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An experimental study on the influence of instructional mobile applications in enhancing listening comprehension of rural students in India

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Introduction: Mobile learning (M-learning) is integral to language education, offering accessibility, portability, and diverse resources. It offers real-life language use with synchronous learning, flexibility, and an opportunity to engage with the global community. It allows learners to practice language skills from anywhere. This study aims to evaluate linguistic instructional mobile applications' effectiveness on listening comprehension among Indian rural students.

Methods: Pedagogic mobile applications were employed in an experimental study with 149 tertiary-level students from rural colleges in Tamil Nadu, India. Participants were divided into control ($n = 75$) and experimental ($n = 74$) groups. Pre and post-tests assessed listening comprehension levels, considering demographic variables. Different types of audio files were used in the intervention to improve the listening skills of the experimental group.

Results: Statistical analyses, including paired t -tests, independent t -tests, and ANOVA, revealed significant improvement in listening skills for the experimental group. Gender, locality, and parental income were considered as significant variables, showing that students from diverse backgrounds benefited from mobile applications.

Discussion: The results indicate that M-learning effectively aids rural students in overcoming language barriers, emphasizing the potential of mobile applications in language education.

KEYWORDS

mobile apps, listening skills, rural students, socio-economic impact, self-learning

1 Introduction

Effective communication skills are crucial for students to succeed academically and professionally. Due to different languages and cultural factors in multilingual countries, English is often considered as a second language. Here, English proficiency facilitates the exchange of knowledge, culture, education, and innovation (Dang and Vu, 2020). Since the English language is mandatory, mobile devices and their apps have become essential tools

in the field of English language teaching and learning with 5G technology. The COVID-19 pandemic increased the use of mobile devices and consumption of mobile data, and it also illuminated a better future for the development of the language learning field (Jonntan et al., 2022). According to Hoang et al. (2021), language instructional gadgets are utilized increasingly in the field of language teaching. Recent research has shown that productive use of language learning apps for just 30 min a day significantly improved English language proficiency (Booton et al., 2021). However, students from rural backgrounds are confronted by a variety of difficulties. These make it challenging to learn a language and include a lack of equipped institutions (Assunção Flores and Gago, 2020), socio-cultural barriers (Malik et al., 2021), financial difficulties, a lack of parental guidance, and a lack of motivation (Khan et al., 2020). It is crucial to practise listening in the language learning process and difficult to provide linguistic knowledge (Namaziandost et al., 2019). Thus, students struggle to learn the English language and this might be attributed to the lack of focus on language skills (Spada and Lightbown, 2019). When the aspects of the language learning process are looked into, concentration, understanding, and memory are the important components (Yüzlü and Dikilitaş, 2022). Thus, it is important to provide students adequate time to develop their listening skills in the classroom and promote self-learning (Hamid and Idrus, 2021). Many rural colleges are still using traditional teaching methods such as chalk and talk and textbook instruction methods and they are hindering the holistic development of students (Zengulaaru and Nyamekye, 2023). Language labs and software initialization are often expensive, so the institutions do not implement these, and thus the students have less chance to access and familiarize themselves with effective sources. The educational environment is not conducive to language knowledge for rural students. Hence, it hinders the students from having enough exposure to language skills. "By providing innovative mobile apps to rural students, we foster English language proficiency" (Akkara et al., 2021). Here, this study intends to investigate and explore the practical implication of utilizing mobile applications in language learning classrooms to foster the listening skills of those from rural backgrounds. Additionally, this study helps to understand the challenges of rural college students and promotes self-learning skills.

This quantitative study introduced the language learning apps from the Google Play Store (Android OS) to the students and converted the learning text into audio for learners in a rural setup and all used the applications denoted in Table 1. The following section discusses methodology including the research design, instruments used for the study, data collection technique, a geographical unit of the population, possible participants, sampling technique and selection strategy, and reliability of quantitative research instruments. Then, in the findings section, the quantitative findings are presented (types of analysis), respectively. Finally, a discussion and conclusion are given based on the research findings.

1.1 Research questions

The research questions (RQ) were framed based on the objective of the study in India.

TABLE 1 Listening materials.

Applications	Content track to the mobile apps
British Council app Listening	Beginner (A1)—A voicemail message and the first English class. Pre-intermediate (A2)—Transport. Intermediate (B1)—An introduction to a lecture, announcement, instruction for assignments, and a morning briefing. Upper intermediate (B2)—Business interviews, getting advice, joining a gym, talking about rumors, and a design presentation. Advanced (C1)—A project management meeting.
TOEIC	Part 1—Picture Description, Part 4—short talk
Listen English practice	Level A1—Baking Bread. Level B2—Shopping, Language of India and Tamil Nadu. Level C1 International—Shan's Family.

RQ1: Does the M-learning method enhance the listening skills in English of rural college students?

RQ2: Is there any impact on language learning by prior knowledge?

RQ3: Do demographic factors such as parental education, college environment, socioeconomic status, and locality impact language listening?

