ISSN 1799-2591 (print); ISSN 2053-0692 (online)
Theory and Practice in Language Studies, Vol. 16, No. 5, pp. 1411-1422, May 2026
DOI: https://doi.org/10.17507/tpls.1605.01

# Fostering Learner Autonomy Through an AI-Integrated CALL Framework for Developing Undergraduate Listening, Speaking, Reading, and Writing Skills

Jayasri Suma. V*
Department of English, Aditya University, Surampalem, India

Ramesh Pettela
Department of English, Aditya University, Surampalem, India

*Abstract*—**Artificial intelligence has developed rapidly and started to interfere with English language teaching in India across regional universities, where traditionally undergraduate learners remain less engaged in listening, speaking, reading, and writing (LSRW) skills. Against this backdrop, the study has attempted to design, implement, and evaluate an AI-Integrated CALL framework to enhance LSRW skills and learner autonomy among undergraduates of a regional public university in Uttar Pradesh. A mixed methods sequential explanatory design has been adopted in this study, where, in a purposive sampling, 150 second-year undergraduate students (B.A., B.Com., B.Sc.) were divided equally into two groups: an experimental group and a control group. In terms of data compilation, the research involved pre-and post-tests of LSRW proficiencies using adapted CEFR descriptors, administration of a modified learner autonomy questionnaire, AI-usage logging, interviews and focus groups, and reflective journals. The quantitative analyses (t-test, ANOVA, regression, and Tukey HSD) established that the experimental group had a statistically significant improvement over all the domains of LSRW with autonomy and regular AI tool use being strong predictors of performance, whereas the qualitative findings showed enhancement in self-regulation, motivation, and perception of the role of learning, and discussed hazards such as digital access and digital literacy. AI-CALL has expedited the democratization of access to personalized language learning and functional communication and autonomy in resource challenged Indian higher education, subject to careful consideration of disciplinary and infrastructural contexts.**

*Index Terms*—**AI-Integrated CALL, learner autonomy, LSRW skills development, Mixed-Methods Research**

## I. Introduction

The increasing integration of Artificial Intelligence (AI) in education has revolutionized the conceptualization, delivery, and assessment of language learning, particularly in multilingual and resource-constrained contexts such as India (Cope et al., 2021; Jaiswal & Arun, 2021). Teacher-centred instruction has been the main characteristic of traditional English teaching in India for a long time, along with reliance on textbooks, and limited practice with listening, speaking, reading, and writing skills, especially in large undergraduate classes where personalized feedback is not possible, as these skills get little attention (Patni & Dawar, 2025). Even though the use of communicative and task-based approaches has made some contribution to higher education in terms of interactivity, the educational system continues to use primarily rote learning and exam-oriented methods (Kadam & Pusawale, 2023). The introduction of Computer-Assisted Language Learning (CALL) opened new doors for technology-based practice (Hubbard, 2023), but previous CALL models were non-interactive and non-adaptive (Yao et al., 2025). The use of AI technologies together with their standards of natural language processing, automatic speech recognition, adaptive learning systems, and intelligent tutoring has turned CALL into a lively paradigm that promotes personalized, independent, and context-sensitive learning (Zhao, 2025). The AI-Integrated CALL framework goes beyond traditional CALL in providing real-time monitoring, adaptive task difficulty, and personalized feedback that help learners to take control of their learning processes (Kovalenko & Baranivska, 2024). In the case of India's diverse and large classrooms, AI-driven CALL has lessened the differences in exposure, practice, and feedback, especially in areas with limited resources. AI-enabled CALL systems are thus essential for the development of LSRW skills: online listening platforms assess comprehension in real-time (Abdellatif et al., 2024; Raza et al., 2024); recognition tools for speech in free settings improve speaking proficiency (Napitupulu & Dalimunte, 2025); adaptive reading platforms help understanding by altering text difficulty (Chatzichristofis et al., 2025); and automated writing evaluation tools provide feedback on correctness and coherence

* Corresponding Author.

(Bahari, 2025). Although the world has made great strides in technology, the number of Indian studies focusing on AI-integrated CALL is very small and mostly limited to urban areas, thus neglecting the semi-urban and rural areas. More so, the earlier studies usually separated the four language skills of listening, speaking, reading, and writing (LSRW), instead of integrating them together in a holistic way. To fill the voids of the existing literature, the proposed empirical study intends to examine the application of an AI-Integrated CALL framework at a public regional university in Uttar Pradesh, which is aimed at facilitating learner autonomy in the LSRW among undergraduates. Its goals are to create an AI-driven CALL model tailored to Indian undergraduate students, contrast its impact with that of traditional teaching approaches, and investigate its contribution to the development of learner autonomy through AI-supported feedback, monitoring, and self-regulation processes.

## II. Literature Review

Recent worldwide studies indicate a revolutionary effect of AI-based Computer-Assisted Language Learning (CALL) on the learners' involvement, motivation, and independence through different contexts. Bahari et al. (2025) reported a remarkable improvement in students' enthusiasm, involvement, and language through personalized tutorials and active feedback. In the same manner, data from Zhang et al. (2025) pointed out that CALL-related activities in China were an important reason for increased learner autonomy and vocabulary intake through self-initiated efforts. Moreover, the qualitative analysis showed the development of more considerable cognitive flexibility and independent learning inclinations. The research of Namaziandost (2025) revealed that interactive learning through automation significantly developed both the writing skills and mental comprehension of Iranian EFL learners. In a different study by Zhou et al. (2025), it was observed that Chinese university students utilizing AI chatbots as a part of mobile-assisted blended learning (MABL) not only elevated their communication skills but also improved accuracy and satisfaction. Nopas (2025) pointed out the dual role of AI in teaching in Thailand, indicating that even though there was more engagement and feedback, there was also less space for creativity due to the control of algorithms and the digital divide that impacted countryside students. Hong and Guo (2025) mentioned that AI-based multi-screen instruction made the students more enthusiastic, more independent and in control of their own tasks, while Zong and Yang (2025) emphasized that social-emotional learning through AI had a major positive impact on students' psychological well-being and involvement.

Sehlaoui (2024) engaged in an investigation of the role of AI in the creation of autonomous cognitive abilities in Algerian foreign language education and discovered a slight similarity in learners' attitudes between the French and English programs. Shanthi et al. (2024) unveiled a model backed by AI that was able to tune the feedback and questions according to the comprehension levels of the individual learners, thus positively contributing to the realm of interpersonal communication skills development. Aufa (2025) researched the Busuu online language platform and deemed it effective in the development of learners' autonomy and speaking fluency, notwithstanding technical and accessibility problems. Feng (2025) evaluated AI-assisted teaching, which included intelligent tutoring and speech recognition, indicating a better learning outcome and a lower cognitive load. Wang (2025) verified that the AI-powered teaching approach resulted in a decrease in student apprehension and a rise in motivation, joy, and English language proficiency. Moreover, Zhang et al. (2025) pointed out the mediating functions of technological optimism and anxiety reduction, declaring that AI literacy promotes communicative confidence in EFL learners.

