make pronunciation mistakes systematically rather than speedily or unexpectedly. Therefore, students use mispronounced words, create barriers and make their listeners perplexed. Hence, it is evident that false pronunciation is more problematic than other sub-skills such as the glossary, poor spellings and grammar while communicating in English. However, it is considered a complex task to get mastery over pronunciation by the language experts.

This study intends to explore the use of different pronunciation-based software for students to correct their English pronunciation and to help them enhance correct phonemic system awareness, which is also anticipated to provide a foundation for educating English pronunciation. The researcher of the current research hypothesized that with the practice of CALL pronunciation software and advanced technology in learning English sounds can be easier for students, and they can easily comprehend English language like native speakers. Pothuri <sup>[9]</sup> acknowledged that Computer-assisted pronunciation practice and speech interactive CALL software offer a wide range of new teaching methods of pronunciation, such as right and wrong feedback and fascinating learning. CALL and Computer-Assisted Instruction (CAI) programs also create a comfortable environment where not only pronunciation skills are polished but also vocabulary and spelling errors are also improved, and students can use these computer-based tools wherever and whenever according to their needs. Rogerson-Revell <sup>[10]</sup> also explored in their study that with the help of CALL pronunciation materials students can easily find out their mistakes and correct themselves through numerous computer software. Nowadays, the massive use of CALL and CAPT in the field of language learning, particularly improving pronunciation skills around the globe, has grown. Although in Pakistan, these magical CALL and CAPT tools are gaining popularity but have not been fully explored <sup>[11]</sup>. This paper is an effort to highlight mispronounced words and the use of prior mentioned CALL tools to correct students' pronunciation.

The condition of English pronunciation of ESL learn-

ers in Pakistan is not satisfactory. Students are weak while communicating in English, and sometimes it is hard for them to utter a couple of sentences fluently in English <sup>[12]</sup>. Moreover, authentic pronunciation materials and content cannot be easily available in their textbooks. Consequently, teachers do not accurately instruct speaking skills not only in schools but also at the college and university levels. No one, neither teachers nor students, is ready to put extra effort into learning pronunciation practically. One of the major reasons behind this lack of focus and neglected skill during learning English language is grammar translation method in Pakistani ESL classrooms <sup>[13]</sup>. As a result, they cannot speak out a couple of common sentences fluently. Less accurate pronunciation skills limit ESL learners' success in both academic and professional places. According to Li <sup>[14]</sup>, Nasir et al. <sup>[15]</sup> and Zhang <sup>[16]</sup>, CALL pronunciation software can bring a massive change in learners' speaking skills. Fazal et al. <sup>[17]</sup> in their recent study show that in Pakistan, ESL learners are acutely familiar with the CALL and CAPT tools. Subsequently, the question arises here about knowing the awareness and impact of CALL pronunciation materials on learners' familiarity with CALL and CAPT technologies.

Three basic investigating queries are as follows: First, it investigates the impact of interactive Computer-Assisted Language Learning (CALL) on pronunciation skills among ESL learners at the undergraduate level. Second, it seeks to evaluate the adequacy of CALL pronunciation tools and materials in language learning in Pakistan for learners at the undergraduate level. Finally, the study also aims make the English tone more identifiable through Computer-Assisted Pronunciation Training (CAPT) for ESL learners.

### Research Questions

1. What is the impact of interactive Computer Assisted Language Learning (CALL) on English pronunciation skills of ESL learners at the undergraduate level?
2. To what extent are CALL Pronunciation tools and materials adequate in English language learning in Pakistan at the undergraduate level?
3. How do the CAPT tools create English tones identifiable to the ESL students?

## 2. Literature Review

The study of ‘computer applications’ which are used in language teaching and learning is named Computer-Assisted Language Learning (CALL)”<sup>[18]</sup>. CALL has proved marvelous success in teaching and learning. Chapelle<sup>[19]</sup> added in their study that CALL programs are always considered as an accompaniment and improve classroom activities like storytelling, listening activities or word-processing, audio-visual aids and language games for compositions, speaking and listening preparation by practicing in English language as a Second Language (ESL) environment. In multilingual societies like Pakistan, the role of the English language is far from straightforward. Urdu is spoken as an official language, although English still plays an enormous role in our country<sup>[20]</sup>. It is applied as a mandatory subject in all education departments such as schools, colleges and universities. All official documents of government and private departments, on the billboards and in professional agreements English language is used as a medium of instruction. In the courts of Pakistan, English is also considered an official as well as legal language<sup>[21]</sup>.

According to Yolchiyeva<sup>[22]</sup>, pronunciation and spelling are not the same in the English language. Pronunciation is also identified as a part of and style of speaking skills and is notoriously difficult. Pronunciation is the first step that is observed during conversation by listeners. Improper pronunciation can leave a bad impression not only on pronunciation style but also on vocabulary. It can also make communication ineffective and create misunderstandings. English is often spoken by nonnative speakers according to their own regional dialect and some words are mispronounced and wrong articulated, which is rare in their oriental languages.

AbuSeileek<sup>[23]</sup> argued that an important aspect of CALL is also presented in computer-assisted pronunciation training applications, which is a great example of the modern digital mechanism for teaching phonological features of the English language. Numerous language teachers believe that students themselves acquire pronunciation through the environment in their language exposure of speaking; many ESL teachers were amazed whether it is needed to teach or practice the phonological segments (phonemes, phonemics and allophones) and supra-seg-

ments (syllable, stress, rhythm and intonation) and characteristics of the second language. Computer Assisted pronunciation training (CAPT) fetches many approaches to pronunciation learning, for example, right and wrong feedback, stress pattern, rise and fall in pitch and total captivation learning, and provide directions that proceed beyond the restrictions of the classroom and offer students an independent control to improve their speaking skills. Mahdi and Al Khateeb<sup>[24]</sup> added in their study that CAPT and CALL could improve learners’ pronunciation as a native speaker does. These tools have the potential to solve learners’ segmental and supra-segmental issues.

Moreover, the CALL materials for learning and teaching English are priceless. It helps students improve their language skills. Ratananingsih et al.<sup>[25]</sup> investigated that CALL has potential to improve speaking ability. Nasir et al.<sup>[15]</sup> further strengthens the idea that CALL tools offer a variety of learning approaches that help improve speaking skills, particularly pronunciation skills. According to Gómez González et al.<sup>[26]</sup>, phonetic competency is crucial, but difficult to understand phonetic perceptions and transcriptions. CALL software offers massive language programs for language learners and teachers making it easy to understand the transcription and articulation. These CALL tools are beneficial for enhancing speaking skills. This is a sterling source of access to reading magazines, books, reference works and full-text newspapers. CALL tools can trace the problems that teachers or students face and provide overwhelming answers and effective methods for novice users. There are many apps on internet like Firefox, Search Engines, Google Chrome, Directories and online encyclopedias that are helpful to search the required information students want to search, whether it is particularly related to English language software or CAPT and CALL. According to Bogach et al.<sup>[27]</sup> supra-segments are not easy to learn through dictionaries. Feedback in the sense of pronunciation assessment is required for both teachers and students. Wrong rhythmic pattern and improper intonation are no longer blindly accepted. Hence, students can only be trained through CAPT tools.

