Listening in the EFL Classroom: The Role of AI-SRT in Learning Gains

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Abstract
This study investigates the impact of AI-driven speech recognition technology (SRT) on Saudi EFL learners' listening comprehension, focusing on their flow experience and anxiety. A mixed group of fifty-two intermediate and advanced undergraduate EFL students at Majmaah University, Saudi Arabia participated in the intervention that lasted eight weeks. Participants were assigned to an experimental group (n=30) which used the Google Text-to-Speech application with AI-SRT features, and a control group (n = 21) which continued with the prevalent pedagogy over the intervention period. Both groups were subjected to listening tests before, during and after the study period. The study used the PPL-FSQ (Flow State Questionnaire of the Positive Psychology Lab) tool of Magyaródi et al. (2013) to assess the flow experiences which were then measured statistically via paired sample t-test and Cohen's *d* to derive pertinent results. Kim's (2000) FLLAS **(**Foreign Language Listening Anxiety Scale) was utilized to assess listening anxiety amongst the participants. Results indicated higher listening comprehension scores in the experimental group, stronger flow experiences, and less listening-related anxiety after the intervention. This progress reflected in the follow-up test also, showing the lasting effect of AI-SRT. Cohen's d indicated moderate size effect of reduced anxiety.
Keywords: AI-powered Speech Recognition, flow experiences, anxiety, listening comprehension, FLLAS, PPL-FSQ

INTRODUCTION

Rapid evolution in artificial intelligence (AI) technologies has radically transformed language education in general and English language education in Saudi Arabia in particular (Al-Hoorie et al., 2025; Al Fraidan & Alaliwi, 2024), making a favorable case for new and efficient approaches for acquiring English as a Foreign Language (Son et al., 2025). In the spate of this technological surge, AI-Powered Speech Recognition Technology (henceforth AI-SRT) systems offer possible solutions to long-standing language-learning challenges such as listening comprehension, learner engagement, and learning anxiety (Wei, 2023; Xiao, 2025).

Listening comprehension skill is a fundamental pillar in learning any language, and it is challenging for EFL learners placed in settings that have a high probability of lacking authentic and stable exposure to English speech. The phonological intricacy involved in EFL learners' interaction with a novel acoustic system as in English, entails interplay of myriad processes, including phonological decoding, lexical coding access, syntactic analysis, and semantic integration (Alotaibi, 2021, 2022).

Learning needs of Saudi learners are not fully met as the language learning environment is constricted by the linguistic gap between their first language (Arabic) and foreign language (English), poor exposure to authentic listening opportunities, and teacher- and product-centred pedagogy. Consequently, the impact on learners' engagement is adverse, which is an important factor impacting the flow experiences in foreign language learning (Wu &

Wang, 2025). First identified by psychologist Mihály Csíkszentmihályi in the 1970s, flow experience or "in the zone" experience is a psychological state of optimal absorption and mental focus of a person in an activity to such an extent that they lose track of time and self-consciousness. Relevance of the flow experience is being recognized as an effective predictor of the conditions associated with effective learning. The ideal ingredients of this are complete absorption in an activity, clear goal setting, and rapid feedback (Santos, 2018; Kiili, 2014). Recent findings (Zou & Ren, 2024; Strielkowski et al., 2025) suggest that technological interventions can improve the flow experiences, likely as a result of anxiety alleviation, though this is an under-researched area in the Saudi EFL context.

Listening anxiety is a major challenge in EFL acquisition (Alpert, 2007; Chen et al., 2023). Anxiety and listening comprehension performance have been proven to be negatively correlated in some experimental trials (Zhang, 2013; Wang & MacIntyre, 2021; Zhao, 2022). Listening anxiety issues are multifaceted including cognitive issues, affective issues, and situational factors issues (Dalman & Plonsky, 2022). For Saudi EFL students, other issues may further be added such as, insufficient exposure to different English dialects, accent variations, and cultural differences in the communication process, feedback mechanisms in place, and leaning of assessment on accuracy rather than fluency (Alotaibi, 2018; Wiriya, 2025). All factors considered, it is worth exploring the role of AI-SRT as a solution as it does support the needs of immediate feedback, individual support tailormade to learner needs, and technological intervention that tackles anxiety (Deeley, 2018; Chen, 2024; Moybeka, 2023; Hossain et al., 2023). The Saudi context is a new testing ground for these earlier findings, prompting the current study which not only adds to the available literature, but also presents a unifying framework that considers how learners respond cognitively and emotionally to an AI-SRT tool over an extended period of time.