Together, these studies—conducted in China, Iran, Thailand, Algeria, and other places—confirm that AI-based computer-assisted language learning (CALL) is beneficial for the learners' autonomy, engagement, and listening, speaking, reading, and writing (LSRW) skills (Bahari et al., 2025; Zhang et al., 2025; Namaziandost, 2025; Zhou et al., 2025; Nopas, 2025; Hong & Guo, 2025; Zong & Yang, 2025; Sehlaoui, 2024; Shanthi et al., 2024; Aufa, 2025; Feng, 2025; Wang, 2025). Nevertheless, the bulk of the studies is focused on East Asia and the Middle East, ignoring the socio-cultural, infrastructural, and pedagogical challenges faced by Indian undergraduates, particularly in the case of regional public universities where the traditional method of teaching remains dominant. Moreover, previous studies often address isolated aspects such as motivation or a single skill, rather than integrating all four LSRW components with learner autonomy. To bridge these gaps, the present study proposes and evaluates a comprehensive AI-integrated CALL framework designed to holistically develop LSRW skills and learner autonomy among undergraduates at a regional public university in Uttar Pradesh, India.

### *Theoretical Framework and Hypothesis Development*

The current research on an AI-based CALL model to enhance learner agency in undergraduate listening, speaking, reading, and writing (LSRW) in India is established on two related theoretical approaches: Constructivist Learning Theory (Bada & Olusegun, 2015) and the Technology Acceptance Model (TAM) (Davis, 1989). The Constructivist Learning Theory is an active, self-directed, and socially situated process in which the learners construct knowledge through interaction, reflection, and scaffolds (Kharroubi & ElMediouni, 2024). In this view, the learner is not a passive recipient of information but rather an agent that creates meaning through interaction with learning resources, fellow learners, and tools (Bonk & Cunningham, 2012). The CALL framework, used in the present study and combined with AI technologies to form the LSRW development, is consistent with the principles of constructivism because it offers an environment of self-guided practice, feedback flexibility, and reflection. AI-driven listening apps like BBC Learning

English and Duolingo Stories dynamically adjust the difficulty level, enabling the learner to complete zone of proximal development (ZPD) activities that are challenging, but not too challenging. Likewise, speech-generating programs based on AI, such as ELSA Speak or Hello English, can enable one-to-one correction of pronunciation, just as peer and teacher scaffolding would in a large classroom setting where little individual attention is available. Constructivism, therefore, renders AI-CALL as a context in which learners gradually advance to self-regulation through guided practice towards gaining autonomy by owning their progress in LSRW skills (Du, 2025).

To supplement the constructivist approach to pedagogy, the Technology Acceptance Model (TAM) offers the theoretical basis to consider the way learners interact with AI-based CALL interventions and perceive them. TAM was originally theorized by Davis (1989) on the basis that perceived usefulness (the belief that a technology improves performance) and perceived ease of use (the belief that a technology does not require any effort) are two fundamental determinants of user acceptance, adoption, and long-term engagement. TAM is very applicable in the Indian higher education scenario, especially in a regional governmental university in Uttar Pradesh, where there is a range of exposure to digital in the community of learners. Because of this, access to digital tools by undergraduate students is frequently not equal, and their readiness to implement AI-CALL is determined by their feelings about whether or not these tools genuinely enhance their language competence and their ability to use them without a high level of technical skills. TAM thereby aids in the understanding of the difference in participation among learners using CALL and how AI tool attitudinal views affect skills development and learner autonomy.

Constructivist Learning Theory and TAM, in particular, are synergies that are particularly important to this study. TAM describes the psychological and behavioural adoption processes (Liao et al., 2018). When the learners believe the AI-CALL tools to be useful and easy to operate with, they can more easily engage with them, continue to practice, and become autonomous. Here, in this integrated framework, learner autonomy is both a result of constructivist interaction and a component of technology acceptance, and LSRW skills development is mediated by the pedagogical affordances of AI tools on the one hand and motivation conditioned by the attitudes of learners on the other. The overlap between these theories can be used to achieve a comprehensive view of how CALL interventions can be translated into quantifiable changes in the aspects of language competence and independence of learners. The hypotheses are formulated on the basis of this theoretical background. Based on the Constructivist Learning Theory, first, it is assumed that AI-based CALL framework students will show significantly better LSRW skills improvements than students who receive traditional instruction (H1). The adaptive feedback mechanisms inherent in AI technologies would yield better improvements in proficiency because constructivist pedagogy is based on scaffolding that is learner-centered. Since TAM is based on attitudes, it is assumed that the positive perceptions of AI-CALL will differ among student demographics (program of study), which will have a different impact on the development of LSRW (H2).

## III. Research Methodology

The present study employs a rigorous mixed-method sequential explanatory design to investigate how an AI-based Computer-Assisted Language Learning (CALL) framework has enhanced learner autonomy and improved listening, speaking, reading, and writing (LSRW) skills among undergraduate students in a regional public university in Uttar Pradesh, India. English, being a compulsory subject in these institutions, is often taught in teacher-centred, textbook-driven environments, leading to uneven proficiency levels. The research is focused on the second-year undergraduates from different fields of study, Arts, Commerce, and Science, thus guaranteeing a variety of disciplines without losing comparability. A purposive sample of 150 students is equally split into an experimental group (AI-based CALL instruction) and a control group (traditional classroom instruction), with the same number of students in both groups having similar background in English and technology. The AI-based CALL intervention gradually develops all four LSRW skills while creating learners' independence. For the listening skill, there are tools like BBC Learning English, Duolingo Stories, and ELSA Listening Lab that offer adaptive comprehension exercises with instant feedback. For speaking practice, there are ELSA Speak, Hello English, and Google Read Along applications that allow practicing of pronunciation and fluency with AI-based feedback. Through adaptive vocabulary and comprehension tools like Newsela and Quillbot Summarizer, which monitor progress and suggest appropriate texts, reading skills are enhanced. For writing, platforms such as Grammarly, Cambridge Write & Improve, and Quillbot Paraphraser provide automated feedback on grammar, coherence, and lexical variety. Reflective journaling, goal-setting activities, and AI-driven progress dashboards, moreover, build self-regulation and reflective learning, which are the main aspects of learner autonomy. Meanwhile, the control group undergoes an old-fashioned method of teaching consisting of lectures, textbook exercises, and teacher-marked assignments with little personalized feedback or technology integration.

Data collection includes three main stages: (1) a pre-test that aims to find out the level of proficiency and autonomy of the participants; (2) a 12-week intervention synchronized with an academic semester; and (3) a post-test for evaluating the outcomes. The quantitative data consist of standardized assessments of LSRW skills (adapted from CEFR) and a Learner Autonomy Questionnaire (modified and validated through pilot testing), both of which are analyzed by means of paired and independent t-tests, ANOVA, and regression analysis to establish the links among CALL exposure, autonomy, and skill development. The reliability is measured through Cronbach's alpha, and the construct validity is confirmed through factor analysis.

The qualitative aspect of the research involves semi-structured interviews with a total of 20 students from the experimental group, focus group discussions with students and faculty, and the analysis of reflective journals. The resulting data will be analyzed thematically using open coding to highlight the themes of motivation, perceived usefulness of AI tools, and barriers to autonomous learning among the participants.