### **CALL as Interdisciplinary Approach**

Levey<sup>[18]</sup> emphasized that CALL is also an interdisciplinary approach. It includes various theories, disciplines and different areas that can be classified into five main

types: artificial intelligence, psychology, computational linguistics, advanced instructional digital design and inference of humans in computer studies. Chen et al. <sup>[28]</sup> also agreed that CALL is an interdisciplinary approach. The study reviewed the 1,295 articles and results declared that CALL, Language Learning and Technology and ReCALL are helpful for language learning.

Ghounane and Rabahi <sup>[29]</sup> conducted research in Saida University, Algeria also emphasized that Computer Assisted Pronunciation Training (CAPT) tools can change the students' negative mind about pronunciation learning. New advanced technology helps the students listen to native speakers, try to pronounce as it is, record their own sounds, compare their sounds with native's sounds and then correct their own pronunciation. The study also pointed out that the students who use CAPT tools can learn quickly how to pronounce consonants and vowels sounds. Lee <sup>[30]</sup> is also opined that CALL and CAPT pronunciation materials are a better way of learning; they encourage students and produce an interactive environment.

An advanced discipline of CALL is Intelligent Computer-Assisted Language Learning (ICALL). Newvine <sup>[31]</sup> conducted his study in Japan and explored that the advance field of CALL is ICALL. The use of ICALL tools is beneficial in EFL classrooms. The elegance of ICALL is to understand the context and response according to that. Teachers and learners can change the activities according to their level and can receive feedback immediately. Yu and Gaspar <sup>[32]</sup> stated that ICALL tools make Portuguese as foreign language learners (PFL) autonomous. It proposes self-regulated language learning materials that PFL learners can use in and out of the classrooms according to their convenience. The findings revealed that ICALL tools are also beneficial for other foreign language learning. Chen et al. <sup>[33]</sup> also considered that ICALL tools are beneficial for second language learners. ICALL tools have the potential to solve linguistics complexities. The findings of this experimental study reported that using ICALL tools for regular language learning supports all types of second language learners.

According to Namaziandost and Rezai <sup>[34]</sup>, ICALL is a transformative source for ESL learners. The growing prominence of ICALL plays a pivotal role in language learning. The results declared that the multifaceted ap-

proach ICALL is beneficial for Iranian ESL learners and makes them autonomous. The study explains that ICALL tools are also beneficial for policymakers and educators to add ICALL applications to curriculum. Patty <sup>[35]</sup> also confirmed the evolution of ICALL for language learning. It encompasses CALL and artificial intelligence and offers applications for all types of learning, formal and informal, and language-learning environments. Ardini et al. <sup>[36]</sup> mentioned in their research the advancement of technology with the collaboration of artificial intelligence and mobile applications to enhance pronunciation skills. The results demonstrated superior performance through CALL speech recognition tools. Dennis <sup>[37]</sup> stated in his study that CALL and AI speech recognition tools for improving English pronunciation and speaking instructions prove notable benefits.

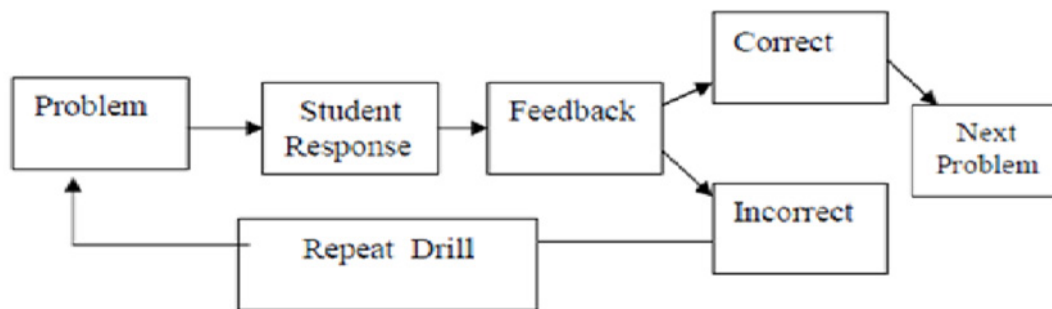
Pinto-Llorente <sup>[38]</sup> advocated that in this digital world, to acquire English pronunciation through computer programs is the most important tool. Kobilova <sup>[39]</sup> asserted that imitation is also the best therapy for refining pronunciation in language teaching. ESL learners tend to imitate whatever the teachers pronounce. The imitation method is also known as 'drill and practice'. According to Chang <sup>[40]</sup>, CALL and CAPT applications offer many platforms for drilling and practicing activities for language learners. In these activities, learners first listen, watch the sound pattern through machines, and then try to repeat it. The advanced technology CALL and CAPT applications pronounce accurate sounds just like native speakers. This is an absolute way to give a real chance to the ESL learners to speak like native speakers <sup>[41,42]</sup>.

Mohammed <sup>[43]</sup> investigated in his study that the language lab plays a crucial role in improving pronunciation skills among Saudi students. A multimedia network system is also known as Language Media Laboratory (LML). The findings of the study verified some advantages for learning skills of the foreign language pronunciation. For example, Computer-Assisted Instruction (CAI) is used as a sound analyzer for improving pronunciation. The attractive classrooms with loaded computer gadgets can be utilized for improving pronunciation. These gadgets permit the students to use computer-assisted instruction (CAI) applications and get an opportunity to talk with native speakers. In this environment, learners can communicate and share

their ideas to the foreigners by using computers. These advanced gadgets offer copious varieties of attractive methods for language coaching, instructing and pronunciation training. In these modern technologies, AV aids are another way of delivering pronunciation materials through visuals and vocabulary, e.g., clarification, imagery, maps, figures and vigorous graphics as dynamic videos <sup>[44]</sup>. The researcher further debated that our brain has the power to work through the CALL application for learning a language.

Drill and practice activities are helpful to sharpen the mind for speaking practices.

**Figure 1** shows a procedure that helps the teacher find the solutions to the problems of language learners. Hence, a teacher by following CAI designs can achieve better results and high-quality improvement in learner's English pronunciation. This can be the reason for positive attitudes in language learning.