LITERATURE REVIEW

The positive role of AI tools in the language classroom, especially of AI-SRT has been the focus of contemporary research (Crompton et al., 2024; Sari & Kurniawan, 2025). These tools are powered with features such as accurate analysis of different aspects of speech, including but not limited to phonology, prosody, fluency, and word appropriacy (Nguyen, 2024). Moreover, prompt feedback and unique engagement that is adapted to individual needs set them apart from the traditional methods (Ngueajio & Washington, 2022; Rogers et al., 2020).

The efficacy of ASR technology has been proven in studies by Inceoglu (2020), Jiang et al. (2023), Sun (2023), and Chen et al. (2025). Where EFL pronunciation is concerned, the efficacy of ASR technology has been studied by Dennis (2024) which added to the positive outcomes reported by other studies. Apart from language gains, this research also reported gains in learner confidence and engagement in speaking tasks. Compared to traditional methods in the language classroom where learning is mostly passive, this technology not only actively involves the learner, it also gives individual feedback. Other studies (El Shazly, 2021; Liu, 2024; Tai & Chen, 2024) add that ASR tools also provide clarifications where information is inadequate and even offer visual reinforcement for better comprehension and make corrections in learner output (Mulyanto et al., 2024) by offering the correct pronunciation.

These studies indicate that with ASR technology, students can achieve a state of deep focus and fundamental motivation due to their adaptability that generates cooperative and rich-feedback environments. This connection between technology use and flow experience has led to an expanding body of research in its application to language learning (Al-Ahdal,

2020; Far, 2024). AI environments provide opportunities that facilitate learning by offering instant feedback, individualized learning pathways, and enabling learners to focus on the material without disengaging (Al-Ahdal & Alharbi, 2021; Lampropoulos, 2022).

The adaptive nature of AI-powered systems facilitates flow experiences by regulating task difficulty and intricacy in real-time, thus preserving an optimal level of challenge for beginners (Gligorea et al., 2003; Zitouni et al., 2021). Flow experiences are linked to lower anxiety in classroom settings (Dewaele, 2022; Li & Wei, 2023; Ahmed et al., 2023) based on instant and precise feedback which are inherent features of AI-SRT. This has been reiterated by Biró and Kató (2024) which linked flow with lower anxiety in the language classroom. Besides, the application of technological tools in enhancing learners' verbal skills is a stated aim of Saudi Arabia's Vision 2030, and studies such as Al-Ahdal and Alkhalaf (2020) have shown that tools as simple as podcasts have a great potential for boosting these skills in EFL learners.

Cognitive demand on listening comprehension in EFL has a significant relationship with anxiety among learners. Unlike other skills such as reading, which allow readers to process and review the text at their own pace, listening requires the listener to continually process transitory audio generated in real-time (Mitsugi & MacWhinney, 2016; Su, 2025). This time pressure creates overload on the working memory and increases anxiety (Baddeley, 2012). For Saudi EFL students, the struggle might be intensified by exposure to limited amounts of authentic English audio materials, lack of familiarity with various English accents and the way they are spoken, along with traditional learning approaches that focus on accuracy more than on communication.

The use of technology in listening instruction holds potential to lower anxiety. AI-powered listening activities could provide more private and self-paced practice settings, leading to a reduction in the social anxiety that EFL students may experience in face-to-face listening classes (Jiao, 2023a; Fathi, 2024). Furthermore, adaptable playback speed and visual assistance from transcription can help learners by reducing cognitive load and anxiety as shown by Fitria (2021).

METHODOLOGY

This study uses a controlled trial specifically made to examine the efficacy of AI-SRT on EFL listening outcomes among Saudi students at Majmaah University. The study used three instruments for gathering data: assessments in the pre-post phase, PPL-FSQ tool of Magyaródi et al. (2013) to assess the flow experiences, and Kim's (2000) FLLAS to measure listening anxiety. The research is centred around the following queries:

- Does AI-SRT improve listening comprehension among Saudi EFL students?
- Does AI-SRT affect flow experiences of Saudi EFL students during their learning activities?
- Does AI-SRT reduce listening anxiety among Saudi EFL learners?

Population and study sample

Fifty-one Saudi university students enrolled in EFL programs at Majmaah University, Saudi Arabia were recruited through general emails to participate in the study. The students' ages ranged from 19 to 21 years. and their language proficiency levels ranged from intermediate to advanced.