The research location, which was an under-resourced state university in the Indian state of Uttar Pradesh, was chosen intentionally to display the digital and teaching divide between urban and rural institutions in India, where the use of computer-assisted language learning is still very limited. The study is conducted ethically through informed consent, voluntary participation, anonymity, and institutional approval. This research uses a combination of statistical rigour and qualitative depth to be already comprehensive, sure of how and why AI-based CAL frameworks could be a great help in developing learner autonomy and LSRW proficiency in the sociocultural and infrastructural context of Indian regional universities.

## IV. Results

### *A. Quantitative Findings*

Findings of this research give a broad picture of how an AI-based CALL system can be used to promote learner autonomy and contribute significantly towards improving LSRW skills in undergraduates in a regional state university in Uttar Pradesh. Table 1 provides the demographic data of the participants (N = 150), which will provide the necessary background regarding the interpretation of the outcomes of the intervention. The sample is also fairly balanced in gender, and 48 percent of the surveyed are men and 52 percent are women, which means that no gender is overrepresented in the results. The values of age distribution indicate that the greater part of students (86.7) is between the ages of 18-21, which is the average undergraduate age in India. Students with BA, BCom, and BSc programs provide a disciplinary diversity, with the biggest share of students with BA programs (40%), the middle and the end share of BCom (33.3%), and BSc (26.7). This disciplinary combination is especially important since CALL application and learning patterns might be different based on subject exposure, e.g., BA students in many cases have a more language-centred curriculum than BSc students. The exposure to CALL technologies was quite uneven, as 46.7% of respondents had low exposure, 40% moderate, and 13.3% high exposure. This implies that the vast majority of the study participants came into the research with little knowledge about the AI-based CALL applications, which speaks to the novelty and the possible effectiveness of the intervention program. These demographics, combined with each other, represent a typical demographic of a regional university in North India, which justifies generalizing the results to other regional universities.

Table 1
Demographic Profile of Participants (N = 150)

| Variable | Category | Frequency | Percentage (%) |
|---|---|---|---|
| Gender | Male | 72 | 48.0 |
| | Female | 78 | 52.0 |
| Age (years) | 18–19 | 60 | 40.0 |
| | 20–21 | 70 | 46.7 |
| | 22–23 | 20 | 13.3 |
| Program of Study | BA | 60 | 40.0 |
| | BCom | 50 | 33.3 |
| | BSc | 40 | 26.7 |
| Prior Exposure to CALL | Low | 70 | 46.7 |
| | Moderate | 60 | 40.0 |
| | High | 20 | 13.3 |

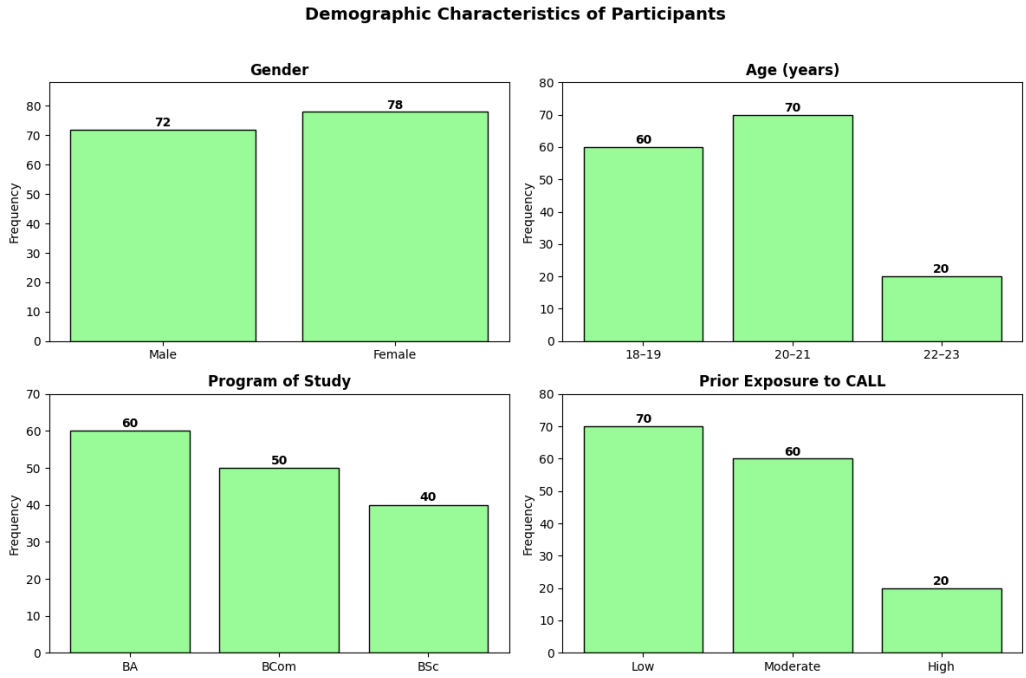


Figure 1. Demographic Characteristics

Table 2 displays the comparison of the pre-test and post-test scores of the control and the experimental group. The performance of the control (M = 42.8, SD = 5.4) and experimental groups (M = 43.2, SD = 5.3) at the baseline was statistically the same, which indicates that the groups were similar at the beginning of the intervention. However, the results of the post tests are bleak. The experimental group made a tremendous jump in its mean score to 58.4 (SD = 4.8), whereas the control group scored a small step up to 45.1 (SD = 5.6). The control group had a mean difference of 2.3, which was significant but small ($t = 3.21$, $p = 0.002$) and showed no major gains through traditional instruction. Opposed to that, the experimental condition gained an increase of 15.2 points ($t = 18.45$, $p < 0.001$), which is a distinct difference and a sign of the great power brought by AI-interventions through CALL. Thus, the result suggests that the AI framework did not just support the learning process but also made it much faster than the traditional way of teaching through lectures. The significant disparity in post-test results demonstrates the possibilities of adapting feedback, independent practice, and individual learning tracks with the help of AI.

TABLE 2
COMPARISON OF PRE-TEST AND POST-TEST SCORES IN CONTROL AND EXPERIMENTAL GROUPS

| Group | N | Pre-test Mean (SD) | Post-test Mean (SD) | Mean Difference | t-value | p-value |
|---|---|---|---|---|---|---|
| Control | 75 | 42.8 (5.4) | 45.1 (5.6) | 2.3 | 3.21 | 0.002* |
| Experimental | 75 | 43.2 (5.3) | 58.4 (4.8) | 15.2 | 18.45 | <0.001* |

