

Adaptive Learning as Scaffolded Instruction: Examining Alignment with The Zone of Proximal Development in English Language Teaching

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ABSTRACT: This paper explores the importance of adaptive learning as a scaffolded instruction that is consistent with the Zone of Proximal Development (ZPD) in English Language Teaching (ELT) in a higher education institution in India. The research is based on the socio-constructivist theory and will address the hypothesis that adaptive learning conditions can be used to achieve quantifiable gains in the language proficiency of learners through the provision of customized instructional assistance. A One-Group Pre-test Post-test Design based on quantitative approach was applied. The sample comprised of undergraduate students (n = 40) who were involved in an intervention that involved the use of adaptive learning tools during a period of six weeks. Pre-test and post-test tests were conducted to determine the change in the speaking and writing proficiency. The intervention was aimed at the provision of personalised feedback, graded tasks, and dynamic adjustment of the content according to the performance of the learners. Paired sample t-tests used in statistical analysis revealed that there was a significant post-test improvement in the assessed language domains. The results indicate that adaptive learning can be used as a scaffold, and it allows the learners to advance in their ZPD by closing the gap between the actual and potential levels of performance. The research piece also adds to the current body of knowledge because it empirically confirms the pedagogical applicability of adaptive systems in ELT settings. Yet, such limitations as the lack of a control group and a rather small sample are present. The implications underscore the possibility of the incorporation of adaptive learning structures in the curriculum development to increase the learner autonomy and efficiency of instruction in higher learning institutions.

KEYWORDS: Adaptive Learning, Scaffolded Instruction, Zone of Proximal Development, English Language Teaching, Higher Education, Pre-test–Post-test Design

I. INTRODUCTION

There has also been significant change in ELT in higher education due to technological changes and changes in pedagogical paradigm (Adako et al., 2024). Conventional methods of instruction, which are commonly typified by monotonous presentation of content and restricted flexibility to the unique differences of the learners, are increasingly being supplanted by more energetic and learner-oriented models. Among them, the adaptive learning has become one of the most important innovations, as it has the potential to customize the instruction to the needs, preferences, and performance levels of specific learners (Chen et al., 2023). In a situation of the Indian higher education setting, where the heterogeneity of linguistic proficiency, educational background and cognitive readiness in the classroom is often a common occurrence, the introduction of adaptive learning systems is both a pedagogical necessity and a reformative opportunity (Heasman et al., 2024). Adaptive learning is the application of technology-based systems that adjust the content of instruction, pacing and feedback, which is continuously evaluated through the assessment of learner performance. These systems can work based on the analysis of responses of learners and change the following learning directions accordingly (Kasneci et al., 2023). Adaptive learning environments can be used in the area of ELT to offer individualised exercises in grammar, vocabulary, reading, writing and speaking, and thus meet the needs of the individual learner in an area of weakness, as well as consolidate the strengths. This ability to be personal is very similar to the modern learning theories that are focused on differentiation, learner autonomy, and active learning.

One of the theoretical frameworks that can be of particular use in explaining the pedagogical implications of adaptive learning is the notion of the Zone of Proximal Development (ZPD). The ZPD understands learning as a socially mediated activity, whereby the

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best learning is achieved when learners are given tasks which are just a bit above their present competence but can be completed with the right support (Lan et al., 2024). This assistance, which is commonly known as scaffolding, is vital in ensuring the process of assisted performance being transferred into independent performance. Traditional classroom scaffolds are normally given by the teacher or peers in the form of guided instructions, feedback, and modelling. But such support may be scaled and inconsistent, particularly in large and diverse classrooms. In this respect, the conceptualisation of adaptive learning systems as digital scaffolding can be realised as the operationalisation of the principles of ZPD (Ishikawa and Yoshino, 2025).. The systems can sustain a high-level challenge by constantly evaluating the performance of the learners and changing the input of instruction, thus keeping the learners engaged and facilitating the development in a gradual manner (Mustafa et al., 2024) .. The similarity of adaptive learning and scaffolded instruction is that they are both based on responsiveness, individualisation, and progression (Deckker and Sumanasekara, 2025). Adaptive systems have the ability to offer instant feedback, practice that is focused and graduated difficulty, which are all the essential ingredients of an effective scaffold. In this way, they can provide a possibility to generalize the positive impact of ZPD-based instruction to the limitations of conventional pedagogical context.