2 Review of literature

2.1 M-learning environment for education

Mobile-assisted language learning (MALL) is a subfield of computer-assisted language learning (CALL) (Kukulska-Hulme, 2021). Mobile devices allow users to download preferred apps for language study and the apps are available in these marketplaces. It allows students to learn English anytime, anywhere (Ameri, 2020). Ebadi and Raygan (2023) examined MALL with 223 Iranian students and found that the educational environment had a major impact on learners' perceptions of ease of use, facilitating circumstances, and perceived usability. Another study was carried out with 447 Saudi undergraduates and strongly predicted that the utilization of MALL was "promoting interest and reducing learning anxiety" (Alamer et al., 2022). Mobile learning is a promising alternative to traditional learning methods and promotes quality education (Al-Samarraie and Saeed, 2018). Mobile devices are mostly used to access open educational resources and online platforms, which are now essential in the education field (Kic-Drgas et al., 2023). According to the self-determination theory, the students could get learning guidance outside of the classroom through mobile devices (Annamalai et al., 2022). The Sustainable Development Goals (SDG 4.3) state that, by 2030, in education, students should have "equal access for affordable and quality technical, vocational and tertiary education, including university". This goal is in accordance with the usage of MALL in language classrooms. Moreover, technology can be a promising tool that fosters educational development if implemented properly. MALL, with its accessibility and adaptability, could be implemented and used in language classrooms with little investment compared

to CALL classrooms (UNESCO, 2015). MALL is a sustainable approach to education, promoting self-directed learning beyond classroom settings and also offers accessibility, portability, flexible learning environments, better interaction, and improved self-efficacy in English language learning performance (Jeong, 2022). MALL has accelerated the convergence of mobile technology with language learning and teaching (Colpitts et al., 2021).

2.2 M-learning method for listening skills

Mobile phones are becoming more multifunctional for users to enhance their listening skills in English (Uzoqova, 2023). These innovative techniques are employed in a variety of language learning contexts such as academic contexts, everyday communication contexts, virtual classrooms, and workplace contexts (Fredrick and Karthikeyan, 2018). Mobile phones provide different tones and accents of the English language in a single device. For example, podcasts and audiobooks, including listening apps, interactive listening exercises, and video content improve listening skills (Al-Jarf, 2021a). The voice recording option of the mobile device makes it possible to self-assess. Learners repeatedly listen to their voice and learn the correct phonics of the language (Reinders, 2010). Moreover, mobile phones are user-friendly to access online forums in real-life situations with native speaker settings (Islands, 2020). Through text-to-speech applications, users translate text into audio and gain a better understanding of the discussed topics. Several studies have shown that mobile applications have served as personal assistants for language learners to improve their vocabularies and translation abilities (Dokukina and Gumanova, 2020; Dizon et al., 2022). MALL has revolutionized the language learning strategy by providing flexibility, increasing curiosity, and emphasizing pronunciation and intonation for the English context (Cahyono et al., 2023). According to Al-Jarf (2021b), students can access TED Talks (TTs) from a range of applications and select materials depending on different factors such as the student's interests, degree of familiarity, the level of difficulty, and the complexity of both language and content to develop the intensive and extensive listening skills of the students in L2.

2.3 Status of listening skills of ESL students among rural-based colleges

The acquisition of a second language might pose a challenge for students from rural locations, mostly stemming from limited access to resources and a diminished level of enthusiasm (Paltridge and Starfield, 2019). In rural institutions, there is a lack of communicative competence, a limited number of trained teachers, and an unavailability of laboratory facilities, which hinders the listening practice of the learners (Hossain, 2016). Language learning is typically focused on the exam point of view. Hence, students have minimal exposure to a second language. As noted by Jeyaraj (2013), rural students mainly listen to their teachers' voices, there are no other options to practice listening skills and this increases the number of mistakes in speaking. Therefore,

rural students need more opportunities to practice listening skills. Additionally, the duration of a teacher's talking time (TTT) in English is limited in ESL classrooms (Faturrochman et al., 2021). Several pedagogical strategies have addressed the issue that most rural students struggle with, namely, comprehension of speaking discourse due to a lack of familiarity with word stress, sentence intonations, assimilation, and ellipsis in connected speech (Wu and Tarc, 2021).

2.4 Process of teaching listening skills

An effective teaching method for listening skills is providing hands-on experience for active engagement rather than didactic instruction (Mujumdar, 2017). Furthermore, it is essential for students to have the ability to employ listening skills that might aid their comprehension. It is recommended to develop activities and assignments that facilitate the enhancement of individuals' listening abilities. The following two approaches are prominently used for teaching listening skills through top-down and bottom-up processes and much research has been carried out on teaching listening skills by using these approaches.

The top-down process means ascribing meaning to language which involves internal knowledge utilizing various comprehension strategies for students. There are several challenging factors, such as accent, speech speed, prosody, and prior knowledge (Al Omari, 2019). The foundational step to teaching listening skills is a bottom-up process, which is effective for teaching listening activities to beginners, and the bottom-up process deals with ascribing meaning to language. The advantage of this process is that it is free from the challenges mentioned in the top-down process.

This process helps the listener to put together the message from the speech stream from pieces into whole information and also consists of detecting and parsing the speech stream progressively from auditory-phonetic to pragmatic (Newton and Nation, 2020).

3 Methodology

3.1 Participants

This study involved tertiary-level participants who were selected from three different types of colleges, namely, government, aided, and self-finance colleges, located in rural areas. All participants were first-year computer science students in Villupuram District, Tamil Nadu, India because it is predominantly a rural area where 75% of the population resides in the rural side. Additionally, 35.8% of the population in this district falls in the age group of 15–34 years, making it essential to invest in skill development to take advantage of the demographic dividend. The lack of infrastructure for accessing basic language skills has made English communication a significant challenge for workers in the service sectors, and students are quite unaware of the importance of language skills.

3.2 Research design

Figure 1 shows the flow of a true experimental study design. The target population of this study was arts and science college students and 35 arts and science colleges are in the selected district. There are different types of colleges, including 29 self-finance colleges, five government colleges, and one aided college. A simple random sampling method (Chawla and Sondhi, 2015) was used to choose the samples and a random number was generated for each type of college with the help of SPSS and three colleges were selected. The intervention was given only to the experimental group with the support of mobile apps and the control group was treated with the existing syllabus by the university. The intervention was carried out to enhance and test the listening skills of the participants and pre-tests and post-tests were employed for both groups (Sodhi and Neena, 2011).