*Significant at $p < 0.05$

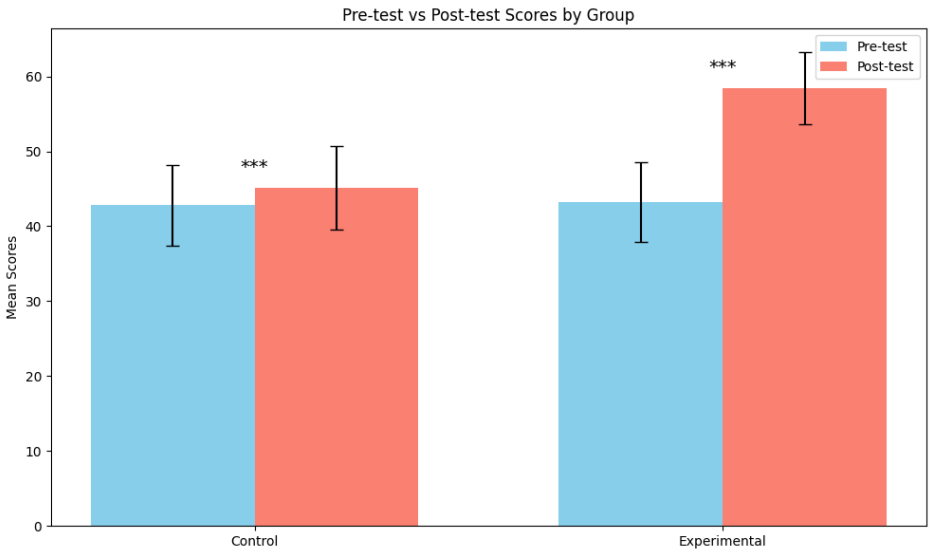


Figure 2. Overall Scores Comparison Between the Groups

Table 3 further breaks down the area of the skill by comparing the pre- and post-test scores in Listening, Speaking, Reading, and Writing individually. The performance of the control group also has a minor improvement in all skills, with an average of around 1 point of improvement per skill. To illustrate this, Listening was changed to 12.0, then Speaking changed to 11.6, Reading changed to 12.2, and Writing changed to 11.3. These increments are even consistent with what one would expect out of exposure to classroom-based activities, but they are, at the same time, relatively modest. Conversely, the experimental group showed a considerable improvement at all LSRW domains. Listening increased 11.0 to 15.5, Speaking increased 10.8 to 15.0, Reading increased 11.2 to 15.8, and Writing increased 10.9 to 15.6. Such advantages of the AI-based CALL tools of about 4-5 points per skill point to the fact that they are acting as holistic communication tools. ELSA Speak and Hello English platforms probably led to improvements in speaking and listening with real-time feedback on pronunciation and adaptive listening activities, whereas Grammarly and Write and Improve platforms may have improved writing skills with constant and automatic feedback. Likewise, Newsela and Quillbot were used to aid reading comprehension by the use of scaffolded exercises and summarization tools. The coordinated growth of all of the LSRW skills supports the synergy of the CALL framework.

TABLE 3
PRE-TEST AND POST-TEST SCORES BY LSRW SUB-SKILLS (CONTROL VS EXPERIMENTAL)

| Group | N | Listening | | Speaking | | Reading | | Writing | |
|---|---|---|---|---|---|---|---|---|---|
| | | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Control | 75 | 10.8 (1.5) | 12.0 (1.6) | 10.5 (1.7) | 11.6 (1.8) | 11.0 (1.6) | 12.2 (1.7) | 10.5 (1.6) | 11.3 (1.7) |
| Experimental | 75 | 11.0 (1.4) | 15.5 (1.5) | 10.8 (1.5) | 15.0 (1.6) | 11.2 (1.5) | 15.8 (1.4) | 10.9 (1.5) | 15.6 (1.5 |

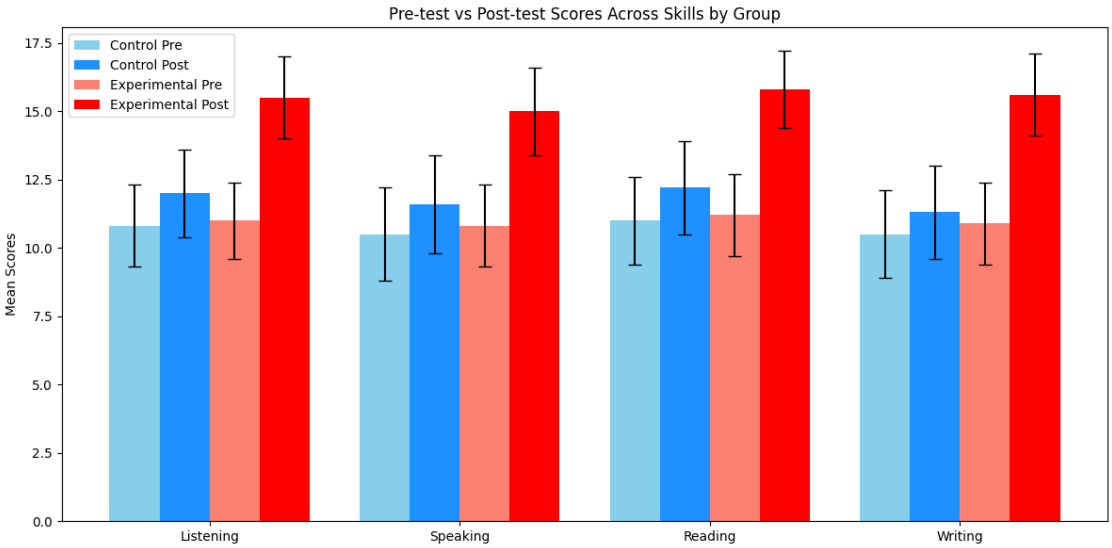


Figure 3. Scores Comparison Between the Groups Across Skills

Table 4 verifies the statistical significance of the difference between the control and experimental groups in post-test performance using an independent t-test. The experimental (M = 58.4, SD = 4.8) and control groups (M = 45.1, SD = 5.6) had a significant difference between them with a t-value of = -15.67 ($p < 0.001$). The size of the difference is a response to the strength of the intervention. The gains of the control group, though statistically significant, are insignificant when compared to the gains of the experimental group, which once again proves that traditional methods, though functional, do not as effectively utilize learner autonomy and provide personalized feedback on the same level as AI-assisted CALL.

TABLE 4
INDEPENDENT SAMPLE T-TEST BETWEEN CONTROL AND EXPERIMENTAL GROUPS (POST-TEST)

| Variable | Group | N | Mean | SD | t-value | p-value |
|---|---|---|---|---|---|---|
| LSRW Skills Post-test | Control | 75 | 45.1 | 5.6 | -15.67 | <0.001* |
| | Experimental | 75 | 58.4 | 4.8 | | |

* Significant at $p < 0.05$

Table 5 displays the results of the ANOVA to compare scores after testing for the experimental groups per their programs of study. Statistically important inter-group differences were recorded in all four skills: Listening ($F=3.85$, $p=0.025$), Speaking ($F=3.20$, $p=0.045$), Reading ($F=4.40$, $p=0.016$), and Writing ($F=4.95$, $p=0.010$). This has shown that not all the programs benefited from CALL equally. Such disparities might well be symptomatic of disciplinary leanings, with BA students possibly possessing a wider background of exposure to coursework that might lean toward the linguistic-intensive and, thus, might be more able to adjust to AI applications that emphasize linguistic factors, as

opposed to the BSc students who may show a steeper learning curve. However, the presence of statistically significant differences demonstrates that the difference in disciplinary background-mediated degree, to which CALL is effective, is also very important to scaling such interventions within various university settings.

