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Enhancing ESL Learners' Speaking Proficiency through Adaptive ICALL Tools: A Mixed-Methods Study

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ABSTRACT

Adaptive Intelligent Computer-Assisted Language Learning (ICALL) technologies are reshaping the development of speaking skills among ESL learners. The goal of the study is to investigate the impact of the ICALL adaptive system on learners' speaking proficiency. This study also depicts the learners' personal ICALL experiences. An in-depth analysis of contemporary literature is conducted to uncover the recent development and trends in ICALL for enhancing speaking skills. Concerning ICALL, the study also investigates the role of artificial intelligence (AI), natural language processing (NLP) and intelligent tutoring systems (ITS) in improving speaking skills. A mixed-methods sequential explanatory research design is employed. The quasi-experimental method is used for the first part. The 110 participants are divided into two groups as control and experimental group. The three ICALL applications MyET, Duolingo and ELSA are used to improve learners' speaking skills during the intervention. The intervention is only provided to the experimental group. The second part consists of semi-structured interviews. The seven participants who participated in the intervention were selected for

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interviews. Quantitative data are analyzed using SPSS and qualitative data are analyzed through thematic analysis following Grbich's approach. Findings reveal that ICALL tools contributed to notable gains in speaking accuracy and fluency after consistent use. ESL learners also reported increased confidence and expressed favorable perceptions regarding the ICALL tools' ease of use, instant feedback features and autonomous learning. Based on the posttest, which shows an 86.56% average improvement in speaking proficiency scores, it is strongly recommended that the ICALL tools be adopted as core approach to support speaking skills development.

Keywords: AI Speaking Tools; ICALL Tools; Natural Language Processing (NLP); Intelligent Tutoring Systems (ITS); Speaking Proficiency; Learning Opportunities

1. Introduction

Intelligent Computer-Assisted Language Learning (ICALL) has gained significant popularity in language learning over the past few decades. These revolutionary AI-powered tools offer adaptive platforms for language learners to enhance their speaking skills. Weng and Chiu^[1] commented in their study that ICALL facilitates supportive learning environments for multiple language learning tasks for ESL learners. ICALL can serve as a bridge between learners' understanding and their language learning approaches. The evolution of these AI tools facilitates language learning and fosters learners' interest in language development^[2,3]. The advancement of ICALL tools has profoundly influenced ESL learners in language learning. It reduces language anxiety and motivates learners to engage in language learning. Additionally, ICALL promotes a shift toward individualized learning and automated evaluation^[4].

Speaking skills are a vital component of a language and remain a significant hurdle for second language learners and undermine their confidence to communicate in English with natives and non-native speakers. Numerous studies emphasize that speaking skills pose a persistent challenge for ESL learners, with pronunciation difficulties and barriers created by traditional teaching strategies further undermine speaking fluency^[5-8]. Moreover, ESL learners often face problems in enhancing their speaking proficiency, such as a lack of communication practice during class, negative peer evaluation, and reluctance in verbal engagement^[9]. To confront these issues, the ICALL platform provides adaptive learning resources for improving speaking skills. According to Chaisiri^[10], ICALL is a transformative approach, and AI-mediated resources enhancing speaking skills and increase ESL learners' willingness to use this advanced technology.

The emergence of ICALL tools has paved the way for robotic teachers and artificial tutoring systems. Wang et al.^[11] highlighted that AI-based adaptive systems, based on personalized learning, provide instant feedback and increase engagement and language proficiency among language learners. Du and Daniel^[12] reviewed twenty-four research papers and proposed a comprehensive overview of learners' perceptions of AI chatbots. The study identified that AI chatbots enhance confidence, reduce speaking anxiety and improve pronunciation proficiency. The engaging features and adaptive system enhance its effectiveness for language learning. The study also emphasizes that there is a lot of space for using AI tools to improve speaking skills. To put it differently, another study was conducted by Celik et al.^[13] with ESL learners in Erbil, Iraq, to improve their speaking skills. Findings prove that an AI chatbot, such as ChatGPT is useful in enhancing learners' speaking skills and harmoniously involves ESL learners in their classrooms.

The effectiveness of ICALL has recently been demonstrated. Choi^[14] stated that ICALL is an advanced field of Artificial Intelligence for language learning. Findings of the study declared that ICALL tools have the potential to enhance Korean ESL learners' language proficiency. ICALL tools offer process-oriented feedback that is supportive of fostering their grammar skills. Another study conducted by Kim^[15] investigated Korean ESL learners on technology-based learning within the broader framework ICALL. The study demonstrated that AI-based constructive feedback nurtures a language learning environment in the absence of a language teacher. Liu^[16] extrapolated in his research that ICALL tools allow learners to practice speaking English with AI tools, and it has the potential to arrange interactive exercises, provide immediate feedback, and improve pronunciation skills. This study goes beyond previous research

by not only investigating the advancement of ICALL tools for improving speaking proficiency but also by exploring how personalized and adaptive learning experiences within ICALL systems influence ESL learners' performance in real-world settings. This remains a less explored area that has yet to be fully examined.