3.3 Data collection procedure

This study involved 149 college students and data was collected using Testmoze software, which allowed for the easy incorporation of audio and video files for listening evaluations (Sangle et al., 2020). The Oxford Placement Test (OPT) tool was used to assess the homogeneity level of the students' listening skills, and a screening test was conducted before the intervention to divide the samples into two groups (Pajo, 2022). With the help of the screening test score, the participants were divided into groups based on a predetermined pattern. The pattern was determined by selecting every n th participant after an initial random start. For example, if the pattern was every 5th (Hariton and Locascio, 2018) (based on the screening test score) participant, after a random starting point, then participants 5, 10, 15, ..., 30 would be assigned to the same group and divided into control and experimental groups. Before the intervention, a pre-test was conducted to determine the students' listening comprehension levels. The experimental group received mobile app content in audio format from selected apps which are shown in Table 1 and guidance on using various English language-related mobile applications to practice listening skills for 8 weeks. A post-test was then conducted for both groups using closed-ended questions and the reliability was checked. The concept of reliability pertains to the capacity of questions or assessments to consistently yield identical outcomes when delivered repeatedly under comparable circumstances and was tested by use of a scale reliability test with a Cronbach's α value of >0.764 . The data were analyzed using SPSS software.

3.3.1 Data collection tool

The OPT is an English language proficiency assessment tool developed by Oxford University Press, used by educators and institutions to determine the appropriate level or placement of non-native English speakers in English language courses. The test is adaptive, with questions adjusted based on the test taker's responses. This adaptive nature allows for a more precise assessment of an individual's language proficiency. The OPT is quick and accurate, taking approximately 30–40 min to complete. It helps educational institutions determine the most suitable level

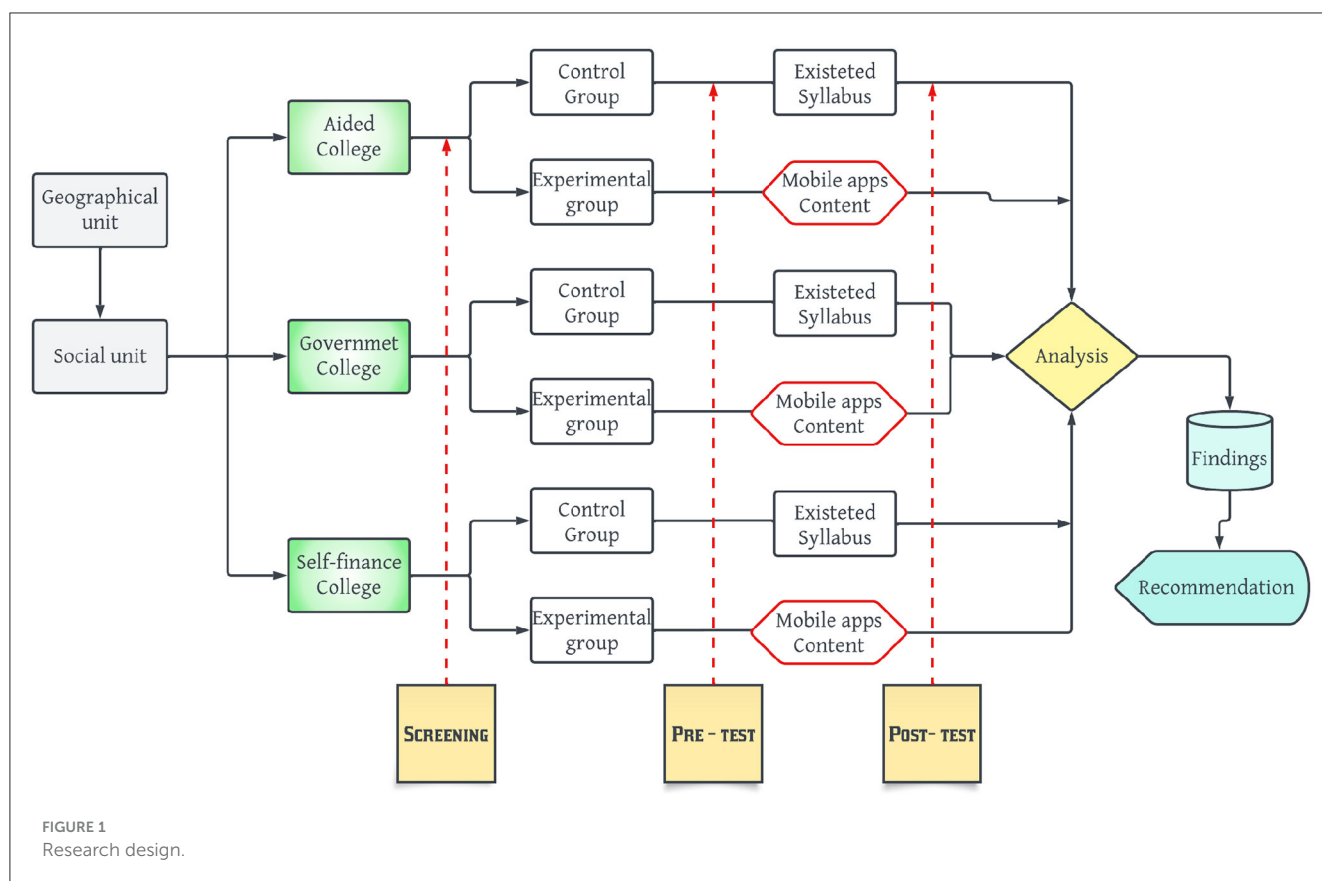
of English language instruction for students. The test assesses various language skills, including listening, reading, grammar, and vocabulary, providing a comprehensive overview of a test-taker's proficiency. It is aligned with the Common European Framework of Reference for Languages (CEFR), a common framework for describing language proficiency levels. The OPT helps educational institutions and language schools make informed decisions about meeting their student's language learning needs, enhancing the effectiveness of language instruction (Oxford University Press, 2023).