TABLE 5
ONE-WAY ANOVA FOR LSRW POST-TEST SCORES BY PROGRAM OF STUDY (EXPERIMENTAL GROUP)

| Skill | Source | SS | df | MS | F | p-value |
|---|---|---|---|---|---|---|
| Listening | Between Groups | 12.8 | 2 | 6.40 | 3.85 | 0.025* |
| | Within Groups | 116.2 | 72 | 1.61 | | |
| Speaking | Between Groups | 10.5 | 2 | 5.25 | 3.20 | 0.045* |
| | Within Groups | 118.0 | 72 | 1.64 | | |
| Reading | Between Groups | 14.2 | 2 | 7.10 | 4.40 | 0.016* |
| | Within Groups | 116.0 | 72 | 1.61 | | |
| Writing | Between Groups | 15.0 | 2 | 7.50 | 4.95 | 0.010* |
| | Within Groups | 109.2 | 72 | 1.52 | | |

*Significant at $p < 0.05$

Table 6 shows the regression analysis of predicting LSRW post-test scores. Three predictors were studied, including pre-test scores, learner autonomy and frequency of usage of CALL. Each of them was a major predictor, and pre-test scores ($b = 0.48$, $p < 0.001$) revealed that pre-test competence is a factor that influences the results. The theoretical basis of the study was confirmed: the autonomy of the learners ($b = 0.39$, $p < 0.001$) turned out to be a strong predictor of the benefits that CALL could produce. Usage of CALL frequencies ($b = 0.27$, $p < 0.001$) was also a significant factor, which explains the fact that regular application to AI platforms is converted into greater improvements. The model has been significant as it explained 62 percent of the variance ($R2 = 0.62$), with the three factors explaining the largest portion of the gains. Notably, the predictive power of learner autonomy implies that CALL is not a purely technological intervention but one that can prosper in case students are allowed to control their learning process.

TABLE 6
REGRESSION ANALYSIS PREDICTING LSRW POST-TEST SCORES

| Predictor | B | SE | β | t | p-value |
|---|---|---|---|---|---|
| Pre-test Score | 0.52 | 0.08 | 0.48 | 6.50 | <0.001* |
| Learner Autonomy | 0.41 | 0.07 | 0.39 | 5.86 | <0.001* |
| Frequency of CALL Usage | 0.23 | 0.05 | 0.27 | 4.60 | <0.001* |

Model Summary: $R^2 = 0.62$, $F(3,146) = 79.9$, $p < 0.001$
*Significant at $p < 0.05$

Table 7 provides post hoc comparisons, through the Tukey HSD test, of the differences in LSRW skills by program of study. Findings indicate that BA students performed better than BCom and BSc students in most of the skills. In the case of Listening, BA students achieved much higher scores as compared to BCom ($p = 0.032$) and BSc ($p = 0.005$), with non-significant BCom-BSc difference. The same thing occurred with speaking, with BA doing better than either group, even though BCom and BSc were not significantly different. The students who were from the BA discipline were recorded to be better at reading, compared to those from BCom ($p=0.015$) and BSc ($p=0.003$). Writing had the highest level of observed difference, where BAs were way superior to BComs ($p=0.007$) and BScs ($p=0.002$). These results would suggest that BA students might have made better use of CALL tools because of their traditional emphasis on language. BSc students, on the other hand, because of their typical orientation more towards technical subjects, might have found it difficult to engage in work requiring heavy use of language in the beginning.

TABLE 7
TUKEY'S HSD POST-HOC TESTS FOR LSRW SKILLS BY PROGRAM OF STUDY (EXPERIMENTAL GROUP)

| Skill | Comparison | Mean Difference | Std. Error | p-value | Interpretation |
|---|---|---|---|---|---|
| Listening | BA vs BCom | 0.4 | 0.15 | 0.032* | Significant |
| | BA vs BSc | 0.7 | 0.17 | 0.005* | Significant |
| | BCom vs BSc | 0.3 | 0.16 | 0.12 | Not Significant |
| Speaking | BA vs BCom | 0.3 | 0.14 | 0.045* | Significant |
| | BA vs BSc | 0.5 | 0.16 | 0.012* | Significant |
| | BCom vs BSc | 0.2 | 0.15 | 0.18 | Not Significant |
| Reading | BA vs BCom | 0.5 | 0.16 | 0.015* | Significant |
| | BA vs BSc | 0.8 | 0.18 | 0.003* | Significant |
| | BCom vs BSc | 0.3 | 0.17 | 0.09 | Not Significant |
| Writing | BA vs BCom | 0.6 | 0.17 | 0.007* | Significant |
| | BA vs BSc | 0.9 | 0.19 | 0.002* | Significant |
| | BCom vs BSc | 0.3 | 0.18 | 0.10 | Not Significant |

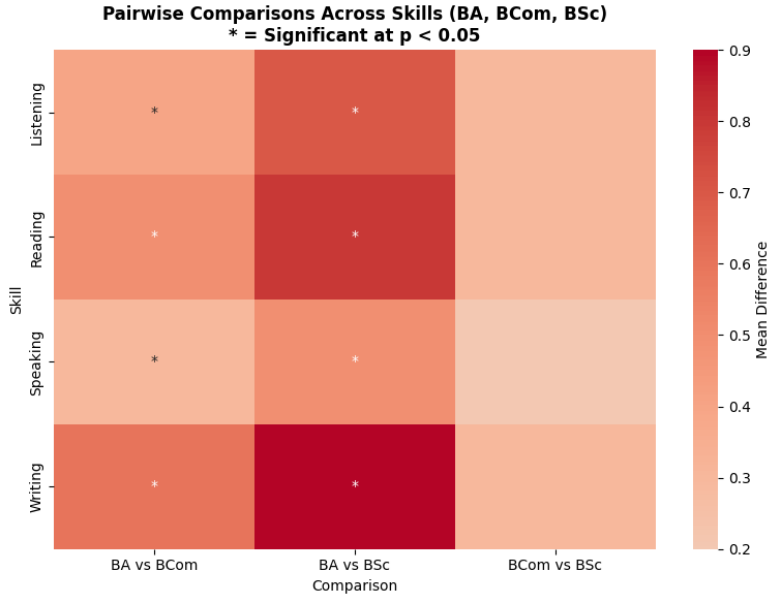


Figure 4. Pairwise Comparisons Across Skills

*B. Analysis Results*

A qualitative analysis of interview data involving undergraduate participants of a local state university in Uttar Pradesh has produced four major themes, each spotlighting the subtle influence of the AI-integrated CALL framework on learner autonomy and LSRW skills along with the course. These common themes (1) Enhanced Self-Regulation and Independent Learning, (2) Increased Motivation and Engagement through AI Feedback, (3) Problems of Access, Digital Literacy and Language Anxiety and (4) Shifts in Perception of Teacher and Peer Role all offer a multifaceted perspective of how the intervention influenced the experiences of students in contrast to the traditional mode of instruction followed by the control group.