In Pakistan, conventional methods are used for language learning. ESL learners use their mother tongue in classrooms and out of the classroom for communication. Yasmeen et al.^[17] argued that speaking is the most neglected skill in Pakistan. Many learners use diverse methods to improve their speaking skills, but they face a lack of personalized learning experience. Zou et al.^[18] pointed out in their research that in Pakistan, students at the university level prefer AI tools for learning speaking skills; however, they do not have sufficient exposure to AI-speaking tools. The given reference indicates that in Pakistan, there is a need for personalized learning for improving speaking proficiency. Moulieswaran and Kumar^[19] also investigated that lack of knowledge of AI-powered language apps can cause hurdles for language learners to utilize these applications' benefits. Minotta et al.^[20] highlighted that AI-powered speaking tools have the potential to enhance speaking skills. Modern ICALL speaking tools go beyond the static content that offers dynamic personalized language learning experiences for improving speaking skills. Shahid et al.^[21] agreed in their study that AI-powered language learning tools are beneficial for Pakistani ESL learners. Despite the growing adoption of ICALL tools for language learning, comparatively limited research has examined their impact on speaking proficiency. The current study addresses the gap by evaluating the usefulness of ICALL tools on speaking skills among Pakistani ESL learners.

Research Questions

The purpose of this study is to evaluate the performance of an Intelligent Computer Assisted Language Learning adapted system for enhancement of speaking proficiency and highlight learners' personalized learning experiences. The following research questions are formulated.

1. What is the impact of an Intelligent Computer Assisted Language Learning adapted system on the enhancement of speaking proficiency?

2. What are the students' personalized learning experiences with the ICALL adapted system for speaking proficiency?

2. Literature Review

ICALL is an advanced area within Artificial Intelligence and Computer-Assisted Language Learning (CALL). It has subfields Natural Language Processing (NLP), Intelligent Tutoring Systems (ITS), Robotic Language Learning (RALL), and Automatic Speech Recognition (ASR) for language learning. Maharrani et al.^[22] discovered in their study that the integration of ICALL offers a promising avenue for language enhancement. The potential of ICALL lies in providing an adaptive platform for learning language skills. ICALL uses AI applications and machine learning to prepare language learning tasks. These ICALL applications foster ESL learners' language competencies and guide their future language development.

Lu^[23] also agreed with the effectiveness of ICALL and NLP tools in language learning. The study disclosed that NLP and ICALL adaptive systems enhance learners' language proficiency in speech and recognition of sound patterns. The presented work also emphasized language accuracy, immediate feedback and the solution of language complexities through NLP technologies in ICALL. Son et al.^[24] classified computer-assisted language learning (CALL), natural language processing (NLP), automated writing evaluation (AWE), intelligent tutoring systems (ITS), automatic speech recognition (ASR) and chatbots as forms of AI-supported language learning. The study reported that these AI-based applications are accessible to language learners and teachers, but further exploration is required. The findings of the study ensure the effectiveness of AI-based language learning tools. Moreover, they provide a solid foundation for further language acquisition and learning.

Another study was conducted in Ireland by Ní Chiaráin and Ní Chasaide^[25] on ICALL tools. The research confirmed the adaptive systems of these new AI-based tools. Many applications can easily be downloaded on mobile phones, and learners can learn anywhere according to their comfort level. Its motivation is justified by ICALL-based language revitalization and deeper learners' feedback. Banaeian and Gilanlioglu^[26] are also in favor of advanced technology and

recommend its use for vocabulary learning. They believed Robot Assisted Language Learning (RALL) is a magnificent source to improve vocabulary. However, the scope of the study is limited, its potential is significant.

Chen et al.^[27] found that the ICALL adaptive platform supports learners individually and offers activities according to their needs. The study revealed that the ICALL system effectively manages the processes involved in language learning. It also demonstrated that second language practitioners agree that ICALL has potential for adaptation. The outcome of the study disclosed that the ESL learners were able to handle the writing complexity with the help of the ICALL adaptive system. A subsequent study by Ruiz et al.^[28] indicated that ICALL applications can contribute to a massive change for second language acquisition. It is a unique opportunity for language learners to leverage technology to overcome deficiencies in their target language. The study also highlights the limited data, and further study can be strengthened for language learning.

Aziz et al.^[29] observed that the use of technology emphasizes the value of individual practice and improves speaking proficiency. The findings revealed that the scores of their speaking test significantly improved their speaking performance and fluency. The results also showed that the use of technology improves their pronunciation at a deeper level, enabling learners able to understand the intonation pattern, verbal expression and correct sound recognition. Practice makes them confident and fluent. Barjestesh et al.^[30] commented in their study that technology-integrated language instruction by investigating digital literacy of Iraian EFL teachers enhances their teaching skills. The insights support that digital literacy is essential for professional development and highlight the urgent need for training programs for both teachers and learners.