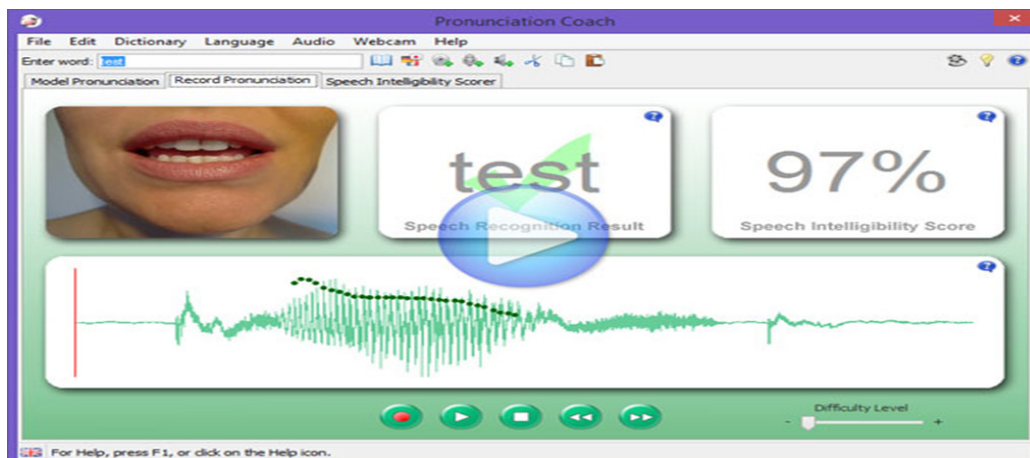
**Figure 1.** The basic characteristics and design of 'drill and practice' activity.

The goal of this study is to make pronunciation easier for the listener and the receiver. English language requires a lot of movement in the mouth. Mouth, tongue, lips, teeth and throat need time to get into the correct position. CALL software like 'Pronunciation Coach' and 'MyET' are very helpful, as they give learners time to set their vocal organs while uttering words, and after utterance, they show the result at which vocal organ positions are incorrect and need improvement.

Pronunciation Coach is a new, interesting and easy to use application that demonstrates the learner's correct

pronunciation and sounds through animated images. It displays an animated image that shows how pronunciation coach software helps learners to improve pronunciation skills, particularly the sound patterns.

**Figure 2** shows the scores in percentage. The screenshot, taken from the application, is used to illustrate the process. It also tells how to combine these sounds to pronounce any word or sentence. It also records learners' pronunciation and gives them a chance to compare their sound to an example.

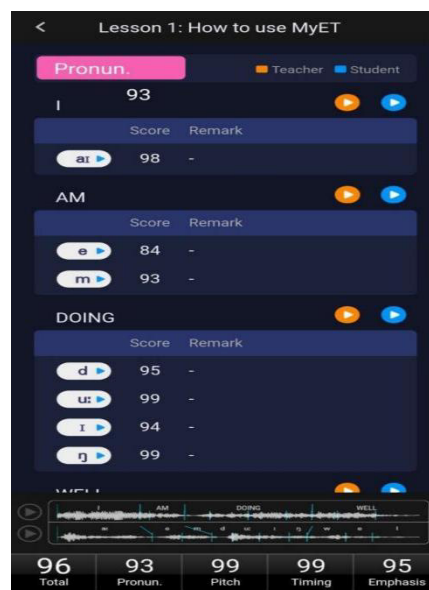


**Figure 2.** Interface Design of the Correction through Pronunciation Coach.

MyET is like a personal tutor that can help the learner learn English pronunciation. It is a unique and award-winning technology. It can analyze learners' speech on pronunciation pitch, timing, and emphasis and even pinpoint the problems to individual sound patterns. Almasifar and Heidari <sup>[45]</sup> explored the effect of CAPT on speaking skills. The study focused on suprasegmental features like intonation, stress and rhythm. The findings revealed that CAPT tools like MyET play a crucial role in improving speaking skills and reducing speaking anxiety among students.

**Figure 3** is a screenshot taken from the MyET application, showing a representation of a scored list. The learner must keep in mind some points that during the record-

ing, not only the researchers but also computer software analyzes the learners' voice and talk about the learner's pronunciation, pitch, emphasis and overall score. However, Shamsi and Bozorgian <sup>[46]</sup> highlighted in their study that suprasegmental features are difficult for Iranian learners. The speech pattern of the learner's mother tongue Farsi and target language English is quite different. The CAPT tool MyET was used during the experimental study to improve learners' speaking skills. The results also showed positive perceptions of CAPT tool MyET. The findings declared a significant improvement in learners' speaking skills, particularly their improvement in pronunciation skills was observed.



**Figure 3.** User Interface Display of Voice Recording.

Several studies recommend that the use of CALL applications and CMC in English language classroom are always beneficial. Du <sup>[47]</sup> pointed out that the design of multimedia is convenient when technology is beneficial and gives a progressive effect on learning. Video clips and emojis are also used to provide visual material. Baskota and Poudel <sup>[48]</sup> investigated that CMC and Artificial Intelligence (AI) have a significant impact on ESL learners in Nepal. CMC and AI technology have potential to improve learners' communication skills and increase learners' interest in using these technologies for language learning in and out of the classroom. Hsu <sup>[49]</sup> and Guskarska <sup>[50]</sup> reported that ESL learners perceived CALL and CAPT tools as effective in enhancing pronunciation skills when examined

through the TAM framework. However, their study confirmed the perceived usefulness and ease of use of such tools, it primarily emphasized learners' perceptions rather than their actual performance. Aufa <sup>[51]</sup> evaluated using the TAM framework to measure EFL students' perceptions of speaking skills through technology. Their studies leave the gap that present study seeks to address by combining both pre- and post-test and TAM2 -based perceptions.

### 3. Research Methodology

In this study, the researcher used a quantitative research method. The aim of this research paper is to investigate the impact of modern technology CALL on learners'

English Language pronunciation skills and to examine their perceptions of CALL pronunciation tools. The study adopted quasi-experimental pre and posttest alongside survey based quantitative approach grounded in the Technology Acceptance Model 2 (TAM2). The pre and posttest design assessed both segmental and suprasegmental features, enabling evaluation of changes in ESL learners' pronunciation proficiency.

TAM 2 (Technology Acceptance Model) was presented by Venkatesh and Davis <sup>[52]</sup>. This model is intended as one of the most widely accepted models to recognize the causes for acceptance of numerous advanced technologies in different contexts and to check the impact of technology on its users. TAM 2 follows the theoretical rules of the most fundamental and influential theory of behavior, which is aimed at the Theory of Reasoned Action (TRA) <sup>[53]</sup>. TAM 2 questionnaire captured the ESL learners' perceptions regarding usefulness and ease of use, adequacy and tone recognition through CALL tools. For the data collection, the researcher modified a questionnaire framed by Itayem <sup>[54]</sup>. The goal of this model is to provide a base to investigate the impact of externalities, impulsive variables on attitudes, internal faith and objectives.