*Theme 1: Improved Self-Regulation and Self-study*

The feeling of increased ownership and responsibility exhibited by the learners with respect to their language development was one of the prevailing themes of the interviews. The CALL system, based on AI and the use of apps like Grammarly, Write and Improve, and ELSA Speak, provided students with immediate feedback that they could observe at any stage. Unlike the control group, which was described by the high dependency on teacher observations, the experimental group described how they used these tools as the means to self-correct, set their individual goals, and reconsider learning materials at their own pace. One student remarked, "*I would wait till my teacher could point out where I had gone wrong in writing. But with the help of Grammarly and Write and Improve, I may get to see the mistakes I make and improve. I do not have to rely on anyone. I believe that I am now my own master of learning*." Another one said: "*I practiced a lot with ELSA Speak to give me practice with pronunciation, and then I talked to the classroom. It gave me marks, and I could track my progress daily. It was my personal coach*." These considerations reflect how learners increasingly became independent and less dependent on the teacher, which speaks to a broader aim of CALL interventions: to make learners agency-producing.

*Theme 2: More Motivation and Engagement by AI Feedback*

The second theme had an accent on the motivational forces of AI-based, personalized, and gamified feedback. Students continuously stated that adaptive features of applications like Hello English, Duolingo Stories, and Google Read Along hold their attention with rewards, feedback, and difficulty levels that are scaffolded. The AI tools provided a more interactive experience as opposed to the conventional exercises that used textbooks, which were described by many as monotonous. According to one of the participants, "*it was exciting to move ahead when Duolingo awarded me with points and badges upon completing tasks. It was not similar to homework; it was more of a game. I wanted to improve my level*." Another one shared: "*Hello, English app gave me an explanation of meanings in Hindi, also, and I became less scared of new words. It motivated me to learn more*." Another aspect that the students pointed to was the psychological benefits of obtaining non-judgmental feedback via AI systems. One of the participants said, "*Sometimes when teachers correct the situation in front of the crowd, I feel shy. However, the AI tools provide feedback anonymously, and I am not embarrassed. That makes me try more*." This theme provides a good example of AI feedback that not only inspired students but also provided them with a psychologically safe environment to experiment with, which is essential to building confidence to speak and minimizing performance anxiety.

*Theme 3: Problems of Access, Digital Literacy, and Language Anxiety*

The responses from the interviewees were largely positive, but some issues were raised regarding the learners' access, infrastructure, and digital preparedness. Certain students have expressed difficulty with the use of different platforms

and cited problems related to poor Internet connection or inability to use AI applications on low-end smartphones. At some points, these impediments lessened their participation and minimised the smoothness that was to be enjoyed by the framework. One of the students said, "*Sometimes the app was not loaded due to a poor internet connection in my hostel. Then I missed practice time. We do not have such problems in class*." Another one wrote: "*I did not know how to use Quillbot or Write & Improve at the beginning. It took me time to learn. It did not have the assistance of peers*." Interestingly, some students said that they had language anxiety even after getting AI feedback. As an example, one participant said, "*Although ELSA Speak provided me with scores, sometimes I became nervous when I received low scores repeatedly. It got me thinking that maybe I can never get my accent any better*." This shows that although AI minimizes social anxiety, it can unintentionally cause other types of performance stress. These results highlight the need to offer sufficient orientation, technical support, and infrastructural support upon the implementation of AI-incorporated CALL, particularly in under-resourced institutions in North India.

*Theme 4: Shifts in Perception of Teacher and Peer Roles*

The last theme showed a reorganization of the roles of teachers and peers viewed by learners in the process of language learning. Although the traditional approach put the teacher as the main source of knowledge and feedback, learners in the experimental group had to start perceiving the teacher as a facilitator who assists in integrating AI tools in their learning. One participant said, "*I have previously believed that it is only teachers who can correct my English. However, now I realise that the apps are supporting me as well. A teacher is a kind of a guide to indicate which application is helpful*." Another one reflected: "*We practised using AI applications in terms of what to say before speaking in front of friends in group activities. This allowed the peer discussions to grow more active because everyone was ready with AI for the training, to start with."* Students responded that they enjoyed this hybrid model, with AI taking corrective feedback on chores, while teachers take care of the higher-order activities, such as critical discussions, cultural contexts, and training strategies. The shift did not merely foster a stronger sense of autonomy for the learners but also democratised participation within the classrooms, as even shy students were more willing to speak up.

### *C. Synthesis of Themes*

Altogether, these four themes paint a huge yet comprehensive territory of the antediluvian landscape through the force of AI-adapted CALL exercises on learner autonomy, an area that primarily concerns LSRW skills. Student responses lauded autonomy in the higher education setting as they were feeling empowered, motivated, independent of the teacher, and given new chances to practice privately. However, the results also cautioned about potential infrastructural and emotional problems, particularly for low-resourced universities. Therefore, this transition to learner autonomy models should be monitored, in balance with AI support and human intervention, equitable access and emotional support for those whose help is lost in the new digital environment.

## V. Discussion

The results of this study provide compelling support and suggest a turning point for AI-assisted CALL technology, which can facilitate learner independence in a higher education institution in India, and at the same time, the development of LSRW skills among undergraduate students. This research, conducted in a public regional university of Uttar Pradesh, is a clear example of significant learning through AI interventions, while also highlighting certain mediating factors - learner autonomy, frequency of usage, and disciplinary background - that influence the learning orientation through CALL. The results of the research position the Indian situation right in the centre of a worldwide conversation about language learning and AI that is just starting to unfold. The most important discovery of all is the incredible and very different test scores of the experimental group compared with the scores of the pre- and post-tests in numbers. The control group gained just 2.3 points, while the experimental group literally and figuratively went up more than 15 points, which consequently contributed to the universal validation of AI effectiveness further. Therein, considering, Bahari et al. (2025) saw that the integration of CALL and AIALL into an interactive model would greatly motivate learners and offer customization and effective feedback. Furthermore, Zhang et al. (2025) investigated Chinese undergraduates who, in contrast to traditional textbook-based instructions, enjoyed more autonomy in their instruction and, therefore, encouragement for self-direction-whether in the very interventions based on CALL. Hence, it may be concluded from these studies that AI-based frameworks for CALL offer advantages that transcend mere efficiency, including personalized feedback and a catalyst for self-paced learning: the same can be observed with the Indian sample studies. Speaking and listening experienced greater levels of richness in improvement, with enhancements in perception or pronunciation probably given by ELSA Speak and Hello English, respectively. The finding indeed revalidates those of Zhou et al. (2025), who observed a great improvement in the fluency and appropriateness of spoken English by Chinese students working with an AI chatbot within the framework of mobile-assisted blended learning (MABL), the learners themselves citing real-time AI feedback as important for their progress. Reading and writing were greatly enhanced in India as well through the use of Grammarly, Write & Improve, and Newsela, which echoes Namaziandost's (2025) results showing that AI-assisted flipped instructions improve writing development and metacognitive awareness among Iranian EFL students. The convergence of such findings across countries highlights the effectiveness of AI-assisted strategies in promoting holistic LSRW development. In the logistic regression-based study, the author further emphasizes the importance of learner autonomy as a key predictor of post-test success, second only to baseline

competence. This observation is in keeping with Zhang et al. (2025), who observed that the use of CALL served to increase learners' autonomy, motivation, and metacognitive awareness. In Thailand, it was found by Nopas (2025) that AI systems offer autonomy and limit it at the same time-giving real-time feedback yet narrowing the scope of intellectual exploration. From an Indian perspective, it was clearly discerned that AI supported greater autonomy and self-regulation, which was also evidenced in students' qualitative reports of managing their own progress and setting their own goals. One can take away from this that autonomy is not merely incidental to CALL but rather the main mechanism through which CALL works.