Abbas et al.^[31] explored many benefits of AI-adaptive tools. Personalized learning systems, intelligent tutoring systems (ITS), and automated assessment tools make language learning easy and accurate. Amrate^[32] investigated the potential of that Computer Assisted Pronunciation Training (CAPT) has the capability to improve learners' oral pronunciation. The software gained significant attention from learners for improving their pronunciation proficiency, which is most challenging for ESL learners. The 'Pronunciation Coach Software was used to improve the learners' pronunciation

proficiency at the segmental and supra-segmental levels. An additional investigation carried out by Rogerson–Revell^[33] on CAPT, the study highlighted the main concern about accuracy and automatic feedback. The interactive CAPT tools grab the attention of language learners rather than regular pedagogical methods. The CAPT tools, Duolingo and Mondly offer customized feedback on learners' pronunciation skills. The findings highlighted the challenges of technology-based learning and the bright future of CAPT and AI-based language learning tools.

Another study conducted by Yang et al.^[34] found that AI tools can enhance speaking skills and offer an improved strategic plan for individual learners. The study utilized the Talk AI dialogue system to enhance the speaking skills of English as a Second Language (ESL) learners in China. Alongside the reported improvements in speaking proficiency, the study also offered measurable indicators for language progress. The significant positive impact of AI-speaking tools was observed. The study revealed that AI-speaking tools (ICALL) are supportive for improving pronunciation, grammar, feedback and fostering awareness of future learning strategies for enhancing speaking skills. Further, longitudinal data would be needed to assess potential of AI-driven feedback.

Altıncı and Mohammadzadeh^[35] conducted their research in Turkey on ICALL tools for word-class problems. The findings depict the effectiveness of ICALL tools in addressing word-class problems. The learners enjoyed ICALL-based learning and were willing to use ICALL tools to learn about other language problems. Pokrivčáková^[36] also agreed with the efficiency of ICALL tools and recommended them for language learning. ICALL tools promote personalized language learning materials. Thus, the integration of AI with CALL can help learners and ESL teachers improve their language skills according to their convenience and can arrange activities.

The extensive history of AI implementation in the field of language learning has grown consistently over time. Umaroh et al.^[37] studied the use of ICALL applications 'Speaklanguages', 'Duolingo' and 'Elsa' for students' speaking skills, and results received positive perceptions from students. Although the study highlights the essential elements for speaking proficiency, intonation and spontaneous dialogues were not directly addressed. These limitations in-

dicating the need for incorporating ICALL speaking tools that offer supra-segmental features and instant feedback. Abimanto et al.^[38] agreed that the use of AI significantly improves learners' speaking and listening skills. The findings made it evident that Google Read Along's use is beneficial for enhancing pronunciation skills. Additionally, the results also shed light on the challenges, pointing a significant gap in nuanced practicing of AI speaking tools (ICALL) that can provide feedback on both segmental and suprasegmental sounds.

The study is framed with Vygotsky's Sociocultural Theory (SCT) and Krashen's Input Hypothesis. These theories provide valuable insights into how language acquisition can be supported through advanced technology. As articulated by Vygotsky^[39], SCT maintains that language learning emerges from socially situated experiences, within the Zone of Proximal Development (ZPD) as a central part. ICALL and NLP tools, with their adaptive features, act as digital mediators by providing timely feedback and scaffolded language input that aligns with learners' ZPD, particularly in speaking skills, which are often marginalized in formal language instruction. According to Shadiev and Wang^[40] technology-enhanced language learning frequently employs social constructive theoretical foundations with speaking skills and writing skills are the most studied language skills. The study highlights interactive digital tools evocatively enhance learners' motivation, engagement and confidence. Framed through Vygotsky's SCT, the findings revealed that ICALL technologies through speech recognition tools, immediate feedback and scaffolding enable learners to improve their oral proficiency within their ZPD. This theoretical alignment validates the effectiveness of adaptive ICALL tools in targeting speaking difficulties with customized feedback-driven instruction.

Meanwhile, according to Krashen's Input Hypothesis^[41], Second Language Acquisition (SLA) occurs most effectively through exposure to language slightly beyond the learners' competence. ICALL tools offer such input dynamically, with adaptive features that ensure learners receive interactive listening and feedback, which are ideal for developing speaking skills. This study bridges the gap by showing that ICALL platforms, through intelligent speech interactions and feedback loops, emulate this condition and tailor learners' current speaking proficiency levels. Research conducted by Golovachyova^[42] systematically aligns with Krashen's Input Hypothesis and Vygotsky's SCT, supporting

AI-based language learning (ICALL instructions, immediate feedback and speech recognition tools). ICALL adaptive systems continuously adjust input difficulty, ensuring it aligns with individual learners' needs and improves their speaking proficiency. Together, these theoretical alignments position ICALL tools as pedagogical supporters that not only support comprehension but also learner-generated output within the learners' ZPD.

3. Research Methods

The present study used sequential explanatory research of mixed methods. The first part employed a quantitative quasi-experimental method. The intervention was provided by the experimental group. Purposive non-probability sampling was used for this study. The participants of the experimental group received ICALL treatment for improving their speaking proficiency. The control group did not receive any ICALL intervention. A pre-test was conducted with both the control and experimental groups, and after the intervention, post-test was also administered to both groups.

The next step is qualitative research. For this, data is collected through semi-structured interviews. The interviews were analyzed through thematic analysis.