3.4 Teaching method and material for listening skills

This lesson aimed to enhance listening skills through the use of mobile applications. Table 1 shows the selected applications for the listening practice, which were chosen based on their rating, content, assessment, and user-friendliness. The content of the applications included listening to instructions, interviews with specialists, lectures, information, and descriptions. After the guided practice, students were encouraged to do independent practice using a self-regulated approach. The traditional chalk-and-talk method was avoided, and students were asked to listen to the audio content until they became familiar with the phrases and comprehended the content. The applications allowed users to listen to the content in offline or online mode, with interactive audio scripts available. Users could also re-listen to vocabulary or phrases if they missed them and these exercises were included in each episode, and students could monitor their own progress through the mobile assessment section (John Vijayakumar and Karthikeyan, 2019) and also Tang et al. (2022) mentioned that micro-lectures are more effective than traditional explanatory lectures. For the Listening Comprehension activity process, the question might involve listening to a short audio clip from the selected mobile apps mentioned in the table, such as a conversation or a monolog, and then answering questions about what students heard. For example, students were asked to listen to audio and answer the question following the audio. This exercise improved pronunciation of the language and helped to know how students comprehended the audio content. Testmoze software was used to conduct this process.

The intervention was implemented by following apps such as the British Council Listening, TOEIC (The Test of English for International Communication), and Listen English Daily Practice. "Learn English Podcasts", developed by the British Council, provides many audio clips that allow learners to acquire new vocabulary and phrases while improving listening skills. Exercises and audio scripts for each episode are provided to help a learner assess their comprehension. This program teaches learners how to pronounce words properly and learn the English sound system. Additionally, learners may record their voice and contrast it with the example pronunciation (British Council, 2024).

The "TOEIC" app is widely used to recognize English language proficiency and assess the English language skills of non-native speakers in an international context. Typically, it is used to measure the listening skills of the English language abilities of candidates and help individuals prepare for the exam (ETS, 2023). Specific activities carried out by this app include picture description and listening



to a short talk. The activity is followed by intermediate (B1) and upper-intermediate (B2) levels.

The “Listen English Daily Practice” app is designed to help users practice English listening skills. This app provides audio content such as dialogues, speeches, podcasts, and news articles for users to improve their comprehension. It offers various features for varying difficulty levels, interactive exercises, progress tracking, and a different collection of topics. For the purposes of this study topics such as baking bread, the language of India, and shopping were used, which are of the advanced (C1) level. These applications are available on the Google Play Store. The assessment section of these apps is framed with the help of the CEFR rubric scale pattern. The questionnaire is framed from the selected content such as choosing the best answer, true or false, arranging the phrases, and matching the phrases.

3.5 Data analysis

The magnitude of the samples is very important for the experimental study and it determines the significance of the study. G*Power calculator was used for sample size calculation, and this prior analysis was carried out before the experimental study. This software is used to estimate the sample size (n) and the software determines the actual power proportion of the population. The required to ascertain the effect size d (0.5), desired α level (0.05), and the power level is above 0.70. The power level was $(1-\beta)$ (0.80) for an independent t -test sample size of $n = 128$, $(1-\beta)$ (0.95) for

paired sample t -test and a sample size of $n = 54$, and $(1-\beta)$ (0.95) for F -test ANOVA (analysis of variance) and a sample size of $n = 129$ (Kang, 2021). The collected quantitative data were analyzed using the SPSS tool and no missing values were found in this data (Brace et al., 2016). The normality of the data was tested using the Shapiro-Wilk test. The p -value was found to be 0.164, which is >0.05 which means that the data were normal and so the data were eligible to carry out the parametric test.

3.6 Hypothesis

The null hypothesis (H_0) was formulated to test the experimental data collected by this study and whether the assumed statement of this study is true or not.

H_{01} : The M-learning method does not enhance the listening skills of rural college students.

H_{02} : The medium of instruction and an individual’s gender do not result in a change in listening skills.

H_{03} : Demographic factors such as college infrastructure, socioeconomic status, and parents’ education do not affect English listening skills among the students.

4 Results

Table 2 shows the demographic characteristics of the sample, and the frequency of gender, socioeconomic status, and home

locality of the participants were calculated to determine whether the demographic characteristics influenced the schema of learning or not.

4.1 Independent sample *t*-test

The independent samples *t*-test is a powerful tool to determine whether there are differences observed between two groups. Here, the authors inspected the differences between groups such as the control and experimental group, Tamil medium and English medium students, and male and female.