Instruments

Listening comprehension was measured by applying the standardized IELTS Listening Test. The domain of listening was divided into three sections related to various listening

contexts: social conversation, academic lecture, and educational discussion. The PPL-FSQ tool was adopted entirely to assess the flow experiences of participants during the learning processes. The established validity of the PPL-FSQ for use in multiple educational contexts is especially relevant to technology-assisted learning settings. The measure has been successfully applied in language learning research and is sensitive to intervention effects (Hamari et al., 2016). The FLLAS instrument (Kim, 2000), was used to measure listening anxiety across three listening anxiety domains viz., domain of tension along with domains of worry, lack of confidence, and challenges while listening. Responses were sought across the five point Likert Scale where 1 stands for strongly disagreement and 5 for strongly agreement.

The Google TTS application with ASR features was chosen for the intervention. Its features are compatible with the study aims such as live text-to-speech outcomes, built-in audio recognition on pronunciation accuracy, fluency, and intonation patterns. Moreover, it is flexible enough for individual need adjustment and configuration in multiple themes.

Procedure

Pre-Intervention Phase

All participants were assumed to have a similar baseline evaluation in the first week of the study since they came through a common selection process at the university. The experimental group were given systematic training on using the Google TTS application. The control group followed the prevalent pedagogy.

Intervention Implementation

The intervention took place over a course of eight weeks during which EG interacted with the Google TTS app. The listening tasks planned for the sessions gradually increased in difficulty over time. Learners were enabled to revisit the earlier activities as often as needed, rewind, and review the transcript for clarification, and receive immediate feedback on their output.

Post-Intervention

After completing the eight-week intervention, each participant accomplished his/her post-intervention assessments using the same tools and processes as those used during the first assessment. All post-intervention assessments were conducted no later than one week following the intervention.

RESULTS

The study concentrated on how the learners' output changed across the two assessment iterations. Table 1 below summarizes the pre-test findings.

Table 1: Performance of CG and EG prior to intervention

	Group	N	Mean	Std. Deviation	Sig
MEANS	Control	21	1.4481	.14564	.401
	Experimental	30	1.4808	.12843	

Table 1 presents the performance of students in the two groups before exposure to the AI-SRT intervention.

It is evident that the two groups started at around the same level. They did not perform well on the first test and hence, there was no apparent statistical difference between their performance. Therefore, any improvements observed in the second iteration may be attributed more reliably to the intervention rather than preexisting differences. Table 2 below summarizes the performance of the groups post intervention.

Table 2**:** Performance of CG and EG after the intervention

	Group	N	Mean	Std. Deviation	sig
Listening_ test	Control	21	1.7286	.11019	.000
	Experimental	30	1.8750	.05686	
Lecture_ test	Control	21	1.6381	.20119	.000
	Experimental	30	1.8933	.08683	.
Educational discussion	Control	21	1.8048	.07400	0.334
	Experimental	30	1.7733	.13374	

Table 2 indicates that EG fared better than CG in the listening and lecture assessments. Their average scores were higher (1.8750 for EG compared to 1.7286 for CG for listening, and 1.8933 for EG compared to 1.6381 for CG for lecture). Further, EG had smaller standard deviations which means that the improved performance levels were similar for all participants.

It was noted in the educational discussion dimension scores that EG performed poorer than CG. This may be attributed to variations in the type or complexity of the debates, differences in content, or lack of engagement of participants. The slightly higher mean in CG suggests that the benefits of AI-SRT might be limited and other instructional methods may be necessary for certain domains.

The next variable that the study investigated was learners' flow experience before and after the intervention. Table 3 below summarizes the findings for EG in the two phases.

Table 3: PPL-FSQ in the pre-post phases for EG

Skill	Mean in pre phase	Mean in post phase
Challenge skill balance	3.80	4.0
Absorption in task	2.15	4.07

These analyses clearly show that, following the intervention, EG experienced heightened flow experiences in the associated dimensions. It can therefore be inferred from these results that the intervention was effective in ensuring greater consistency in flow-related experiences of all the participants.

The third factor that the study explored was learners' anxiety in acquiring a foreign language and how the use of AI-SRT reflects upon it. Table 4 below summarizes the pre and post-intervention data related to this factor for EG.

Table 4: FLLA in the pre-post intervention phases for EG

Factor	Mean in pre-intervention phase	Mean in post-intervention phase
Problems while listening	4.12	1.94
Lack of confidence	4.13	2.38
Tension and worry	4.11	2.01

The pre-intervention result shows that there was strong anxiety among the learners regarding foreign language listening, largely around problems such as being unable to listen, lacking confidence, and feeling tense and worried. This supports the idea that this kind of anxiety is a common problem for both male and female learners. In contrast, responses in the post-intervention phase indicate that the intervention contributed to reducing anxiety levels along with positive reduction across all the three factors.