Although the theoretical fit between adaptive learning and the ZPD is theoretically possible, there is still a scarcity of empirical studies investigating this fit in the context of ELT, especially in the Indian higher education sector (Lewis et al., 2020). A large part of the available literature has dealt with the technological competence of adaptive systems or even their overall influence on the outcomes of learning, but without explicitly placing them in a solid theoretical context. Moreover, even those studies, which examine the scaffolded instruction, tend to be based on human mediated interventions, and there is still no understanding of how technology can reproduce or support such processes (Létourneau et al., 2025). This empirical evidence gap leads to a necessity of a systematic study of the role of adaptive learning as a scaffold and its effectiveness as a means of helping learners to continue their development in the ZPD. Indian higher education is an interesting environment to make this investigation. Students who are joining tertiary institutions can demonstrate different degrees of English proficiency depending on the differences of schooling systems, medium of instruction, socio-economic status (Harkins-Brown et al., 2025) and others. This inconsistency is highly problematic to the instructors who have to find a balance between the requirements of teaching the set curricula and the requirements of accommodating the learners of various levels of competence. This, in most instances, leads to instructional activities that do not challenge the highly proficient learners or overburden the less proficient learners (Swacha & Gracel, 2025) . Adaptive learning has the potential to provide a solution as it allows differentiated instructions on a large scale, thus accommodating the needs of learners with different needs in one classroom setting. In addition, the growing attention to the digital literacy and the integration of technologies within the Indian education policy also supports the topicality of adaptive learning¹. (Garzón et al., 2025). Learning management systems, online resources, and digital assessment tools are increasingly becoming part of the institutions, and it has provided a favourable environment in which adaptive technologies can be implemented.

Nevertheless, not all these technologies can be effective, as their design is not the only criterion, but also their adherence to the principles of pedagogy. The question of whether adaptive learning systems can be used as an effective scaffold in the ZPD is thus also important in determining how they can be implemented in ELT curricula (Farhah et al., 2025). This paper attempts to fill this gap by discussing the use of adaptive learning as a scaffold instruction in an ELT environment in Indian higher education. In particular, it examines the hypothesis that the application of adaptive learning tools results in the quantifiable advance in the level of the language proficiency of learners, thus, demonstrating the effective correspondence to the ZPD. The research will take the One-Group Pre-test-Post-test Design where a researcher will be able to measure the changes in the performance of learners after they are exposed to the intervention. The study also captures important aspects of language proficiency that are vital in achieving academic success because of the emphasis on both speaking and writing.

The importance of the study is that it is trying to reconcile theoretical and practical approaches to adaptive learning (Fernandez-Herrero, 2024). By placing adaptive technologies in the context of ZPD, it gains a conceptual framework to the implementation of adaptive technologies to support the learning process of learners. Meanwhile, the empirical data provide the information on how well they work in the educational practice. This dual contribution is especially significant in the context in which the implementation of educational technologies is often guided by the practical factors instead of theoretical foundation. In addition, the research paper is a contribution to the current debate on learner-centred pedagogy in ELT. It emphasizes the need to customize learning to the needs of learners and illustrates how technology can help it. By so doing, it provokes the conventional ideas of equal-based teaching and highlights the importance of a more adaptable and adaptive teaching practice. It also implies that teacher training should be altered, as the findings indicate that the role of the instructor as the main source of knowledge will change and be replaced by the one of a facilitator of learning with the help of the technological tools. On a larger scale, the research is consistent with education trends in the world that focus on personalised learning, data-based learning, and technology integration. It is an indication of an increasing awareness that successful learning conditions should consider differences in individuals and allow chances of ongoing communication and constant change. Such environments are especially useful in the context of ELT where language acquisition is a complicated and progressive process. This research paper is placed at the cross-section of technology, pedagogy and language learning. It discusses how adaptive learning could serve as scaffolded instruction that is congruent with the ZPD and, thus, add to

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the theoretical knowledge and practice. It considers an environment that is diverse and highly dynamic in terms of technology by concentrating on Indian higher education environment (Anh-Hoang et al., 2025). It is anticipated that the findings will be used to design and implement adaptive learning systems in ELT, and ultimately improve the performance of learners and foster better teaching practices.