### 3.1. Sample Population and Sampling Techniques

To check the adequacy of CALL pronunciation applications on learners' proficiency level, the researcher has selected the Institute of Southern Punjab, Main campus, which is situated in the Multan city, Pakistan, as a site for the sample population. The institute is actively integrated with technology for language learning. The single institution ensures contextual consistency, control for extraneous variables and allows for streamlined coordination for data collection both pre and posttest and survey.

Convenience sampling was used to select students from the department of English in the Institute of Southern Punjab, Multan, Pakistan. A total of 119 participants were selected using convenience sampling. It was deemed appropriate given the accessibility of participants and exploratory nature of examining the impact of CALL pronunciation tools. All participants are ESL learners and enrolled in at least one advanced level English-speaking pronunciation course. All students have equal access of internet, and they are familiar of computer and capable of running CALL

tools.

### 3.2. Research Instruments and Data Collection

Data was collected through pre and post-test and questionnaires. The pre and post-test were conducted under standardized conditions. Same rubric scoring was used, and the trained raters ensure the reliability and validity in the assessments for both segmental and suprasegmental features. Three CALL pronunciation tools MyET, SpeakPipe and Pronunciation Coach were used during intervention. After the pre and posttest, questionnaires were distributed to the students. The researcher administered the students to fill in the questionnaire. A five-digit Likert scale questionnaire of CALL speaking materials to communicate in a second language scale adapted by Itayem (2014) was used for measuring students' speaking proficiency to communicate in a second language inside the classroom.

### 3.3. Learners as a Research Population

The population setting was held in Pakistan at the ISP Main campus. The institute has its own speech laboratory, used as a research site. The speech lab is used with the approval of the Head of the English Department. The speech laboratory has more than 70 computers with some other necessary gadgets. Pre-test was conducted to check the learners' proficiency level. To conduct research, the researcher used three pronunciation-based computer applications (MyET, Pronunciation Coach and SpeakPipe) for the students to investigate the impact of these applications. The researcher used CAPT (Computer Assisted Pronunciation Test), CAI (Computer Assisted Instruction), ASR (Automatic Speech Recognition), pronunciation Coach, SpeakPipe and MyET with its recording function and some other programs.

The additional pronunciation classes were also organized for the ESL learners at the undergraduate level. Learners were requested to join these classes for the research after the permission of the Head of the Department (HOD). The researcher chose 119 ESL learners at the undergraduate level who participated in the research as the research population. They practiced these applications in the language classroom. After eight weeks of teaching English pronunciation by CALL and CAPT tools, post-test was conducted, their pronunciation record was sent to an

instructor for analysis. After the post-test, to investigate the learners' perceptions, the prepared questionnaire was given to the learners. An instructor, working as a senior lecturer at Government Emerson College in Multan, was hired to analyze the data. He is highly qualified and has more than 25 years of teaching experience in college.

## 4. Analysis

In the next step, the collected data was put into SPSS (version 21) for statistical analysis. In this regard, Cronbach's alpha, Bartlett and KMO Tests were used.

**Table 1** contains details of the descriptive statistical values of the variables. The results of pre and post-test show high internal consistency. Cronbach's alpha is 0.86 and 0.87. TAM2 questionnaire shows the range of 0.83–0.91 and this is acceptable reliability and indicates high internal consistency. Reliability and sampling adequacy is acceptable. The KMO value is 0.77, 0.78 and 0.77 indicate that the sample size is adequate for the pre and posttest and factor analysis. The Bartlett's test is also significant and KMO is acceptable.

To examine the impact of CALL and CAPT pronun-

ciation tools ESL learners' pre and post-test scores were measured. The normality of scores were checked using descriptive statics.

**Table 2** presents the mean , standard deviation and difference between pre and post-test scores at segmental accuracy, word stress, intonation, fluency, and comprehension level. The overall mean is 2.38 SD is 0.49 in pre-test and posttests show mean is 3.08 and SD is 0.43. The difference is 0.70. Here it is clear sufficient difference between pre and post-test scores. It indicates CALL tools have significant positive impact on learners' pronunciation skills.

**Table 3** shows the score of paired sample t-test that was conducted to compare the means of pre and post-test scores. The results indicate the significant difference between pre- and post-test scores. All dimensions of pronunciation segmental accuracy, word stress, intonation, fluency and comprehensibility present significant improvement. The results of Cohen's d also show that effect sizes are large. Overall, the results indicate substantial positive impact on ESL learners' pronunciation skills.

**Table 1.** Internal Reliability of the Scale.

| Instrument                     | Number of Items | Cronbach's alpha | KMO  | Bartlett's Test |
|--------------------------------|-----------------|------------------|------|-----------------|
| Pre-test Pronunciation Skills  | 25              | 0.86             | 0.77 | $P < 0.001$     |
| Post-test Pronunciation Skills | 25              | 0.87             | 0.78 | $P < 0.001$     |
| TAM2 Questionnaire             | 20              | 0.83–0.91        | 0.77 | $P < 0.001$     |

**Table 2.** Descriptive statistics of pre- and post-test scores.

| Dimension          | Pre-test M (SD) | Post-test M (SD) | Difference |
|--------------------|-----------------|------------------|------------|
| Segmental Accuracy | 2.42 (0.53)     | 3.13 (0.44)      | 0.71       |
| Word Stress        | 2.34 (0.58)     | 3.06 (0.49)      | 0.72       |
| Intonation         | 2.29 (0.55)     | 2.97 (0.46)      | 0.68       |
| Fluency            | 2.47 (0.57)     | 3.09 (0.47)      | 0.62       |
| Comprehensibility  | 2.38 (0.56)     | 3.15 (0.43)      | 0.76       |
| Overall Score      | 2.38 (0.49)     | 3.08 (0.43)      | 0.70       |