Another statistical test carried out in this study was the one-sample t-test for anxiety. The result is summarized in table 5 below.

Table 5: One-sample t-test pre- and post-intervention anxiety

	N	Mean	Std. Deviation	Sig
Post-intervention	30	2.1313	0.42576	0.000
Pre-intervention	30	4.0461	0.29459	

The one-sample t-test comparing the means of FLLA before and after intervention for EG indicates considerable reduction in anxiety levels. The pre-intervention average anxiety score was 4.05 which means that the participants strongly reported anxiety before implementing AI-SRT. However, in the post-intervention phase, the mean values dropped to 2.13, indicating that the participants felt better disposed and less anxious towards the learning experience. Statistically, as proven by a p-value of 0.000, it can be inferred that the study validates the efficacy of AI-SRT in reducing anxiety, which in turn enhances listening comprehension and learner determination in language acquisition endeavours. Finally, effect size was computed to determine whether the intervention significantly reduced listening anxiety.

Table 6 below summarizes the findings.
Table 6: One-sample effect size

				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
post	Cohen's d	.42576	5.006	3.671	6.332
	Hedges' correction	.43718	4.875	3.576	6.166
pre	Cohen's d	.29459	13.735	10.197	17.263
	Hedges' correction	.30249	13.376	9.931	16.812

Cohen's d test was run to yield the effect size as shown in Table 5. Results indicated that the intervention typically affected FLLA. Cohen's d for the post-intervention phase was 0.426 while it was 0.295 in the pre-intervention phase. According to Leppink et al. (2016), the values of 0.2 or less are interpreted as small, 0.5 as medium, and 0.8 or higher as large effect size. In this study, Cohen's d was 0.43 in the post-intervention indicating moderate effect size which implies that the utilisation of AI-SRT had a significant effect on reducing listening anxiety.

DISCUSSION

The research sought to examine the effects of AI-SRT on flow experiences of Saudi EFL students during their listening activities, and on decreasing anxiety in a Saudi EFL context. Findings demonstrated that participants in both the experimental and control groups suffered anxiety, exhibited poor learning confidence, comparable low performance on a standardized listening test, marked by incorrect responses and non-significant differences in p-values. In the post-intervention iteration, EG demonstrated higher mean scores across all dimensions, indicating consistent improvement. These results suggest that AI-SRT significantly enhances listening comprehension skills, thus enhancing language acquisition. This finding is consistent with Dennis (2024), and Ding and Yusof (2025) who concluded that the experimental group's L2 speech skills had greatly improved in contrast to the

control group, and their FLSA had dropped. In addition, these studies reported gains in other intrinsic areas and language skills as well. Participants in the current study reported feeling lees anxious along with having better educational experience in the post-intervention stage. Moreover, the effect sizes indicate that AI-SRT helps enhance the learning experience in EFL language classrooms.

Although mixed results have also been reported in studies that have targeted learners' engagement in learning through comprehension-based instruction, technology based listening classrooms need exploration as initial findings indicate potential. Studies such as Dennis (2024) that highlight the role of intervention in fostering consistent flow experiences align with positive psychology objectives aimed at enhancing engagement and overall well-being of learners. Findings of the current study demonstrate that the intervention was effective in ensuring consistently positive experience of flow-related aspects in EG. Further, statistical operations indicate significant decline in the three factors that determined learning anxiety as per the following: problems while listening dropped from a high of 4.12 to a sharp low of 1.94; lack of confidence in listening dropped from 4.13 to 2.38 and; tension and worry in listening dropped from 4.11 to 2.01.

We understand that low or no anxiety in learning is itself a factor that accelerates the learning process as motivation is boosted in the absence of it. Moreover, studies have indicated that motivation is a very significant factor in ensuring achievement of learning objectives. This chain of catalytic factors clearly establishes the role of alleviation of anxiety in the presence of motivation, and consequently, in learning success in the language classroom. Since these positive outcomes were reported by EG in this study, it can be surmised that technology-based listening intervention was a contributory factor whose role can be explored in other contexts too.

CONCLUSION

The positive results obtained in this study lead to the conclusion that with AI-SRT in the classroom, EFL learners stand to gain in overall listening performance, better flow experiences, and reduced learning anxiety. This key finding of the study establishes the validity of AI-SRT as an effective instructional tool that supports the emotional and cognitive components of the language learning process. With reduced anxiety and better engagement, learning motivation is likely to get a boost, thus edging the learners towards better learning outcomes.