4.1.1 Control group and experimental group difference

Table 3 denotes a significant difference between the tests of the independent variable group in relation to the dependent variable. There was no significance in the pre-test results of the control group which yielded $M = 13.28$, $SD = 3.82$ and the score of the experimental group, which was $M = 12.73$, $SD = 3.61$. This test denoted the mean difference between the control and experimental groups in the pre-test. However, the difference was not statistically significant $t_{147} = 0.902$, $p = 0.369$, so the null hypothesis was accepted and there were no changes in the statement, which means that before the intervention, the students were at the same level of listening skill. The post-results of the two groups' values, $M = 16.08$, $SD = 4.43$ and $M = 20.96$, $SD = 3.58$, showed improvement when compared to the pre-test results. The experimental group yielded a high score when compared to the control group. In the post-test, the control group had a mean score of $M = 16.08$, $SD = 4.43$, while the experimental group had a much higher mean score of $M = 20.96$, $SD = 3.58$. The *p*-value ($p = 0.000$, $t_{147} = 7.376$) was less than $\alpha = 0.05$, indicating a significant difference between the groups in the post-test, so here the null hypothesis was rejected and the alternate hypothesis accepted. Finally, these results suggested that there was no significant difference between the groups in the pre-test, but there was a significant difference in the post-test, with the experimental group performing significantly better. Hence, the intervention made an impact on the student's listening comprehension.

4.1.2 Gender and medium of instruction difference

Table 4 shows the gender and medium of instruction difference through an independent sample *t*-test, with group one being gender and group two being medium of instruction. For group one, the result showed that the female group had higher values in the post-test ($M = 20.54$, $SD = 4.486$) than the male group ($M = 16.14$, $SD = 3.793$). This two-tailed *t*-test explored the difference between the female and male groups concerning the dependent variable. The post-test result was statistically significant, $t_{147} = 6.396$, $p = 0.000$. Hence, with a *p*-value < 0.05 , the null hypothesis was rejected. Therefore, the learning outcome differed among the gender groups. For group two, the independent *t*-test explored the different mean effects between the participants who underwent different mediums of instruction on the dependent variable. The results of the English

medium group yielded higher values in the post-test ($M = 19.96$, $SD = 5.36$) than the Tamil group ($M = 17.79$, $SD = 4.21$). A two-tailed *t*-test (equal variances assumed) examined the mean difference between Tamil and English medium groups for the dependent variable and the post-test result was statistically significant, $t_{147} = -2.696$, $p = 0.008$. Hence, with a *p*-value < 0.05 , the null hypothesis was rejected. Thus, the learning outcomes were not the same in the independent variables.

4.2 ANOVA (analysis of variance)

Table 5 shows the influence of demographic characteristics on learning such as college infrastructure, home locality, parental education, and socioeconomic status.

First, the ANOVA test was used to assess the statistical differences in the means of the post-test results of the three different colleges. Aided college students scored higher values ($M = 20.2$, $SD = 5.4$) than the government ($M = 17.7$, $SD = 4.28$) and the self-finance colleges ($M = 17.6$, $SD = 3.96$). A $p = 0.007$ denoted that there was a level of significant difference and the table value was $F = 5.16$. Hence, there was enough evidence to reject the null hypothesis. College environments and infrastructure influence language skill acquisition outcomes, yielding varied proficiency levels among students.

Second, the different types of localities influenced the post-test results of the participants. Urban students had a higher mean value ($M = 25.4$, $SD = 5.62$) than sub-urban ($M = 20.8$, $SD = 4.6$) and rural students ($M = 17.5$, $SD = 4.12$). The table value was $F = 16.256$ and $p = 0.000$ which was less than the level of significance $\alpha = 0.05$. Hence, there was enough evidence to reject the null hypothesis. The differences in results showed that there were changes in learning strategies by the home locality.

Third, socioeconomic status impacted the post-test results. Higher economic status students yielded higher scores ($M = 26.7$, $SD = 3.3$) than the middle ($M = 19.1$, $SD = 4.25$) and lower economic status students ($M = 17.8$, $SD = 4.41$). A $p = 0.000$, which was less than $\alpha = 0.05$, the level of significance, and the table value was $F = 14.337$. Hence, there was enough evidence to reject the null hypothesis, so there were differences in the result, and learning strategies varied based on socioeconomic status.

Table 6 compares all three college's results. First, the aided college results are compared with government college results. There was a statistically significant difference found as $MD = 2.484$ and $p = 0.021$, which was less than the level of 0.05. Second, there was a comparison of the results of the government college and the self-finance college and there were no significant differences between the mean values ($MD = 0.160$) and $p = 0.983$, which was higher than the level of significance of 0.05. Third, the same exercise was carried out for comparing the self-finance college results with the aided college results and there was a significant difference ($MD = -2.644$) with $p = 0.013$ found, which was less than the assumed significance of $\alpha = 0.05$. From the above discussion, the aided college had higher results than the self-finance college and the government college.

For the multiple comparisons between the home locality, a comparison was first carried out between rural students and suburban students. There was a statistical significance difference

TABLE 2 Frequency details of the samples.

Demographic characteristics		Frequency	Percentage	Total
Gender	Male	69	46.3	149
	Female	80	53.7	
Medium of instruction	Tamil	100	67.1	149
	English	49	32.9	
College	Aided College	49	32.9	149
	Government College	50	33.6	
	Self-finance College	50	33.6	
Control/exp group	Control group	75	50.3	149
	Experimental group	74	49.7	
Home locality	Rural	113	75.8	149
	Sub-urban	29	19.5	
	Urban	7	4.7	
Socioeconomic status	Poor	108	72.5	149
	Middle	34	22.8	
	Rich	7	4.7	

TABLE 3 Independent sample *t*-test for the control group and experimental group.

Control/exp group		N	Mean	Std. D	Std. error	<i>t</i>	df	Sig.	M D
Pre-test	Control group	75	13.28	3.829	0.442	0.902	147	0.369	0.550
	Experimental group	74	12.73	3.616	0.420				
Post-test	Control group	75	16.08	4.438	0.512	7.376	147	0.000	4.879
	Experimental group	74	20.96	3.586	0.417				

TABLE 4 Independent sample *t*-test for gender and medium of instruction.