**Table 3.** Inferential Statistics: Paired Sample Test.

| Dimension          | Pre-test M (SD) | Post-test M (SD) | Difference | t     | p      | Cohen's d |
|--------------------|-----------------|------------------|------------|-------|--------|-----------|
| Segmental Accuracy | 2.42 (0.53)     | 3.13 (0.44)      | 0.71       | 15.76 | <0.001 | 1.46      |
| Word Stress        | 2.34 (0.58)     | 3.06 (0.49)      | 0.72       | 14.52 | <0.001 | 1.33      |
| Intonation         | 2.29 (0.55)     | 2.97 (0.46)      | 0.68       | 14.53 | <0.001 | 1.33      |
| Fluency            | 2.47 (0.57)     | 3.09 (0.47)      | 0.62       | 12.84 | <0.001 | 1.19      |
| Comprehensibility  | 2.38 (0.56)     | 3.15 (0.43)      | 0.76       | 16.54 | <0.001 | 1.53      |
| Overall Score      | 2.38 (0.49)     | 3.08 (0.43)      | 0.70       | 15.48 | <0.001 | 1.37      |

### Analysis of Learners' Perceptions

The researcher assisted the expert in developing a questionnaire for this purpose. The questionnaire consists of three parts. The first part is related to their demographic age, gender and mother tongue. The second part explored participants' pronunciation experience. The data is attained through this questionnaire connected to the CALL and CAPT pronunciation applications. The frequencies of the statistics that are involved in the instruments are meticulously analyzed one by one. The third part measured the perceptions of CALL pronunciation tools. Question number 2 and 3 of the TAM2 section assessed the perceived

adequacy and recognizable tone of the CALL and CAPT tools, respectively. The overall results of statistical analyses of the questionnaire are given in the form of a table.

**Table 4** presents the demographic analysis. The ages of the learners are between 15 to 36. 54.6% of learners' age is between 21 to 25. There is only one learner whose age is 36. The mother tongue of learners are Urdu, Punjabi, Saraiki and other languages. Saraiki and Urdu languages are widely spoken by learners.

**Table 5** illustrates the gender of the respondents. Total participants are 119. 45 are male participants and 74 are female participants.

**Table 4.** Descriptive Analysis of Demographics.

| Name          | Items    | Frequency | Percentage |
|---------------|----------|-----------|------------|
| Age           | 15–20    | 16        | 13.4%      |
|               | 21–25    | 65        | 54.6%      |
|               | 26–30    | 31        | 26.1%      |
|               | 31–35    | 6         | 5.0%       |
|               | 36–Above | 1         | 0.8%       |
| Mother Tongue | URDU     | 25        | 21.0%      |
|               | PUNJABI  | 43        | 36.1%      |
|               | SARAIKI  | 48        | 40.3%      |
|               | OTHERS   | 3         | 2.5%       |

**Table 5.** Gender of Learners.

| Gender | No. of Learners |
|--------|-----------------|
| Male   | 45              |
| Female | 74              |

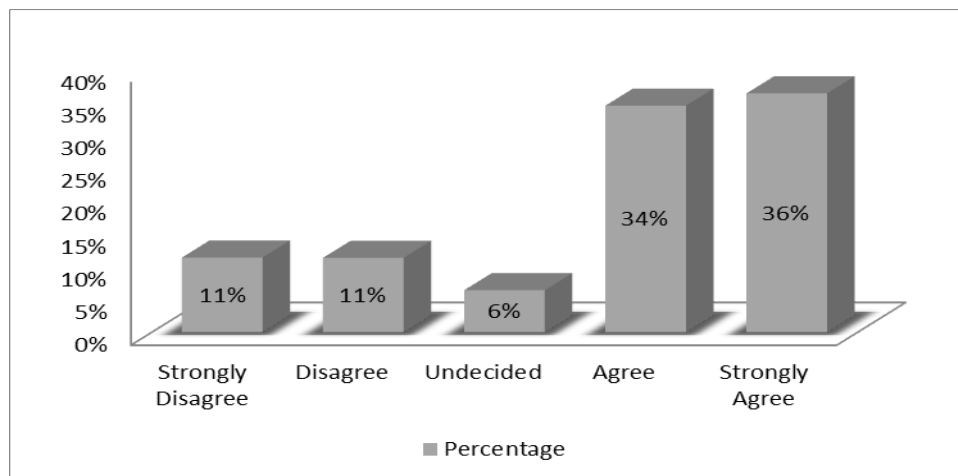
**Table 6** shows 11% of participants strongly disagree with CALL pronunciation tools. 11% of participants disagree with CALL tools. 6% of participants were unable to take any decision. 34% of participants agree with CALL tools and showed positive perceptions. 36% of learners strongly agree with the beneficiary of CALL tools and have positive perceptions.

### Graph:

**Figure 4** is a graphic representation of overall results. The graph illustrates the learners' response after using the CALL tools to enhance their pronunciation skills. Learners' responses were recorded on a five-point Likert scale: Strongly Disagree, Disagree, Undecided, Agree and Strongly Agree.

**Table 6.** Details of learners' responses about CALL Pronunciation tools.

| Scale              | Responses | Percentage |
|--------------------|-----------|------------|
| Strongly Disagree  | 13        | 11%        |
| Disagree           | 13        | 11%        |
| Undecided          | 7         | 6%         |
| Agree              | 40        | 34%        |
| Strongly Agree     | 43        | 36%        |
| Total Observations | 119       | 100%       |



**Figure 4.** Overall Results.

The graphic description in **Figure 4** gives the accurate result of the responses of the respondents: 11% of respondents strongly disagreed about the benefits of CALL pronunciation materials and 11% of respondents also disagreed with this statement. Six percent (6%) of respondents could not make a decision. Thirty-four (34%) of respondents agree that learners' perceptions about CALL pronunciation materials are positive. Thirty-six (36%) of respondents strongly agreed with the statement.

The score of mean and standard deviation (SD) is analyzed through descriptive analysis and followed by the TAM2 model.

The scores of mean and standard deviations (SD) is analyzed through descriptive analysis and followed by the TAM2 model. The aim of **Table 7** is to present descriptive analysis to highlight learners' perceptions about CALL pronunciation applications through a TAM2-based questionnaire. The PU reflects language enhancement through technology-based learning, the mean is 4.11, and SD is

0.69. PEOU indicates the ease of CALL pronunciation tools, and results show that mean is 3.87 and SD is 0.73. The mean of subjective norms (SN) is 3.91 and SD is 0.69. Behavioral Intentions (BI) represents the learners' interest towards CALL pronunciation tools and results display the highest mean score 4.17 and SD is 0.62. It indicates strong intentions and indicators towards technology-based learning. The mean of the output quality (OQ) is 4.11 and SD is 0.61. Which is also high.

**Table 8** shows ESL learners' hold positive perceptions of CALL pronunciation tools. All TAM 2 factors are significantly higher than neutral points. Cohen's d that represents the effect size were in large range. It also shows learners' positive attitude towards CALL pronunciation tools. The overall results of PU, PEOU, SNBI and OQ indicate learners are interested in using them continuously. The findings reflects the high level of acceptance of CALL pronunciation tools.