According to the ANOVA and Tukey's HSD tests, disciplinary differences show that students in a BA degree perform better than their BCom and BSc counterparts in all skills being tested. One plausible explanation might be that the BA program stringently accords language emphasis, and thus, BA students may have benefited more by making use of the CALL features than those of the BCom and BSc programs. Similar interdisciplinary and learner-background-related differences have been reported elsewhere in the literature. For instance, Hong and Guo (2025) established variations in outcomes while testing AI-enhanced multi-display teaching systems with groups of EFL learners. These authors also posit that learners who are more used to technology-enhanced interaction tend to derive a disproportionate share of benefits. Zong and Yang (2025) further argue that affective and contextual factors, such as engagement and emotional well-being, stand in the way of successful AI integration. Consequently, for Indian non-language majors, category-specific interventions integrating disciplinary relevance (e.g., business English or scientific communication tasks) may be inescapable for balance.

The qualitative thematic approach applied in this study resonates with international findings on learners' experiences. Students appreciated self-regulation and feedback-based motivation alongside the agents of control offered via AI platforms. This is in line with the findings of the Busuu study of Aufa (2025), wherein the elements of structured exercises, immediate feedback, and accessibility caused positive perceptions of autonomy and independent learning. A parallel approach adopted by Wang (2025) highlights the view that AI tools reduce inhibitions toward foreign language learning and augment enjoyment- factors observed in our Indian sample as well, wherein students felt they gained over their language anxiety through non-judgmental AI feedback. On the contrary, issues of access, digital literacy, and instances of anxiety brought forth in our study lend credence to the equity considerations raised by Nopas (2025), who contended that digital divides and algorithmic constraints further the disadvantage faced by rural learners. In the Indian lens of variance in connectivity and digital preparedness, such findings signal for infrastructural support beyond just pedagogical advancement.

Another key theme in this article concerns shifting perceptions of teacher roles. Students no longer perceived teachers as sole evaluators but as facilitators complementing AI-driven feedback. This agrees with Shanthi et al. (2024), who propose an AI-supported communication model where automated feedback serves as a complement to teacher intervention and proves to be highly successful in skill development. It resonates with Feng's (2025) findings that, when using strategies assisted by AI, intelligent tutoring systems reduce cognitive load while requiring teachers to act as mediators of AI feedback. The Indian case, therefore, reflects a broader pedagogical shift: AI does not replace the teacher but redefines the teacher's role to mentorship, scaffolding, and dealing with affective needs.

There are two broader implications of this investigation. First, the study extends the existing CALL literature into a rather neglected setting in North India, where infrastructural issues often prevent individualized learning. Attesting to consistent improvements in all LSRW skills, it suggests that AI-powered CALL systems can accommodate these structural deficits while providing an equitable, if underprivileged, opportunity for individualized learning. This affirms Sehlaoui's (2024) observation in Algeria that AI tools are becoming increasingly crucial in teaching foreign languages in developing contexts where resource constraints are similar to those faced in India. Second, the study identifies autonomy as a mediating variable, corresponding to the self-regulated learning theory and supporting findings by Zhang et al. (2025) and Hong and Guo (2025) that autonomy feeds continued achievement in AI-enabled environments. Aligning with the vision of India's NEP 2020, the findings stimulate policymakers to synergize technology with learner-centred pedagogy. The presence of free or low-charge AI platforms, such as Hello English, Google Read Along, or Grammarly, serves to make CALL economically feasible for regional universities. The designers are then suggested to design discipline-sensitive adaptations to guarantee equitable benefits across different undergraduate cohorts. From an educational perspective, teachers should assume a facilitator role in helping students use AI while attending to issues of access and anxiety.

## VI. Conclusion

This study aimed to design, implement, and evaluate an AI-Integrated Computer-Assisted Language Learning (CALL) framework to promote learner autonomy among undergraduate students for the development of listening, speaking, reading, and writing (LSRW) skills within an understudied Indian higher education context. By running a quasi-experimental design with two groups (an experimental group and a control group), the study provided evidence that the AI tools (Bolo/Read Along, Duolingo English Test AI, Grammarly, ELSA Speak, ChatGPT, and Kahoot!) whenever introduced greatly helped in improving students' LSRW skills, motivation, and self-directed learning abilities more than the traditional textbook-based instructor-led classes. Quantitative analysis demonstrated greater gains in the post-tests by the experimental group in all four skills, supported by ANOVA, t-tests, and regression models, whereas

post-hoc tests suggested the most strikingly positive perceptions of CALL came from speaking and writing, as they had proven so efficacious through real-time feedback tools.

The key contribution of the study was to contextualize AI-integrated CALL within the Indian public university system, which has remained deficient in applied linguistics-educational technology research. The study proposes a versatile framework combining local pedagogical needs with global AI platforms, which can further be scaled up for the benefit of other resource-challenged institutions both within India and abroad. Some limitations, however, need to be mentioned. Carrying out the study within a local regional university, limited to a semester-long intervention, may have limited potential generalizability since both linguistic and institutional contexts could have been different. A few technical barriers juxtaposed with a gap in digital literacy, equal access to devices, and reliable Internet connectivity adversely affected the rollout of the program and pointed towards a bigger issue of digital equity for India. Thus, multi-institutional samples, longitudinal designs, and in-depth perspectives on learner experiences in AI-mediated CALL from a qualitative standpoint could stand as worthy future research directions.

## REFERENCES


[1] Abdellatif, M. S., Alshehri, M. A., Alshehri, H. A., Hafez, W. E., Gafar, M. G., & Lamouchi, A. (2024). I am all ears: Listening exams with AI and its traces on foreign language learners' mindsets, self-competence, resilience, and listening improvement. *Language Testing in Asia*, *14*(54), 1–27.

[2] Aufa, A. F. R. (2025). Evaluating Busuu.com application for speaking skills through Technology Acceptance Model (TAM): EFL Student's Perception. *IDEAS: Journal on English Language Teaching and Learning, Linguistics and Literature*, *13*(1), 305–332.

[3] Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, *5*(6), 66–70.

[4] Bahari, A. (2025). Balancing syntactic complexity and clarity: the role of AI in enhancing academic writing proficiency. *Saudi Journal of Language Studies*, *5*(4), 271–290.

[5] Bahari, A., Han, F., & Strzelecki, A. (2025). Integrating CALL and AIALL for an interactive pedagogical model of language learning. *Education and Information Technologies*, *30*, 14305–14333.

[6] Bonk, C. J., & Cunningham, D. J. (2012). Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. In *Electronic collaborators* (pp. 25–50). Routledge.

[7] Chatzichristofis, S. A., Tsopozidis, A., Kyriakidou-Zacharoudiou, A., Evripidou, S., & Amanatiadis, A. (2025). Designing an AI-Supported Framework for Literary Text Adaptation in Primary Classrooms. *AI*, *6*(7), 150, 1–20.

[8] Cope, B., Kalantzis, M., & Searsmith, D. (2021). Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies. *Educational philosophy and theory*, *53*(12), 1229–1245.