Group			N	Mean	SD	<i>t</i>	df	Sig.	MD
Gender	Post-test	Male	69	16.14	3.793	6.396	147	0.000	4.393
		Female	80	20.54	4.486				
Medium of instruction	Post-test	Tamil	100	17.79	4.205	2.696	147	0.008	2.169
		English	49	19.96	5.358				

TABLE 5 Analysis of variance for colleges, home locality, parental education, and socioeconomic status.

Three different groups			N	Mean	SD	<i>F</i>	Sig.
Post-test	College	Aided College	49	20.2	5.4	5.1	0.007
		Government College	50	17.7	4.28		
		Self-finance College	50	17.6	3.96		
Post-test	Home locality	Rural	113	17.5	4.12	16.3	0.000
		Sub-urban	29	20.8	4.6		
		Urban	7	25.4	5.62		
Post-test	Socioeconomic status	lower	108	17.8	4.41	14.3	0.000
		Middle	34	19.1	4.25		
		Higher	7	26.7	3.3		

TABLE 6 Multiple comparisons of dependent variables.

	Comparison		MD	t	Sig.
College	Aided College	Government College	2.484	2.697	0.021
	–	Self-finance College	2.644	2.871	0.013
	Government College	Self-finance College	0.16	0.175	0.983
Home Locality	Rural	Sub-urban	–3.263	–3.66	0.001
	–	Urban	–7.933	–4.75	0.000
	Sub-urban	Urban	–4.67	–2.59	0.029
Socioeconomic status	Lower	Middle	–1.301	–1.53	0.282
	–	Higher	–8.927	–5.28	0.000
	Middle	Higher	–7.626	–4.24	0.000

The mean difference is significant at the 0.05 level.

found $MD = -3.26$, $p = 0.001$, and the p -value was less than the level of 0.05. Second, the table denotes the comparison of results of sub-urban vs. urban and there was a significant difference in the result ($MD = -4.670$) and $p = 0.029$ which was less than the level of significance of 0.05. Third, the same exercise was carried out among the students from urban and rural areas and there was a significance ($MD = -7.933$) as $p = 0.000$ was found. It showed that there was a significance, which was less than the assumed significance of 0.05. From the above discussion, the results from urban areas were the highest followed by suburban and rural. Hence the environment had a major impact on learning.

For the multiple comparisons between the socioeconomic status, the tested samples belong to the poor, the middle, and the rich. Firstly, the mean comparison was carried out between the lower-level economic and middle-level economic students. There was no statistical significance difference found with $MD = -1.301$ and $p = 0.282$, and the value was higher than the level of $\alpha = 0.05$. Second, the results of lower vs. higher-class students were compared. There was a significant difference found with $MD = -8.927$, as the $p = 0.000$ value was less than the level of significance of $\alpha = 0.05$. Third, the same exercise was carried out between the rich and the middle-class students' results. It showed that the results were significant with $MD = 7.626$ and $p = 0.000$, which was less than the assumed significance of 0.05. From above the discussion, the economically higher-level students had the highest results followed by the middle and the poor.

Table 7 shows Tukey's Honestly Significant Difference (HSD) test which was used to know the mean differences of the groups such as different types of colleges, home locality, and socioeconomic status. For the different types of colleges, we compared the means between different types of colleges (50 for the self-financed college, 50 for the government college, and 49 for the aided college) at a 0.05 significance level. There was no significant difference in the means between different types of colleges at the 0.05 significance level, suggesting no strong evidence to conclude that these types have statistically different mean values in the post-test results. Here, self-finance colleges and government colleges were in subset 1 and aided colleges are in subset 2.

For the home locality group, the test was used to compare the means between groups in three home localities (rural, suburban, and urban) with sample sizes for each. The results showed no

significant difference at the 0.05 significance level, with p -values of 0.082 for rural and suburban and 1.000 for urban and other groups. Rural and suburban were in subset 1 and urban was in subset 2 and had a different mean in the post-test. There was no significance within the subset, the p -value was 0.082 in subset one and 1.000 in subset two but the subset groups were significant.

For the socioeconomic group, the study used Tukey's HSD test to compare the means of three socioeconomic status groups (poor, middle, and rich) based on a specific variable. The sample sizes were poor: 108, middle: 34, and rich: 7. The study concluded that there was no strong evidence to conclude that these groups have statistically different mean values and the p -value was given as 0.983 in subset one and 1.00 subset two but the subset was significant. However, the mean was unequal. The performance of the lower and the middle-class students were in subset 1 and the higher-class students' results were in subset 2 and had a different mean.

5 Discussion

The mobile learning method has the potential to improve the English language skills of rural college students as it effectively helps to foster a better understanding of language usage in context; provides regular exposure to audio conversations; improves listening comprehension, accuracy, pronunciation, and active listening practice; and provides exposure to different accents. Through mobile devices, learners could easily engage with audio lessons and learners could use various resources such as podcasts, audiobooks, language learning apps, online videos, and conversation partners. Mobile devices provide quality content, self-motivation, internet connectivity, support to teachers, and transmit the cultural and linguistic context. Instructors can effectively utilize contemporary mobile technology to facilitate listening skills (Al-Jarf, 2021b). Access to smartphones and other mobile devices is limited in rural locations, making M-learning more difficult (Aliyu and Babayi, 2023). For optimal learning outcomes, high-quality devices and the internet are required. Self-motivation is especially important for rural students. Here, the researchers used the M-learning method to improve the listening skills of rural tertiary-level learners, and the hypotheses were statistically confirmed. Before the intervention, the students had low scores in listening

TABLE 7 Tukey HSD test of groups comparison among colleges, home localities, and socioeconomic status.