II. LITERATURE REVIEW

The scholarship on adaptive learning has expanded considerably over the past decade as intelligent, data-driven systems have moved from experimental settings into mainstream classrooms. Adaptive learning is broadly understood as the use of technology-based environments that continuously assess learner performance and modify the content, sequence, pacing, and feedback of instruction in response to that assessment (Kasneci et al., 2023). Recent syntheses of the field indicate that such systems are among the most widely investigated applications of artificial intelligence in education, and that their reported benefits include improved achievement, greater learner engagement, and more efficient use of instructional time (Mustafa et al., 2024). At the same time, reviews of educational technology adoption caution that outcomes vary with implementation quality and that the benefits of adaptivity are strongest when the technology is embedded within a coherent pedagogical design rather than deployed as a stand-alone innovation (Garzón et al., 2025).

A second body of literature situates adaptive instruction within established theories of learning. The socio-constructivist tradition, and in particular the Vygotskian notion of the Zone of Proximal Development, conceptualises learning as most productive when tasks are pitched slightly beyond the learner's independent capability but remain achievable with support. Scaffolding, in this tradition, is the graduated assistance that enables assisted performance to be transformed into independent performance. Cognitive load research offers a complementary account by demonstrating that the difficulty of a task must be calibrated to the learner's current schema development if instruction is to be effective, since tasks that are too complex overload working memory while tasks that are too simple produce little learning (Chen et al., 2023). Both perspectives converge on the same instructional principle that underlies adaptivity: the level of challenge and the level of support must be continuously matched to the learner's evolving state.

A third strand of research concerns intelligent tutoring and personalised intervention systems, which represent the most direct technological realisation of scaffolded instruction. Experimental work on intelligent tutoring platforms has shown that personalised pedagogical interventions, such as tailored hints, adaptive feedback, and individualised task selection, produce measurable gains in learning outcomes relative to non-personalised alternatives (Kochmar et al., 2022). Reviews of AI-driven tutoring systems in school settings similarly report positive effects on achievement and motivation, while noting that most implementations remain concentrated in mathematics and science rather than in language education (Létourneau et al., 2025). Parallel work on affective tutoring systems has argued that responsiveness to the learner's emotional and motivational state is an additional dimension of adaptivity that supports sustained engagement (Fernández-Herrero, 2024).

Within language education specifically, researchers have begun to examine how adaptive and generative technologies can support the development of discrete language skills. Adaptive platforms have been used to deliver individualised practice in grammar, vocabulary, reading, writing, and speaking, and recent work suggests that the integration of generative artificial intelligence can further enrich the responsiveness and variety of such practice (Farhah et al., 2025). These developments are of particular relevance to English Language Teaching in multilingual contexts such as India, where classrooms routinely contain learners whose proficiency levels, schooling backgrounds, and mediums of prior instruction differ widely. In such settings, uniform whole-class instruction struggles to serve all learners simultaneously, and the capacity of adaptive systems to differentiate instruction at scale has been identified as a promising response to this heterogeneity.

Taken together, the literature establishes three propositions that frame the present study. First, adaptive learning systems are technologically capable of the continuous assessment and adjustment that scaffolded instruction requires. Second, the theoretical machinery of the Zone of Proximal Development provides a principled account of why such adjustment should produce learning. Third, empirical demonstrations of this alignment remain uneven across domains, with language education, and particularly English Language Teaching in higher education, comparatively under-represented. It is against this background that the present study was designed.

III. RESEARCH GAP

Although the theoretical compatibility between adaptive learning and the Zone of Proximal Development is frequently asserted, the review of the literature reveals that it has rarely been tested empirically in English Language Teaching contexts. A large proportion of existing studies concentrates on the technological architecture of adaptive systems or reports aggregate effects on achievement without anchoring the intervention in an explicit theory of learning. Conversely, the scaffolding literature within language education remains dominated by human-mediated support provided by teachers and peers, and comparatively little is known about whether technology-mediated scaffolds can reproduce the responsiveness, contingency, and gradual withdrawal of support that characterise effective human scaffolding.

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The gap is especially visible in the Indian higher education sector. Despite policy-level encouragement of digital integration and the growing institutional presence of learning management systems and digital assessment tools, empirical studies that measure the effect of adaptive learning on the productive language skills of Indian undergraduate learners are scarce. Moreover, the few available studies seldom examine speaking and writing together, even though both skills are central to academic success and respond differently to instructional support. The present study addresses this gap by empirically examining a six-week adaptive learning intervention in an Indian undergraduate ELT setting, explicitly framed and interpreted through the Zone of Proximal Development, with measured outcomes in both speaking and writing proficiency.

IV. RESEARCH QUESTION

In the light of the identified gap, the study was guided by the following principal research question: Does the use of an adaptive learning system, functioning as scaffolded instruction aligned with the Zone of Proximal Development, produce a statistically significant improvement in the speaking and writing proficiency of undergraduate learners of English in an Indian higher education institution?