3.1. Population and Sampling

In total, 130 students of graduate programs in English language from the University of Southern Punjab, Multan, Pakistan, were initially selected. The participants who were absent during the intervention and did not complete their pre-test were excluded. A total of 110 participants met the inclusion criteria and completed both the pre- and post-test were selected for this research. The research was composed of 55 participants in the control group and 55 participants were included in the experimental group.

Figure 1 shows that the number of participants was 130, equally divided into two groups; 65 students were in the experimental group and 65 students were in the control group. 6 students from the experimental group did not agree to participate, and 9 students from the control group withdrew from this research. 4 students were absent during the treatment and only 1 student was absent from the control group. 55 students remained in each group and were selected for this study.

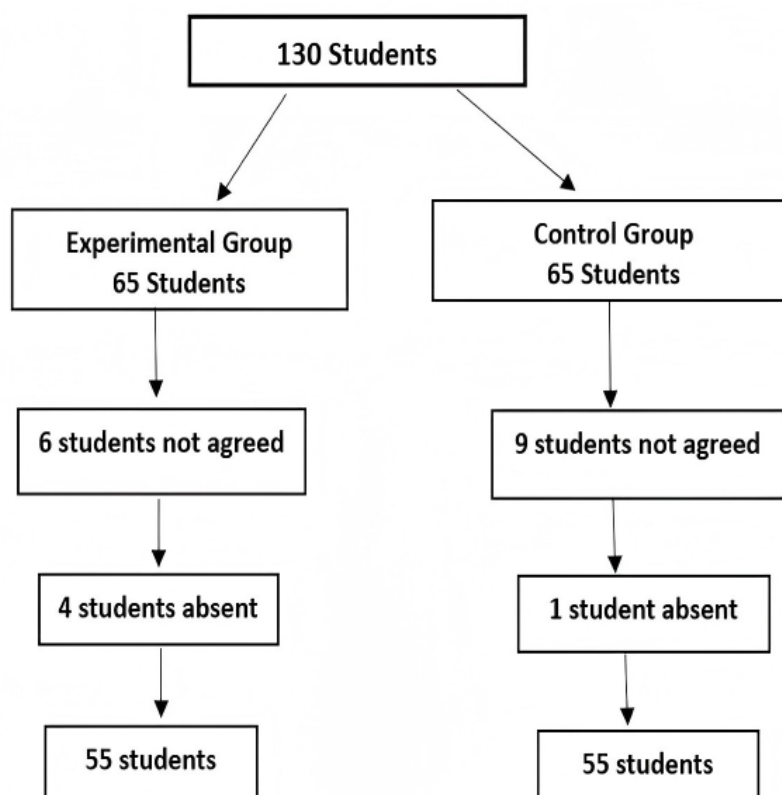


Figure 1. Sampling techniques.

3.2. Research Instrument

Pre-test and post-test were used to evaluate the students' speaking skills. Speaking proficiency was assessed using rubric that aligned with the Common European Framework of Reference for Languages (CEFR). The sub-speaking skills fluency, pronunciation, vocabulary, grammar and coherence were focused. ESL learners' performance was rated on a band scale of 1 to 5 per category. ICALL tools were used as a tool for measuring the level of speaking skills. The treatment was given for a limited time, for four weeks. The participants practiced ICALL tools for 30 minutes daily, and their scores were recorded on an Excel sheet by the researcher. After the experiment, an interview was conducted with the participants who had participated in the experiment. It was optional for all participants of the experimental group to participate and share their experience with the ICALL tools. For the speaking test, inter-rater reliability was confirmed using Cohen's Kappa ($\kappa = 0.83$). The speaking test items aligned with the CEFR descriptors to confirm the construct validity. Interview protocols were validated with two language experts and pilot testing.

3.3. Research Process

The research process has three parts: pre-test, intervention, and post-test. The pre-test was conducted on 10 December 2024, based on their speaking proficiency. ICALL intervention was provided for four weeks to only the experimental group. Specific ICALL speaking tools (MyET, ELSA Speak and Duolingo) were introduced to the respondents. All speaking activities were designed using ICALL tools. All three selected tools covered the sub-categories of speaking skills, pronunciation, fluency, coherence, grammar, and vocabulary. After the intervention, a post-test was administered to both groups to observe the impact of the treatment. Their performances were measured to compare the results.

The next part is semi-structured interviews. Seven students voluntarily agreed to participate in the interview, and they participated in the experiment. The participants were allowed to have face-to-face and video-based interviews according to their preferences. The interview was designed to know the students' perceptions about the intervention of ICALL speaking tools. During the interview, a comfortable environment was provided and allowed participants to share

their experiences freely.

The timing of the interview was 10 to 15 minutes. Although participants were allowed to share sufficient views about the experiment and share their exposure to the ICALL speaking tools. The data was analyzed through thematic analysis followed by Grbich^[43]. The data gathered in the form of interviews was carefully reviewed to identify the major themes. These themes were further analyzed to identify the sub-themes. This comprehensive process facilitates the accurate themes and interpretations of the collected data.