	Tukey HSDa,b	Subset for alpha = 0.05			
		N	1	2	Note
College	Self-finance	50	17.58		
	Government	50	17.74		
	Aided	49		20.22	
	Sig.		0.983	1.000	a. Uses harmonic mean sample size = 49.662.
Home locality	Rural	113	17.5		
	Sub-urban	29	20.76		
	Urban	7		25.43	
	Sig.		0.082	1.000	a. Uses harmonic mean sample size = 16.11
Socioeconomic status	Lower	108	17.79		
	Middle	34	19.09		
	Higher	7		26.71	
	Sig.		0.665	1.000	a. Uses harmonic mean sample size = 16.526.
b. All the group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed. Means for all groups in homogeneous subsets are displayed.					

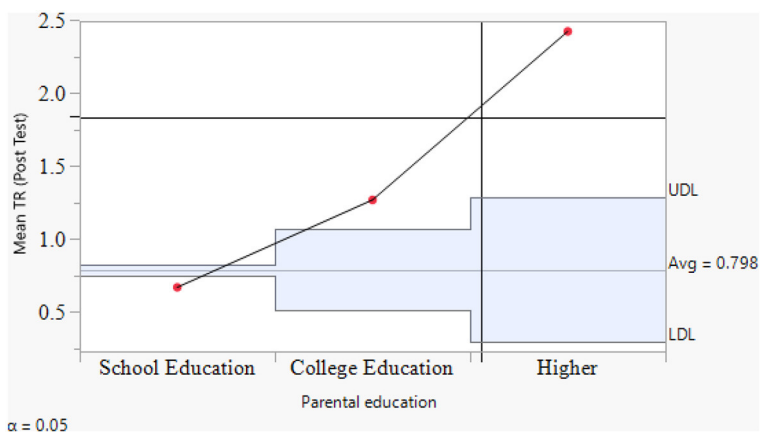


FIGURE 2 Analysis of means-transformed ranks for parental education impact.

comprehension and students had difficulty in understanding very basic vocabulary. However, it was proved that after implementing the mobile app training, the students had an improvement in their listening comprehension test scores which is shown in Table 3 and there was a significant difference in the pre-test and post-test means between the control and experimental groups. It is worth noting that none of the three colleges had language laboratory facilities for training sessions, but the researcher used mobile devices and applications to fulfill the fundamental skills required for the intervention.

There are listening difficulties among the different mediums (schools in English medium and other languages) of students and this statement is confirmed by this study. The problem being addressed is that many states in India still use regional languages for teaching, which presents challenges for students from non-English

medium backgrounds when they enroll in higher education. This has been demonstrated by a study conducted in Mumbai, which highlighted the difficulties faced by students who switched from non-English-medium schools to English-medium institutions (Tandon, 2015). In India, most higher education courses are taught in English. Thus, promoting English-medium education can help them to overcome their learning difficulties. The current study provides evidence of the impact of the medium of instruction on learning outcomes. Students from English-medium backgrounds scored higher in the post-test compared to students from Tamil-medium backgrounds which is shown in Table 4. This highlights the importance of promoting English-medium education to ensure better learning outcomes.

Gender perspective: There are differences in listening comprehension from a gender perspective. A neuro-audiologist

from Indiana University School of Medicine conducted a study on how male and female brains work while listening and found that there is a difference between the two genders (Namaziandost et al., 2018). Brain scans revealed that while listening, males use only one side of their brain, while females use both sides. This physical difference has an impact on listening comprehension, as demonstrated by the study's results, which showed differences in listening scores between males and females through this study. However, it is important to note that the study only focused on listening for the gist and specific information, and did not cover higher critical thinking skills. The independent *t*-test examined the gender difference of the participants who underwent different learning conditions which are shown in Table 4.

Demographic factors such as parental education, college environment, socioeconomic status, and locality can significantly impact language learning. Parental education levels have a strong correlation with a child's language development, with higher-educated parents having more exposure to enriched language environments. The educational status of the parents also impacts the learning comprehension of the students. The result statements proved positive through this study. Wong and Samudra (2019) confirmed that parental education is one of the important factors for second language learning and results in more chances to listen to many phrases from their parents. Learning does not end in the classroom, as parents also play a crucial role in their children's intellectual growth. However, many parents find it difficult to support their children due to their daily responsibilities, financial constraints, language barriers, and inflexible work schedules. As a result, there are limited opportunities to engage in educational activities (Durisic and Bunijevac, 2017). In this study, out of the 149 students, 123 students' parents had completed school-level education, while only 15 parents had completed college-level education, and five parents had had higher education. Figure 2 clearly shows how parental education supports their children. The vertical axis shows the post-test score of the students and the horizontal axis shows the parents' education level. The line connecting the data point is based on the sequential marks and indicates the students' scores. Accordingly, school-level parents' children have got 0.5–1.0 and higher-education-level parents' children have got 2.0–2.5 in the listening post-test. Thus, children's education is influenced by the parents. Although the majority of parents have school-level education, it has limited influence on second language learning, and there is a limited transfer of knowledge from parents to their children.