[9] Davis, F. D. (1989). Technology acceptance model: TAM. In M. N. Al-Suqri & A. S. Al-Aufi (Eds.), *Information Seeking Behavior and Technology Adoption* (pp. 205-219). IGI Global.

[10] Du, Q. (2025). How artificially intelligent conversational agents influence EFL learners' self-regulated learning and retention. *Education and Information Technologies*, *30*, 21635–21701.

[11] Feng, L. (2025). Investigating the effects of artificial intelligence-assisted language learning strategies on cognitive load and learning outcomes: a comparative study. *Journal of Educational Computing Research*, *62*(8), 1741–1774.

[12] Hong, X., & Guo, L. (2025). Effects of AI-enhanced multi-display language teaching systems on learning motivation, cognitive load management, and learner autonomy. *Education and Information Technologies*, *30*, 17155–17189.

[13] Hubbard, P. (2023). Emerging technologies and language learning: mining the past to transform the future. *Journal of China Computer-Assisted Language Learning*, *3*(2), 239–257.

[14] Jaiswal, A., & Arun, C. J. (2021). Potential of Artificial Intelligence for transformation of the education system in India. *International Journal of Education and Development using Information and Communication Technology*, *17*(1), 142–158.

[15] Kadam, D. M., & Pusawale, S. N. (2023). Task Based Approach: An Approach to Develop Writing Skills in English of Engineering Students Leads to Effective Communication Skills. *Journal of Engineering Education Transformations*, *37*(1), 62–69.

[16] Kharroubi, S., & ElMediouni, A. (2024). Conceptual review: cultivating learner autonomy through self-directed learning & self-regulated learning: a socio-constructivist exploration. *International Journal of Language and Literary Studies*, *6*(2), 276–296.

[17] Kovalenko, I., & Baranivska, N. (2024). Integrating Artificial Intelligence in English Language Teaching: Exploring the potential and challenges of AI tools in enhancing language learning outcomes and personalized education. *Європейські соціо-правові та гуманітарні студії, (1)*, 86–95.

[18] Liao, S., Hong, J. C., Wen, M. H., & Pan, Y. C. (2018). Applying technology acceptance model (TAM) to explore users' behavioral intention to adopt a performance assessment system for E-book production. *EURASIA Journal of Mathematics, Science and Technology Education*, *14*(10), 1–12.

[19] Namaziandost, E. (2025). Integrating flipped learning in AI-enhanced language learning: Mapping the effects on metacognitive awareness, writing development, and foreign language learning boredom. *Computers and Education: Artificial Intelligence*, *9(2025) 100446*, 1–11.

[20] Napitupulu, M. F., & Dalimunte, A. A. (2025). A study of students' perception of character AI in practicing English speaking fluency. *Celtic: A Journal of Culture, English Language Teaching, Literature and Linguistics*, *12*(1), 384–404.

[21] Nopas, D. (2025). Algorithmic learning or learner autonomy? Rethinking AI's role in digital education. *Qualitative Research Journal*. https://doi.org/10.1108/QRJ-11-2024-0282

[22] Patni, G., & Dawar, P. (2025). Building Bridges with Words: The Role of LSRW Skills in Language Mastery. *Journal of Rajasthan Association for Studies in English*, *22*, 72–84.

[23] Raza, M. A., Khan, H., & Bukhari, S. (2024). Transforming EFL Listening Skills: The Power of AI Integration in Classrooms. *Social Science Review Archives*, *2*(2), 2284–2295.
[24] Sehlaoui, F. Z. (2024). Integrating AI in Foreign Language Teaching and Learning: Learner Autonomy and Tool Utilization in an Algerian University. *Passerelle*, *13*(2), 116–139.
[25] Shanthi, R., Mythili, M., Gomathi, R. D., Maheswaran, S., Sathesh, S., Murugesan, G., & Haryni, A. S. (2024, June). AI-Driven Education: An Empirical Study on Evaluating LSRW Acquisition Through Active Involvement and Learning. In *2024 15th International Conference on Computing Communication and Networking Technologies (ICCCNT)* (pp. 1–7). IEEE.
[26] Wang, Y. (2025). Reducing anxiety, promoting enjoyment and enhancing overall English proficiency: The impact of AI-assisted language learning in Chinese EFL contexts. *British Educational Research Journal*, 1–26. https://doi.org/10.1002/berj.4187
[27] Yao, X., Zhong, Y., & Cao, W. (2025). The analysis of generative artificial intelligence technology for innovative thinking and strategies in animation teaching. *Scientific Reports*, *15*(1), 18618, 1–22.
[28] Yaqin, L. N. (2025). Emerging research in AI-assisted language learning: A systematic literature review. In *Multi-Industry Digitalization and Technological Governance in the AI Era* (pp. 29–50). IGI Global.
[29] Zhang, H., Xia, Y., Chen, H., & Kannan, S. (2025). Beyond traditional classrooms: CALL as a catalyst for autonomous EAL learning. *Acta Psychologica*, *260*, 105497, 1–10.
[30] Zhang, Q., Nie, H., Fan, J., & Liu, H. (2025). Exploring the dynamics of artificial intelligence literacy on English as a foreign language learners' willingness to communicate: The critical mediating roles of artificial intelligence learning self-efficacy and classroom anxiety. *Behavioral Sciences*, *15*(4), 523, 1–15.
[31] Zhao, J. (2025). Advancing English language education: A mixed-methods analysis of AI-driven tools' impact on engagement, personalization, and learning outcomes. *Education and Information Technologies*, *30*(1), 21773–21813.
[32] Zhou, Q., Hashim, H., & Sulaiman, N. A. (2025). Supporting English speaking practice in higher education: the impact of AI chatbot-integrated mobile-assisted blended learning framework. *Education and Information Technologies*, *30*(1), 14629–14660.
[33] Zong, Y., & Yang, L. (2025). How AI-enhanced social–emotional learning framework transforms EFL students' engagement and emotional well-being. *European Journal of Education*, *60*(1), e12925, 1–20.

**Jayasri Suma. V** is a Research Scholar in English at Aditya University, Surampalem. Her doctoral research explores the development of learner autonomy through Computer-Assisted Language Learning (CALL), focusing on enhancing LSRW skills. Her academic pursuits encompass English Language Teaching, Technology-Enhanced Learning, and Learner-Centered Pedagogical Practices. She has contributed to the research field by publishing an article in Theory and Practice in Language Studies (TPLS), a peer-reviewed international journal indexed in Scopus.

**Ramesh Pettela** is an Assistant Professor of English at Aditya University, Surampalem, Andhra Pradesh, India. He earned his Ph.D. in English from Acharya Nagarjuna University, Guntur, in 2016 and has over 27 years of teaching experience across IIITs, universities, and autonomous institutions. A prolific academic, he has published widely in reputed journals including Scopus, SCI, and UGC-indexed ones, and presented numerous papers at national and international conferences. He has completed research projects worth over ₹45 lakhs funded by ICSSR and AICTE and holds a patent for his research work. A certified communication and soft skills trainer with global credentials, he is an active member of ELTAI and MISTE, serves on Boards of Studies, and authored a book-English for Educators: Easy Methods and Techniques.