The reliability was checked by two researchers for coding independently. This process is helpful to identify accurate themes and cross-validation to avoid bias. All the related differences in coding were carefully examined with two experts and resolved collaboratively to ensure the alignment in data interpretation. Moreover, the reliability of the analysis and the validity of the final themes were reviewed by an expert in the field of English Language Teaching (ELT). The expert

review provided confirmation of the quality of validation and related identified themes^[44].

The data was further analyzed through the identified themes, which supported rich qualitative results. Overall, the validity of the study strengthened the understanding of the ICALL adaptive platform for improving speaking skills.

Table 1 explains the treatment plan that was given to the experimental group. In the first week ICALL tool MyET was introduced to the participants. The main purpose of using this tool was to improve their pronunciation skills. In the second week, the ICALL tool ELSA was used. The learners practice through dialogues and all the activities are arranged to improve their fluency level. In the third week ICALL tool Duolingo was used. The main purpose of using this tool was to improve their vocabulary and grammar. In the last four weeks learners are allowed to use ICALL tools according to their choice and needs. This time, learners were offered topics, and they must speak without giving pause.

Table 1. ICALL speaking activities for intervention.

Date	ICALL Activities	ICALL Speaking Tools	Speaking Techniques
13–17 January	Pronunciation Drills Stress and Intonation Practice Conversation Exercises	MyET	Listening and Speaking Practice Respondents practice with varying tonal patterns and receive immediate feedback. MyET app offers various speaking activities on various topics shopping, sports, Transport etc....
20–25 January	Interactive Dialogue Fluency Practice Sound Comparison	ELSA	Interactive dialogues with immediate prompt response. ICALL tools offers practice activities without pauses and hesitation of longer passage to improve fluency. Comparison with sound differentiation and minimal contrastive pairs. ELSA points out mistakes.
27–31 January	Role Play Vocabulary Grammar based Practice	Duolingo	Respondents engage in role play activities with animated characters. Fill in the blanks with missing words. Activities through Flash cards. Dialogue based exercises with correct sentence structure.
3–7 February	Real-Time Speaking Activities Two minutes speaking test about the given topic.	MyET/ELSA/Duolingo	All three apps offer daily challenges where respondents were offered short stories and comprehension practice. ICALL apps will provide topics, and participants speak and receive immediate feedback.

4. Results

4.1. Quantitative Analysis

The collected data was analyzed through SPSS 25. The frequency and percentages were measured through descriptive analysis to examine the overall performance of speaking skills. Paired sample tests and independent sample test were also employed.

Table 2 shows a significant difference in learners' speaking skills. The pre-test and post-test clearly indicated that the control group did not show improvement in their test scores. There was a slight difference between their results. On the other hand, the results showed a massive difference between pre-test and post-test scores of the experimental group. The average mean score is higher than that of the pre-test of the experimental group.

Table 2. Descriptive analysis.

Descriptive Statistics	N	Mean	Std. Error	Std. Deviation
Pre-test Control	55	59.181	1.46	10.83
Post-test Control	55	60.727	1.55	11.49
Pre-test Experiment	55	60.400	1.55	11.49
Post-test Experiment	55	86.56	0.755	5.600

Figure 2 presents a bar chart that explains the difference between pre- and post-test. The bar chart compares the results of the control and experimental groups. It clearly shows that both groups started at a similar baseline. There

was no progress in the control group between their pre- and post-test means. A clear significant improvement was observed in experimental group. This suggests that ICALL intervention was effective for improving speaking skills.

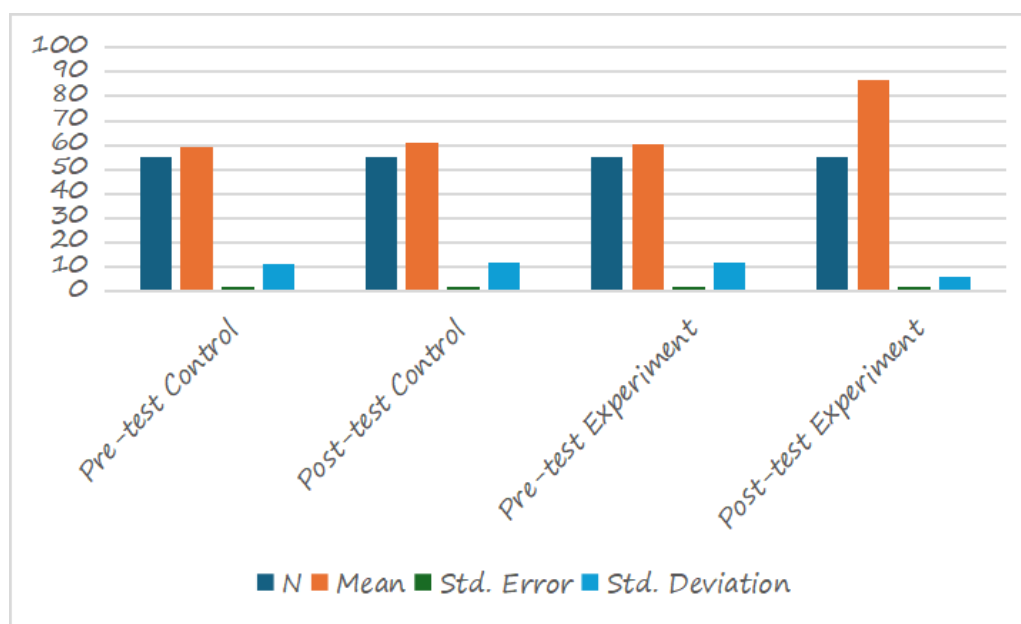


Figure 2. Difference between pre- and post-test.