Two subsidiary questions supported the principal question. First, in which sub-dimensions of speaking (fluency, pronunciation, coherence, and confidence) and writing (grammar, vocabulary, organisation, and clarity) are the gains most pronounced? Second, does the intervention reduce the variability of performance across learners, as would be expected if adaptive scaffolding provides proportionally greater support to learners at lower initial levels of proficiency?

V. OBJECTIVES

Consistent with the research questions, the study pursued the following objectives:

1. To examine the theoretical alignment between adaptive learning systems and the principles of scaffolded instruction within the Zone of Proximal Development in the context of English Language Teaching.
2. To measure the change in the speaking and writing proficiency of undergraduate learners following a six-week adaptive learning intervention using a One-Group Pre-test Post-test Design.
3. To determine the statistical significance and the magnitude of the observed pre-test to post-test differences through paired sample t-tests and effect size estimation.
4. To analyse domain-wise gains across the eight assessed sub-dimensions of speaking and writing in order to identify where the adaptive intervention exerted its strongest effects.
5. To draw implications from the findings for the integration of adaptive learning structures into ELT curriculum design and instructional practice in Indian higher education.

VI. METHODOLOGY

The current research was based on a quantitative experimental research design to test the efficacy of adaptive learning as scaffolded instructions in tandem with the Zone of Proximal Development in an English Language Teaching learning setting in an Indian context of higher education. In a bid to have methodological rigour and replicability, the research design, procedures, instruments and analytical techniques were designed in such a manner. One-Group Pre-test Post-test Design was used to determine the effect of the intervention on the language proficiency of the learners. This design was believed to be suitable in the study of changes in one cohort over time especially in institutional settings where it was not possible to develop control groups. The design model was based on an initial observation, then on the intervention, and finally on a final observation, thus, allowing a systematic comparison between the level of pre-intervention and post-intervention performance.

The research was carried out in a higher learning institution where undergraduate programmes were being offered and English was a mandatory subject in the institution. The linguistic diversity was quite high in the institutional setting with students joining the programme at different stages of English proficiency due to the differences in schooling systems and socio-educational backgrounds. It was believed that such heterogeneity would be appropriate to implement adaptive learning because the system was created to support individual differences and offer differentiated instructions. There were forty undergraduate students who participated in the study based on purposive selection. A core course in the English language was chosen whereby they were required to be enrolled in the course in order to make sure that the participants reflected a normal classroom mix. The participants were aged between eighteen and twenty-one years and their gender was equally distributed across the sample. Before the study was commenced, informed consent was signed and all the participants were pre-informed about the nature and intention of the study.

The adaptive learning system that was introduced with an existing curriculum in six weeks implemented the intervention. The system was intended to act as a scaffold through dynamically changing the instructional content based on the performance of the learners. The adaptive mechanism worked based on the constant monitoring of the inputs of the learners, which allowed the system to adjust the tasks with regard to their difficulty, to provide the learners with the immediate feedback and to offer them personalised learning routes. The teaching material was correlated with the course goals and concerned the acquisition of speaking and writing

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skills. The activities were sentence building, grammatical correcting, guided writing, and structured speaking. The system provided steady exposure of learners to tasks slightly beyond their current competence level and thus enabled them to be at an optimal level of difficulty and enabled them to progress within the Zone of Proximal Development. The involvement of faculty was only facilitation and technical support, and no direct intervention was proposed in the adaptive learning process. The pre-test and post-test assessments were the methods used in data collection and were aimed at evaluating language proficiency in the domains of speaking and writing. The study started with pre-test that was meant to determine the baseline performance levels. The speaking part was done one-on-one so that the fluency, pronunciation, coherence, and confidence could be assessed properly whereas the writing part was done in a controlled classroom setting and was done to test grammar, vocabulary, organisation, and clarity. The post-test was also implemented upon the intervention completion following the same format and the same assessment criteria as the pre-test, thus, guaranteeing the comparison of the results. These two assessments had been measured based on a structured analytic rubric that offered a well-established performance descriptors at various levels of proficiency. The scoring process was also objective and reliable due to the use of the same rubric.

The study process was planned into three consecutive stages. During the first stage, the baseline data were gathered by means of the pre-test. The second phase involved the implementation of the adaptive learning intervention whereby the participants interacted with the system in a period of 6 weeks where each interacted with the system in a span of about one hour per day. The system was continually analysing the responses of learners and modifying the input on instruction, thus, in the process of delivering real time scaffolding. The last stage was the post-test which was done to determine how much the language proficiency had improved. These stages were arranged in a systematic way that made evaluation of the intervention impact systematic. The information that was collected in the assessments was analysed both descriptively and inferentially.