**Table 7.** Descriptive Analysis.

| Factors                      | Mean | Standard Deviation (SD) |
|------------------------------|------|-------------------------|
| Perceived Usefulness (PU)    | 4.11 | 0.69                    |
| Perceived Ease of Use (PEOU) | 3.87 | 0.73                    |
| Subjective Norms (SN)        | 3.91 | 0.69                    |
| Behavioral Intentions (BI)   | 4.17 | 0.62                    |
| Output Quality (OQ)          | 4.11 | 0.61                    |

**Table 8.** One-Sample t-Test Results for Learners' Perceptions of CALL Tools.

| Factors                      | Mean | Standard Deviation (SD) | t     | p      | Cohen's d | Interpretation  |
|------------------------------|------|-------------------------|-------|--------|-----------|-----------------|
| Perceived Usefulness (PU)    | 4.11 | 0.69                    | 18.12 | <0.001 | 1.66      | Positive effect |
| Perceived Ease of Use (PEOU) | 3.87 | 0.73                    | 12.86 | <0.001 | 1.17      | Positive effect |
| Subjective Norms (SN)        | 3.91 | 0.69                    | 14.77 | <0.001 | 1.36      | Positive effect |
| Behavioral Intentions (BI)   | 4.17 | 0.62                    | 20.04 | <0.001 | 1.85      | Positive effect |
| Output Quality (OQ)          | 4.11 | 0.61                    | 20.00 | <0.001 | 1.84      | Positive effect |

## 5. Results and Discussion

The study aims to explore the impact of CALL and CAPT pronunciation tools on ESL learners' pronunciation skills. The analysis focused on pre and posttest scores and learners' response to the TAM2 questionnaire survey. The first question of the study is to investigate the impact of interactive Computer Assisted Language Learning (CALL) on English pronunciation skills at the undergraduate level students. The pre and post-test scores indicate significant improvement in ESL learners' segmental and suprasegmental proficiency. This study aligns with the previous studies of Nasir et al. <sup>[15]</sup>, Pothuri <sup>[9]</sup>, Saleh and Gilakjani <sup>[41]</sup>. The large effect size also suggests that treatment is not only significant but also practically meaningful for pronunciation skills. The results demonstrate the positive impact of CALL and CAPT applications on students' pronunciation. According to the results, most of the learners are willing to use this advanced technology. They also recommend using CALL materials to their siblings and relatives.

In addition to performance outcomes, TAM 2 analysis showed generally positive perceptions of CALL and CAPT tools. The first part of the survey analysis is related to demographic variables. The second part of the questionnaire is related to the students' pronunciation skills that they learn. Are they satisfied with their pronunciation skills or want to improve their pronunciation? The third part is about CALL and CAPT materials, followed by the TAM2 model. It was made to determine the impact of CALL software on their English pronunciation learning. The last part of the questionnaire is open-ended and asks students for additional information about the study.

The second question is to what extent are CALL Pronunciation tools and materials adequate in English language learning in Pakistan at the undergraduate level? The results received high agreement scores that indicate

that ESL learners felt CALL tools provide sufficient support for their learning needs. The results also demonstrate that CALL and CAPT pronunciation tools are adequate for ESL learners in Pakistan because these tools are easy to use and mostly applications are available free and offline. The findings revealed high level of perceived usefulness and ease of use suggesting that CALL tools are effective and well received by learners. Another important feature of such software is, they are not only limited to men but also equally used by female students. Students are in favor of using these CALL tools. The findings are similar to those of Aufa <sup>[51]</sup>, who examined the learners' perceptions of CALL speaking tools using the TAM model.

The third question is about how English tone can be more identifiable through Computer Assisted Language Learning (CALL) for ESL Learners. The analysis expresses that English sounds are more identifiable and helpful to overcome students' segmental and suprasegmental issues of English pronunciation. They can easily visualize the vocal organs' positions and speech patterns through CALL. The applications like 'Pronunciation Coach' and 'MyET' are beneficial to practice English tone with animated videos. These not only score their pronunciation results but also teach them how to correct the positions of their vocal organs and speech pattern through CALL tools. These findings are consistent with the previous research of Hsu <sup>[49]</sup> and Guskaroska <sup>[50]</sup>. Positive perceptions are reported by the ESL learners and suggesting that technology acceptance can enhance language learning.

However, some limitations are also acknowledged. First, the study is conducted on a single institution, reliance on a convenience sample which may restrict generalizability of the results. Second, TAM2 instrument was useful for gauging attitudes, self-reported methods inherently carry limitations between stated perceptions and re-

al-world practices. Third, the study measured short-term gains over an eight-week intervention; long-term retention of pronunciation gains remains unknown. Further research is recommended to broaden the scope by drawing multiple institutions, using mix-methods for deeper insights into the ESL learners' experiences.

Moreover, future research can compare the different types of CALL tools along with Intelligent Computer Assisted Language learning (ICALL) to identify specific pronunciation problems such as accuracy, stress and intonation. Longitudinal designs can also help to explore the retention of pronunciation proficiency and can enhance speaking skills in real-world settings. Finally, incorporating qualitative insights, such as motivational factors and attitudes may yield a more holistic picture of CALL tools towards language learning.

## 6. Conclusions

The results, attained after analyzing the above data, conclude that CAPT and CALL pronunciation applications are valuable and have positive impact on learners' pronunciation. CALL tools significantly enhance learners' segmental and suprasegmental accuracy as the scores of pre and posttest are evidence gains with the large sizes effect. Equally important, the TAM2 analysis further confirmed the effectiveness of CALL and CAPT tools with perceived usefulness, ease of use, subjective norms and output quality highly rated and reflect strong acceptance. Pre and post-test scores show significant impact on learners' pronunciation skills and seventy (70%) percent of the learners are confident that the CALL pronunciation applications must be allowed to use in their language classrooms. This methodology is quite interactive and interesting for all types of learners. Nowadays, it has become a dependable source of learning of English pronunciation as the native speakers do. The practice of language learning with these modern technologies, students can easily communicate in English language with accurate pronunciation and can enhance their confidence level. The feedback received from the learners at the end of the questionnaire is very optimistic regarding CALL applications.

The current research also shows that the CALL programs during practice allow the language learners to have

an experience of listening to their own voices during the practice of CALL materials. It is valuable for them to correct their English pronunciation with machines. Learners can also analogize their own voices and get a chance to imitate native speakers through 'My ET' and 'Pronunciation Coach' English teaching software. Through these CALL tools, the learners can also imitate and copy the native accent. It is described that the learners' feedback towards the CALL pronunciation materials in their learning English pronunciation is positive and confirmative. The study concludes that the use of CALL Pronunciation material is widely accepted by ESL learners. Learners show a very positive attitude towards the CALL Pronunciation Materials. However, the findings show that there were statistically significant differences among the perceptions of learners in the terms of their lives. Its use is not only limited to the male learners it is equally liked and used by the female learners who have access to it. They seem to be aware of the prospects of materials of CALL Pronunciation for their better learning of English Pronunciation, and they have a desire to use this to enhance their knowledge and information.