Table 3 depicts the difference between the pre-test and post-test of the experimental group. The mean of the pre-test was 60.40 and SD was 11.49. On the other hand, the mean of the post-test was 86.56 and the SD was 5.60. A significant difference was observed between the test scores.

Table 4 represents the difference between the paired sample test scores of the pre-test and post-test. The results indicated that there was a huge difference. The difference in mean was 26.163 and the SD was 9.5078. The significant 2-tailed value was 0.000, which was less than 0.05.

Table 3. Descriptive statistics for experimental group.

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-test	55	29.00	77.00	60.4000	11.49976
Pos-test	55	69.00	96.00	86.5636	5.60014

Table 4. Paired sample test.

Paired Differences				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	S. Error	Lower	Upper	t	df	Sig. (2tailed)
Posttest-Pretest	26.163	9.5078	1.282	23.593	28.733	20.408	54	0.000

Table 5 shows the independent test scores and presents a significant difference between the two groups. The average mean was 26.1634 and the SD was 1.72472. The *p*-value of

Levene's test is 0.000, which is less than 0.05. The *t*-value was 15.170 and the difference was 78.248. The table shows the statistical difference.

Table 5. Independent samples test.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
Post-test	Equal variances assumed	27.330	0.000	15.170	108	0.000	26.16364	1.72472	29.58233	22.74494
	Equal variances not assumed			15.170	78.248	0.000	26.16364	1.72472	29.59712	22.73016

4.2. Qualitative Analysis

The second part was qualitative analysis. The data was collected through semi-structured interviews. Ten questions about ICALL tools were asked. For example, "Did the ICALL tools help you to speak better? How?" "How have the ICALL tools affected your pronunciation, fluency and vocabulary?" The study aimed to explore the students' experience about the ICALL tools and to check the improvement in their speaking proficiency. The thematic analysis was chosen for data analysis. The identified themes were summarized below.

4.2.1. Theme 1: Positive Perceptions about ICALL Tools

The students were amazed and astonished by the ICALL speaking tools. Speaking skills has always been a complex skill for them and they feel a significant change in their speaking fluency. Accuracy has always been a big challenge for language learners. ICALL tools were helpful in improving their level of speaking accuracy. Participant 4 said, "ICALL tools are supportive in increasing the accuracy and proficiency level of speaking skills. ICALL-based learning is highly effective." ICALL speaking tools have the potential to make the technicalities of speaking skills easy and adaptable. Additionally, ICALL offers a stress-free learning environment. Participant 3 reported exceptional satisfaction with the ICALL humanoid teacher, stating, "ICALL tools are attractive and more engaging." The ICALL activities were entertaining, and the level of satisfaction makes this

transform into a more dynamic and enriched learner-centered approach. Participant 5 powerfully conveyed, "I would say, the experiment was fantastic and gave me advanced exposure of ICALL speaking tools." The participant enjoyed the experiment and was happy to learn more about advanced technology.

4.2.2. Theme 2: Adaptive Platform for Improving Speaking Skills

ICALL tools promote dynamic adaptive platforms for improving speaking skills. They have the potential to fulfill the individual needs of language learners. ICALL tools provided diagnostic speaking activities that help students trace their proficiency level. Adaptive platforms like MyET, ELSA and Duolingo ensured an efficient speaking environment. Moreover, participants noticed that ICALL adaptive tools customized vocabulary, pronunciation and grammar. Participant 1 remarked, "The adaptive approach ICALL tool is a unique learning pathway and it maximizes my speaking learning efficiency. This technology is very effective." The diversity of these tools empowered the fostering of a significant shift towards technology-based learning. The ICALL tools interpreted learners' input and gave a response accordingly. ICALL tools aim to optimize learning for all types of learners. Learners could adjust activities according to their level and effective adaptation, foster their speaking skills and improve fluency. Participant 4 commented, "If I make many mistakes, ICALL tools give me easier tasks, and if I do well, they give me more difficult ones." The learners perceived the adaptive nature of ICALL tools. It metaphori-

cally conveyed the sense that learners enjoyed the adaptive nature and personalized language learning environment.

4.2.3. Theme 3: Personalized Learning

The use of ICALL tools helped students analyze their strengths, weaknesses and progress. They could tailor their speaking practices according to their needs. ICALL tools were available everywhere and students can use these in classrooms and outside of the classrooms according to their needs. Participant 3 expressed, “ICALL tools are used in and out of classrooms; there are no restrictions on place and time.” These tools made learners autonomous, and students could arrange activities according to their interests. The learners can adjust vocabulary complexity, fluency and voice speed for better understanding and practice with ICALL tools. It removed fear of embarrassment and provides unbiased feedback on learners’ speech. The valuable role of speech recognition tools supported learners in their language development. Participant 4 stated, “with the ICALL tools, I feel lessons are tailored just for me.” The quote reflects that the participant highlights the sense of personalized learning. The participant perceived that ICALL tools are adaptive and supportive for individual learning.