Socioeconomic status (SES) significantly impacts language learning exposure through access to educational resources (Aloui and Eldin, 2020), early language exposure, enriched learning environments (Azzolini et al., 2022), quality education, technology access (Kim, 2020), peer influence, stress and economic barriers (Webb and Doman, 2020), and educational disparities. Higher SES individuals have access to high-quality schools, experienced teachers, and advanced language instruction, while lower SES individuals may face economic challenges and limited access to language-enriching opportunities. Additionally, educational disparities in funding and quality can limit language learning opportunities for lower SES individuals (Rowe and Perry, 2020). Students from affluent backgrounds gained more wealth and benefits by using a variety of high-tech devices for learning

such as smartphones, and computers (Heath et al., 2015) and spending money on a good quality device. Cao et al. (2020) demonstrate that technology integration infrastructure promoted effective English language teaching and learning. Having a good educational infrastructure is an essential component for providing congenial exposure to students. However, these types of facilitation are not possible for those from lower SES backgrounds. When practicing a new language, the less affluent learner has inter-facial interaction with teachers and fellow students in and out of the classroom. Locality can impact language learning opportunities. Multilingual or multicultural areas offer opportunities to learn multiple languages, while isolated or homogeneous areas may limit exposure. Thus, students with rural backgrounds face challenges (Babikko and Razak, 2014) and this study proved the learning differences. Table 6 showed the multiple comparison results of the three different statuses of the students.

College environments can also impact language learning, especially for foreign language students or non-native English speakers. The college environment exposes students to academic language and cultural aspects. There are learning differences among the students based on the college infrastructure. In this study, the listening activities of students from three different colleges were examined: self-financed, government, and aided. The aided college provided higher language exposure to students, such as audio-video classrooms, and allowed students to bring personal devices and guided them to use them for educational purposes. Table 7 presents the differences in results between the colleges. Students attained linguistic knowledge by listening to e-materials through devices.

6 Conclusion

Studies have demonstrated that mobile learning could effectively promote listening skills in second-language learning by implementing the mobile learning method. This method can also cultivate learner autonomy and allow learners to take charge of their learning process by providing them with interactive learning activities. Mobile technology has become an integral part of our daily lives, offering learners unparalleled convenience and enabling them to accomplish tasks that were previously impossible. The M-learning method saves time, allowing learners to access a wealth of digital resources. The digital tools, such as audio and video materials, in ESL classrooms, have been successful in enhancing listening skills. Mobile apps promote multisensory learning, including listening, watching, and interacting. Teachers prefer language-related apps for language learning and use them to conduct listening skill tests, although the Tamil Nadu government board of studies does not conduct listening and speaking tests in board exams. The use of authentic communication materials can help in skill development. Technologically adept students can identify appropriate digital tools for learning, and using the M-learning method, could enhance their listening skills. However, it is unclear how well smartphone apps will help college students learn English. MALL, a novel teaching strategy for Indian students, is gaining acceptance, although it is still unclear how they feel about it. College students have more options because of the variety of apps. There are not enough ideas for useful apps or instructions on how to utilize them well. To comprehend

these problems and create better methods for college students to learn English through mobile apps, further empirical research is required. According to the report, college students are increasingly using their mobile devices. The self-regulated technique for studying English is only appropriate for college students who have self-control and can persevere in doing so. For Chinese college students, using self-regulated smartphone apps to learn English was a novel strategy. The use of mobile apps for English learning benefits students. According to earlier research, children can learn languages effectively and efficiently by using mobile apps. This helps educators and policymakers to focus on ensuring equitable access to educational resources and support for learners from diverse backgrounds.

6.1 Limitations and future scope of the study

The study has certain limitations in that it is solely on listening skills and the content of mobile apps and related to the listening skills of tertiary-level students. The recommended apps are based on the proficiency level of ESL learners, specifically targeting first-year undergraduate computer science students in rural colleges. This study did not focus on the analysis of students' complex cognitive process of listening skills. It is fully focused on the sub-skill of listening with the M-learning method's effectiveness. It is a short intervention of only four weeks for each college. These factors suggest the need for further research on all micro-listening skills' effectiveness and the need for longitudinal studies with larger-scale samples to understand the effects of this approach and explore other strategies to improve student's learning outcomes. For future research in the same field, the researcher suggests exploring common drawbacks of M-learning, such as the potential for students to encounter inappropriate content or become distracted by other activities while using mobile devices. Furthermore, the need for electricity and internet access may limit the availability of M-learning for some individuals. Finally, there may be negative effects on socialization and health, particularly eye strain and poor posture, associated with prolonged use of mobile devices.

6.2 Recommendations

The use of mobile phones in classrooms for language learning is crucial in education. To ensure effective implementation, schools and government entities should develop clear policies, provide teachers with training, select appropriate apps, address device access and equity, ensure network infrastructure supports mobile devices, emphasize cybersecurity and privacy, train teachers on effective classroom management strategies, encourage collaborative learning through mobile-based activities, and use mobile apps for instant feedback and language proficiency assessment. Governments should invest in supporting schools in acquiring mobile devices, educational apps, and teacher professional development. They should also promote digital

literacy, integrate mobile-assisted language learning into national curriculum standards, support research on its effectiveness, invest in broadband accessibility, implement equity and inclusion policies, enforce data security and privacy regulations, and provide incentives for professional development in mobile-assisted language learning. The recommendations suggest that schools and governments can effectively utilize mobile phones for language learning, ensuring responsible implementation, improving education outcomes, and promoting equitable access to technology, while also ensuring responsible and effective implementation.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The requirement of ethical approval was waived by the Vellore Institute of Technology Institutional Ethical Committee for Studies on Human Subjects. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AR: Conceptualization, Data curation, Formal analysis, Methodology, Writing—original draft. PT: Supervision, Writing—review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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