Implications for practice arise directly from these findings. Language teachers can integrate CALL and CAPT tools into their pedagogy. They can provide learners with multimodal feedback, opportunities for drilling practices out of the classrooms and make them autonomous learners. Curriculum designers can also consider CALL resources while designing language curriculum, particularly pronunciation modules. By incorporating accessible CALL platforms, institutions and policy makers can enrich their language programs.

Overall, this study is a useful addition in the existing realm of knowledge of English Pronunciation skills, and it also provides valuable insights into the educational use of technology for learning English pronunciation. To conclude, it is verified that CALL pronunciation material can improve the pronunciation of ESL learners. While summarizing this, it can be concluded in the light of what researchers describe about CAPT and CALL applications and what has been debated about some specific software that can not only support language learners but also ESL instructors in improving their English pronunciation.

## Author Contributions

S.I. conceptualized and drafted the original manuscript, conducted the analysis, and explored the impact of CALL Pronunciation tools on ESL learners. R.B.R. supervised the research, refined the theoretical framework, reviewed and edited the final manuscript for academic rigor and clarity. S.B. proofread and edited the manuscript. All authors approved the final version of the manuscript and made a meaningful contribution to the intellectual content of the study.

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## Institutional Review Board Statement

The study was conducted in single Institution (Institute of Southern Punjab, Multan, Pakistan) To conduct the experiment, permission is granted from the Head of the Department, Dr. Saleem Akhtar Khan.

## Informed Consent Statement

Informed consent was obtained from all the participants in the study.

## Data Availability Statement

The data supporting the findings of this study consists of participants' speech recordings and assessment scores. Due to privacy and ethical restrictions, these data cannot be made publicly available. However, anonymized summary data are available from the corresponding author upon reasonable request.

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## Conflicts of Interest

The authors declare no conflicts of interest.

## References

- [1] Mir, S.H., Afsar, A., 2024. The pronunciation constraints of syllable stress-coloration in Pakistani English. *Journal of Humanities, Social and Management Sciences*. 5(1), 21–35. DOI: <https://doi.org/10.47264/idea.jhsms/5.1.2>
- [2] Noor, A., Aslam, D.M.J.I.R., Abid, M.A., 2025. Exploring the impacts of English language dominance on the linguistic standing of Urdu and Punjabi languages. *Journal of Applied Linguistics and TESOL (JALT)*. 8(1), 484–499.
- [3] Ejaz, I., Abbas, G., Wasif, M., et al., 2025. Factors affecting the speaking skills of ESL students in rural areas of Pakistan. *Southern Journal of Arts & Humanities*. 3(1), 15–37.
- [4] Rahman, T., 2020. Pakistani English. In: *The Handbook of Asian Englishes*. John Wiley & Sons, Inc.: Hoboken, NJ, USA. pp. 279–296.
- [5] Urwat, M.S., Nadeem, M., Zafar, M.S., et al., 2022. Why do university students in Pakistan confront problems in spoken English. *Journal of Education, Society and Behavioural Science*. 35, 40–49. DOI: <https://doi.org/10.9734/jesbs/2022/v35i830447>
- [6] Pourhosein Gilakjani, A., Rahimy, R., 2020. Using computer-assisted pronunciation teaching (CAPT) in English pronunciation instruction: a study on the impact and the teacher's role. *Education and Information Technologies*. 25(2), 1129–1159.
- [7] Gilakjani, A.P., Sabouri, N.B., 2016. Learners' listening comprehension difficulties in English language learning: a literature review. *English Language Teaching*. 9(6), 123–133.
- [8] Zhang, F., Yin, P., 2009. A study of pronunciation problems of English learners in China. *Asian Social Science*. 5(6), 141–146.
- [9] Pothuri, S.B., 2025. *Computer-Assisted Language Learning in Enhancing Speaking Skills*. Elsevier: Amsterdam, Netherlands.
- [10] Rogerson-Revell, P.M., 2021. Computer-assisted pronunciation training (CAPT): current issues and future directions. *Relc Journal*. 52(1), 189–205.
- [11] Talpur, N., Kalwar, T., Talpur, M.J., 2021. Comput-