4.2.4. Theme 4: Fluency and Accuracy

Participant 1 stated, “During the experiment, ICALL tools significantly enhance my fluency and accuracy. These advanced speech recognition systems analyzed my pronunciation, intonation and stress patterns and not only highlighted the areas that needed to be improved but also arranged practice activities accordingly.” Speaking accuracy is often overlooked by human teachers, but ICALL tools always detect pronunciation mistakes and guide the robotic teacher to practice as much as required. Additionally, simultaneous conversational practice made students fluent and poised. Participant 3 commented, “ICALL tools offer a natural flow of language that is helpful for language accuracy and fluency.” ICALL speaking tools maintain conversation without pauses and grammatical mistakes. Participants were in favor of ICALL speaking tools that are efficient for language proficiency and robust for attaining fluency and accuracy. Participant 4 raised an implicit concern about the accuracy of ICALL tools and commented, “It’s not just correcting me, it explains why pronunciation is wrong. That makes it easier to remember the correct pronunciation.” The quote explains that ICALL

tools not only autocorrected errors but also explained the rules and reasons for sound patterns. It helped learners to actively participate and understand the reason behind the errors. It enhanced their speaking skills development.

4.2.5. Theme 5: Motivation and Confidence

All students reported that ICALL tools boosted their confidence level. ICALL played a pivotal role and created a supportive learning environment that motivated students. The gamified elements promoted fun-based learning, reduced anxiety, prevented frustration, and fostered a sense of speaking progress. Participant 2 shared his experience, “I have no idea about the advancement of ICALL tools. These tools are friendly and build up my self-assurance. The ease of use and flexibility were motivating and made me confident.” In tandem with ICALL tools, learners were motivated to speak English fluently and become confident. A non-threatening free environment encouraged learners to communicate effectively. As also noted by participant 4, “Using ICALL tools made me feel more confident. The tools don’t feel embarrassed. ICALL tools corrected me privately.” Participant’s quote reflects emotional safety. The statement, “ICALL tools correct me privately,” shows individualized practices which helped learners’ self-esteem while offering guidance. Cumulatively, participants were satisfied with their stimulating learning experience with ICALL speaking tools.

4.2.6. Theme 6: Constructive Feedback

Four participants reported that ICALL speaking tools offered instant and constructive feedback that helped recognize mistakes. The judgment-free nature motivated them to practice consistently without fear and embarrassment. Participant 1 mentioned, “During the experiment, I received more precise, actionable and immediate feedback. Sentence stress, intonation, mispronounced words and grammar mistakes were highlighted and suggested how to address them.” Right and wrong feedback was not enough for improving speaking skills. ICALL tools not only provided constructive feedback but also corrected sound patterns. Participants agreed on the importance of the clear articulation and reliable pronunciation models provided during the experiment. The nature of ICALL tools was repetitive and made learners comfortable. Overall, ICALL tools gave a detailed and focused feedback loop that transformed into a reliable means of self-assessment and improvement. The theme became

particularly vivid in participant 2's comment, "ICALL tools give feedback right after I speak. They tell me how to improve and fix my mistakes in a moment." The participant's quote reflected that ICALL tools offer constructive and instant feedback, helping learners move toward personalized through technology-enhanced language learning.

5. Discussion

This work aims to explore the impact of an ICALL-adapted platform on ESL learners' speaking proficiency at the undergraduate level. The study used ICALL adaptive platforms MyET, Duolingo', and ELSA for improving speaking skills. The study also explains the learners' perceptions of the ICALL adaptive platform for the improvement of speaking skills. In Pakistan, undergraduate students are fluent in the English language. Vladova et al.^[45] stated that the use of technology is a great source to improve speaking skills. Technology-mediated instruction not only improves pronunciation skills but also motivates language learners. Huang et al.^[46] also recommend that the use of AI-mediated chatbots makes learners confident, enabling them to speak fluently in front of people without any fear or anxiety. Moreover, Son et al.^[24] observed learners' confidence and self-direction towards ICALL tools. Their findings closely aligned with the current study.

Tafazoli et al.^[47] suggested that the ICALL environment has the potential to provide automatic feedback, intelligent tutoring and personalized language learning. The successful integration of ICALL is beneficial for language learning. Chiaráin et al.^[48] highlighted that the incorporation of ICALL tools for speech and technology promotes the level of reading, writing, listening and speaking skills. The ICALL tools offer extensive feedback that is useful for writing and speaking skills. ICALL tools also lessen the difficulty of teaching and learning language skills. Maharrani et al.^[22] shed light on the similar findings that heutagogically designed ICALL environment makes learners autonomous and promote AI based environment for language development.