From the teachers' perspective, motivated learners participate in the learning process, are more engaged in learning, and also positively impact their reasons for studying a language. Technology can make a positive contribution to reducing learning anxiety as contemporary learners are better adjusted to the machines than pen, paper, blackboard, and chalk. Tech tools motivate learners because they make the content interesting and appealing to their age group and address individual proficiency levels, making learning more manageable. Further, technology makes the class atmosphere supportive as technology is with the learners on a one-to-one basis. In this study, learners' flow state (engagement and absorption) and language learning anxiety were found to be positively impacted with the intervention of technology in the listening classes.

The challenge-skill balance and absorption in task were reported to be highly affected when the listening comprehension training was integrated with technology (ASR), and problems while listening, poor confidence and tension and worry were notably lowered. The conclusion, therefore, can be drawn that technology applications hold potential for the EFL classroom and may even enrich global language skills of the learners as they reduce

learning anxiety and enhance learner engagement. Moreover, their inherent features such as immediate feedback, simplification of content, visual input, and ability to repeat scaffolding measures, all score over the conventional teacher-led process which is still handicapped by many physical, institutional, and systemic limitations that ultimately retard the learning process, demotivate the learners, and fail to achieve the learning objectives.

Recommendations

Schools and institutions should consider using AI-based listening technologies and provide training to teachers and students for effective adoption of such tools.

Curriculum designers should design AI-SRT activities that target listening comprehension, skill-challenge balance, and anxiety reduction.

Teachers should monitor students' progress, provide supplementary support for those struggling with technology, and guide them in using AI-SRT for autonomous learning.

Suggestions for Future Studies

Future investigations should consider long-term effects of AI-SRT on listening skills, flow experiences, and anxiety reduction which can help establish sustained benefits and manage limitations. Comparative research is required to assess the effects of various types of AI tools (e.g., speech recognition versus chatbot or subtitle-based technologies) on different language domains and learner profiles.

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Appendices

Appendix A

PPL-FSQ - Flow State Questionnaire of the Positive Psychology Lab

Subscale 1: Challenge-Skill Balance (11 items)
I felt the challenges of the task matched my skill level.
The task was neither too easy nor too hard for me.
I felt competent to meet the demands of the task.
I was confident I could accomplish the task.
The difficulty of the task was appropriate.
I was capable of handling the challenges presented.
The task stretched my abilities without overwhelming me.
I felt challenged but able to succeed.
The task required my full skill but was manageable.
I had the necessary skills to complete the task.
I was prepared to face the task's difficulties.
Subscale 2: Absorption in Task (9 items)
I felt completely absorbed in the task.
I lost track of time while engaged in the exercises.
I was giving the task my all attention.
I put a lot of effort not the task.
I was completely engrossed in the activities.
As I worked on the assignment, everything else vanished.
I have been unaware of distractions when I was working.
I felt a strong connection to the task.

I was engaged without interruption

Appendix 2

Foreign Language Listening Anxiety Scale (FLLAS) Designed by Kim (2000)

Subdomain 1: Tension and Worry (10 items)
When I have to listen to English spoken quickly, I get nervous.
Listening to English causes me to feel tense and worried.
I get nervous before listening to an English conversation.
When I hear people who use English as their first language, I feel under pressure.
I worry I will misunderstand what is said in English.
When I listen to English in a formal setting, I get anxious.
Listening to English makes it difficult for me to relax.
I feel uneasy during English listening tests.
I get startled by unfamiliar English accents.
Listening activities make me feel uncomfortable.
Subdomain 2: Lack of Confidence (7 items)
I often doubt my ability to understand spoken English.
I feel unprepared when I listen in English classes.
I worry I won't be able to follow spoken English.
I lack confidence when listening to English speakers.
I am afraid of not understanding English conversations.
I feel insecure about my English listening skills.
I don't feel confident about my comprehension of spoken English.
Subdomain 3: Problems While Listening (16 items)
I find it difficult to concentrate when listening to English.
I frequently miss important information while listening.
I become confused when listening to speakers with different accents.
When encounter words that I do not comprehend, I become irritated.
I struggle to keep up with fast English speech.
I feel frustrated when I cannot predict what will be said next.
I lose track of conversations in English.
Understanding English listening materials is hard for me.
I find some listening exercises too challenging.
I find it difficult to remember what I hear in English.
Background noise distracts me when listening.
I need to replay English audio several times to understand.
I get overwhelmed by long English listening passages.
I find it difficult to listen for detailed information.
I feel anxious when listening to English lectures.
I avoid situations requiring extensive listening in English.