- er-assisted language learning in Pakistani context during COVID-19 pandemic. *REiLA: Journal of Research and Innovation in Language*. 3(3), 210–225.
- [12] Jawaid, A., Batool, M., Arshad, W., et al., 2024. English language pronunciation challenges faced by tertiary students. *Contemporary Journal of Social Science Review*. 2(4), 2104–2111.
- [13] Memon, A., Siddiqui, N., Jat, A.R.L., 2024. Developing English language productive skills through task-based language learning model at tertiary level education in Karachi. *International Journal of Academic Research for Humanities*. 4(2), 37–48.
- [14] Li, Y., 2024. The role of L1-dialect in L2 production: acoustic measures on Xining and Leshan dialect speakers' production of English vowels. *Journal of Second Language Pronunciation*. 10(2), 232–257.
- [15] Nasir, M., Nazar, F., Abbas, M.K., et al., 2023. Enhancing pronunciation skills of intermediate students through computer-assisted language learning (CALL). *Al-Qanṭara*. 9(3), 142–160.
- [16] Zhang, G., 2024. Enhancing English pronunciation assessment in computer-assisted language learning for college students. *Journal of Combinatorial Mathematics and Combinatorial Computing*. 120, 275–283.
- [17] Fazal, N., Tahir, M.S., Chaudhary, M., et al., 2024. Effectiveness of AI integration into computer-assisted language learning (CALL) on student writing skills based on gender. *Pakistan Journal of Humanities and Social Sciences*. 12(1), 224–230.
- [18] Levy, M., 1997. *Computer-Assisted Language Learning: Context and Conceptualization*. Oxford University Press: Oxford, UK.
- [19] Chapelle, C.A., 2010. The spread of computer-assisted language learning. *Language Teaching*. 43(1), 66–74.
- [20] Khan, A., 2024. The attitude of Pakistani undergraduates towards speaking English. *International Journal of Social Science & Entrepreneurship*. 4(2), 165–179.
- [21] Javed, F., 2017. A historical perspective of Pakistan's language in education policy. *Language in India*. 17(8), 45–55.
- [22] Yolchiyeva, M., 2024. The importance of pronunciation in learning foreign language and prospects of improving pronunciation competence. *Modern Science and Research*. 3(5), 343–347.
- [23] AbuSeileek, A., 2007. Computer-assisted pronunciation instruction as an effective means for teaching stress. *The JALT CALL Journal*. 3(1–2), 3–24.
- [24] Mahdi, H.S., Al Khateeb, A.A., 2019. The effectiveness of computer-assisted pronunciation training: a meta-analysis. *Review of Education*. 7(3), 733–753.
- [25] Ratnaningsih, D., Purba, D., Wiratno, D., et al., 2019. The influence of computer-assisted language learning (CALL) to improve English speaking skills. In: *English linguistics, literature, and language teaching in a changing era*. Routledge: London, UK. pp. 144–149.
- [26] Gómez González, M.D., Lago Ferreiro, A., 2024. Computer-assisted pronunciation training (CAPT): an empirical evaluation of EPSS multimedia lab. *Language Learning & Technology*. 28(1), 1–44.
- [27] Bogach, N., Boitsova, E., Chernonog, S., et al., 2021. Speech processing for language learning: a practical approach to computer-assisted pronunciation teaching. *Electronics*. 10(3), 235.
- [28] Chen, X., Zou, D., Xie, H.R., et al., 2021. Twenty-five years of computer-assisted language learning: a topic modeling analysis. *Language Learning & Technology*. 25(3), 151–185.
- [29] Ghounane, N., Rabahi, H., 2021. The use of computer-assisted pronunciation training in teaching English pronunciation for first-year EFL students at Saida University. *International Journal of Applied Linguistics and English Literature*. 10(6), 76–83.
- [30] Lee, S.T., 2008. *Teaching pronunciation of English using computer-assisted learning software: an action research study in an institute of Taiwan* [Doctoral dissertation]. Australian Catholic University: Melbourne, Australia.
- [31] Newvine, U., 2023. *Intelligent Computer-Assisted Language Learning in the English as a Foreign Language Classroom*. University of California, Riverside: Riverside, CA, USA.
- [32] Yu, X., Gaspar, C., 2022. A tecnologia capacita: uma investigação do ICALL no desenho de materiais de aprendizagem autorregulada. *Diacrítica*. 36(2), 232.
- [33] Chen, X., Meurers, D., Rebuschat, P., 2022. ICALL offering individually adaptive input: Effects of complex input on L2 development. *Language Learning & Technology*. 26(1), 1–21. DOI: <https://doi.org/10.64152/10125/73496>
- [34] Namaziandost, E., Rezai, A., 2024. Interplay of academic emotion regulation, academic mindfulness, L2 learning experience, academic motivation, and learner autonomy in intelligent computer-assisted language learning: a study of EFL learners. *System*. 125, 103419.
- [35] Patty, J., 2024. The use of AI in language learning: what you need to know. *Jurnal Review Pendidikan dan Pengajaran (JRPP)*. 7(1), 642–654.
- [36] Ardini, S.N., Sunarya, S., Latifah, K., 2024. Development of mobile application through the concept of artificial intelligence to enhance pronunciation skill in

- EFL. *KnE Social Sciences*. 56–66.
- [37] Dennis, N.K., 2024. Using AI-powered speech recognition technology to improve English pronunciation and speaking skills. *IAFOR Journal of Education*. 12(2), 107–126.
- [38] Pinto-Llorente, A.M., 2022. Assessing the impact of a digital ecosystem to learn English pronunciation. In: *Research Anthology on Applied Linguistics and Language Practices*. IGI Global Scientific Publishing: Hershey, PA, USA. pp. 747–767.
- [39] Kobilova, N.R., 2024. The importance of imitation technique in teaching English pronunciation. *Academic Research in Educational Sciences*. 5(CSPU Conference 1), 728–732.
- [40] Chang, C.Y., 2018. The effects of communicative framework instruction using computer-assisted pronunciation training (CAPT) on English pronunciation ability of Chinese undergraduate students. *An Online Journal of Education*, 14(1), OJED1401002.
- [41] Saleh, A.J., Gilakjani, A.P., 2021. Investigating the impact of computer-assisted pronunciation teaching (CAPT) on improving intermediate EFL learners' pronunciation ability. *Education and Information Technologies*. 26, 489–515.
- [42] Bergdahl, N., 2025. Second language learning designs in online adult education. *Computer Assisted Language Learning*. 38(1–2), 1–29.
- [43] Mohammed, A., 2017. The role of language laboratory in English language learning settings. *English Language Teaching*. 10(2), 86–93.
- [44] Mayer, R.E., Lee, H., Peebles, A., 2014. Multimedia learning in a second language: a cognitive load perspective. *Applied Cognitive Psychology*. 28(5), 653–660.
- [45] Almasifar, N., Heidari, F., 2024. The effect of computer-assisted pronunciation training on EFL learners' use of suprasegmental features and foreign language speaking anxiety. *English Teaching & Learning*. 48(4), 625–648.
- [46] Shamsi, E., Bozorgian, H., 2023. The pedagogy for teaching suprasegmental features. *Journal of Second Language Pronunciation*. 9(3), 312–322.
- [47] Du, Y., 2024. The impact of emojis on verbal irony comprehension in computer-mediated communication: a cross-cultural study. *International Journal of Human-Computer Interaction*. 41(8), 4979–4986. DOI: <https://doi.org/10.1080/10447318.2024.2356398>
- [48] Baskota, P., Poudel, T., 2024. Artificial intelligence and computer-mediated communication: the text analysis and undergrad's class observation. *Discover Education*. 3(1), 131.
- [49] Hsu, H.W., 2024. An examination of automatic speech recognition (ASR)-based computer-assisted pronunciation training (CAPT) for less-proficient EFL students using the technology acceptance model. *International Journal of Technology in Education*. 7(3), 456–473.
- [50] Guskaroska, A., 2024. Exploring technology acceptance of ASR for pronunciation learning [Doctoral dissertation]. Iowa State University: Ames, IA, USA.
- [51] Aufa, A.F., 2025. Evaluating Busuu.com application for speaking skills through Technology Acceptance Model (TAM): EFL student's perception. *IDEAS: Journal on English Language Teaching and Learning, Linguistics and Literature*. 13(1), 305–332.
- [52] Venkatesh, V., Davis, F.D., 2000. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*. 46(2), 186–204.
- [53] Fishbein, M., Ajzen, I., 1975. *Belief, attitude, intention and behavior: an introduction to theory and research*. Addison-Wesley: Reading, MA, USA.
- [54] Itayem, G., 2014. Using the iPad in language learning: perceptions of college students [Master's dissertation]. University of Toledo: Toledo, OH, USA.