The findings of the study prove the significant difference in learners' speaking skills. The comparison between control and experimental groups indicates that the ESL learners who were not part of the experiment could not show im-

provement in their speaking proficiency and the learners who actively participated in the ICALL experiment showed a massive change in their speaking proficiency. Jiahua Liu^[16] also conducted a study on technology-based learning for speaking skills and the results show that technology-based learning offers a high impact on speaking proficiency. The study also revealed that computer-aided technology offers personalized, attractive modules for improving speaking skills. It not only promotes speaking proficiency but also complements optimized learning of speaking skills. In another study, Yang et al.^[34] discovered that AI-powered training for speaking skills develops a systematic judgment for performance observation. The study also suggested strategies for improving speaking skills. The outcomes of the study are the same and it is acknowledged that AI speaking tools (ICALL) increased awareness among ESL learners, and these tools are helpful to improve productive skills and propose strategic follow-up plans for speaking proficiency.

The observed improvement of ICALL speaking tools is aligned with Vygotsky's SCT and Krashen Input hypothesis. Vygotsky explains in his theory that learning happens through interaction and supportive tools. Krashen's Input Hypothesis also explains the value of tools that can give learners language input which is easy to understand but still need to push students toward new learning. The theories emphasize the role of social interactions and scaffolding in language development, as ICALL tools provide comprehensible input in positive and meaningful output for language acquisition. The ICALL speaking platform functions as a mediated tool that offers immediate feedback and error correction practices that help learners improve their language proficiency.

Other studies also describe the effectiveness of ICALL technology for improving speaking skills. Zou et al.^[49] claimed that ICALL offers speech recognition accuracy. It offers solutions for non-standard accents. One of the main reasons for a non-standard accent is a lack of feedback on learners' speaking skills. The experimental study proved that ESL learners are willing to use AI-speaking tools for their speaking proficiency and accuracy. The results also highlight the feedback that AI tools provided to the ESL learners and the optimal efficacy of AI-speaking tools. The current study is also parallel with Chen et al.^[27] who emphasized the role of ICALL adaptive input in real-time learning processes.

6. Limitations

Despite the valuable insights, the study has limitations on the use of ICALL speaking tools. From a technological standpoint, issues such as slow internet speed, device compatibility and familiarity with ICALL speaking tools may have affected the quality of the learners' involvement. Contextually, socioeconomic disparities, national curriculum, and language learning policies may limit the integration of ICALL tools in educational settings. The study also faces the sampling limitations; the sample size was relatively small and unable to fully represent the population. Methodologically, the study relied on only two instruments, performance tests and interviews, which may restrict the external validity of the findings. The duration of the intervention is also short and might be inadequate to investigate the impact of ICALL tools on speaking skills. Furthermore, theoretical language acquisition frameworks are not explicitly discussed.

7. Recommendations and Implications

In light of the findings, the study recommends various directions and implications for future research. Future researchers should consider larger sample groups to make the findings more generalizable in different contexts. It is needed to conduct longitudinal tools to explore the long-term impact of ICALL tools on learners' speaking proficiency, engagement and their autonomous learning. The study also recommends aligning ICALL tools with the national curriculum, educational policies and teachers' training workshops. Furthermore, the study also suggests accessing digital infrastructure for ICALL-based language learning.

The findings of the study also carry important implications for educators, curriculum designers and policy makers. ESL teachers can use ICALL tools for lesson planning, quizzes and real-time feedback. ICALL speaking tools support the learners in and out of the classrooms. Curriculum designers should consider ICALL tools can complement traditional instructions by integrating them into assessments and syllabus design. Moreover, policy makers play a pivotal function in shaping national strategies that promote the integration of ICALL applications into language learning across both formal and informal educational contexts. Such coordinated efforts may contribute to the advancement of language

education system that is more inclusive, learner-centric and adaptive approach that empowers ESL learners.

8. Conclusion

The study proves that an Intelligent Computer-Assisted Language Learning (ICALL) adaptive platform is supportive and significant for ESL learners, particularly valuable for speaking skills. The integration of AI technology in the form of ICALL is beneficial for ESL learners to enhance their supra-segmental features (intonation, stress, rhythm and pitch). The learners can arrange activities according to their convenience and language requirements and can receive immediate feedback. They can practice with ICALL applications as much as they need. Constructive feedback offers a facilitative learning environment that makes learners autonomous. Enriching the ICALL environment reduces speaking anxiety. Despite the challenges of technology-based learning, the overall impact of the ICALL adaptive system is significant. The results are positive. ICALL adaptive system is instrumental, and students' personalized learning experiences are effective for improving their speaking proficiency.

Author Contributions

Conceptualization, S.I. and R.B.R.; methodology, S.I.; software, S.I.; validation, S.A., H.H.H., and S.A.K.; formal analysis, S.I.; investigation, S.I.; resources, M.A.; data curation, S.I.; writing—original draft preparation, S.I.; writing—review and editing, R.B.R.; visualization, S.I.; supervision, R.B.R.; project administration, S.I.; funding acquisition, S.A. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in single Institution (University 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, assessment scores and interviews. Due to privacy and ethical restrictions, this 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 that there is no conflict of interest.

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