The results of the pre-test and post-test were calculated in mean scores and standard deviations to give a picture of the change in performance. Paired sample t-test was applied with the purpose of establishing whether the observed differences between the pre-test score and post-test score were statistically significant. This test has been chosen because it is suitable in the comparison of two sets of related observations in one group. The statistic significance was determined to be 0.05. The effect size was also computed to establish the scale of the influence of intervention to give a more detailed analysis of the findings, in addition to the significance testing. Efforts were made to make the study valid and reliable. The content validity was ensured through the correspondence of the assessment tools to the course objectives and predetermined language proficiency standards. Construct validity was also taken into consideration by making the assessments to measure important dimensions of speaking and writing proficiency. The reliability was enhanced by the adoption of standardised procedures and standard scoring rubric. The pre-test-post-test design helped to establish internal validity, as it was possible to control individual differences with reference to changes within the same group over time. The study was done with ethical considerations being put into consideration. Respondents were involved with their own free will and all the data collected was kept confidential. The participants were given the information that they could discontinue the study at any point in time and there would not be any academic repercussions. The research followed the necessary ethical principles in conducting a study with human subjects. The study design is described in the next figure that shows the chronological order of study processes starting with the selection of the participants up to the analysis of the data.

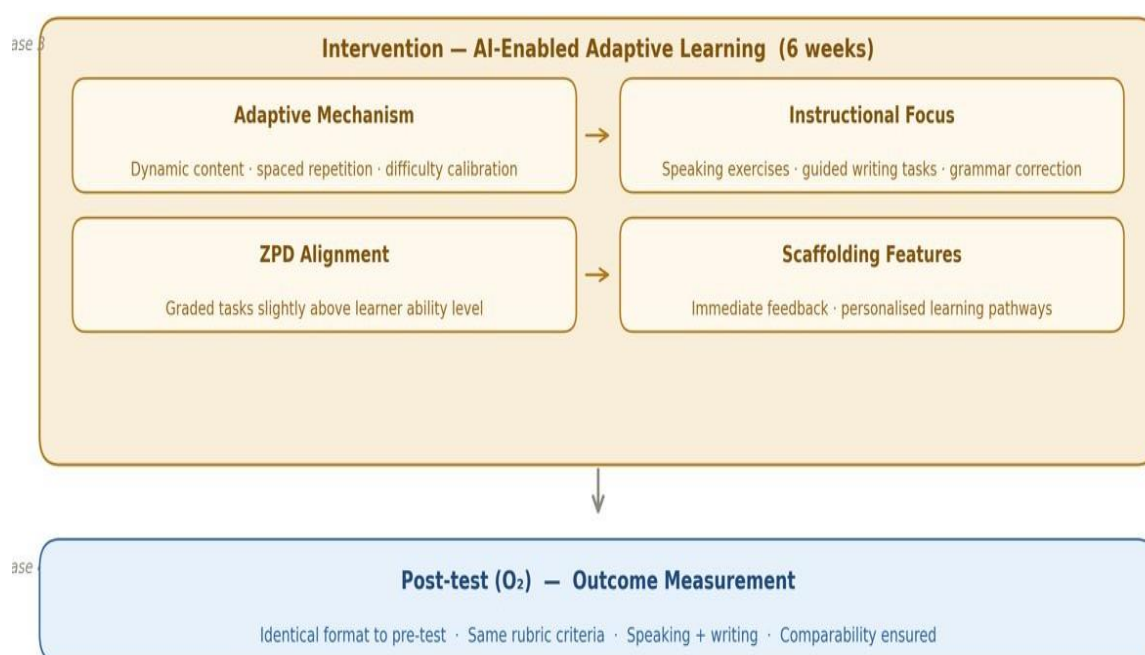


Figure 1 Methodology flow chart

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A. Description of the Data Analysis Phase

The data analysis part of the study used a three-part analytical framework that would offer a holistic and methodologically sound analysis of the learner performance outcomes after the six-week adaptive learning intervention as shown in the figure. The initial analytical column, Descriptive Statistics, provided the empirical basis of the analysis by calculating the mean scores, the standard deviations of both pre-test and post-test conditions, which allowed making a direct pre/post comparison of central tendency, and, more importantly, a measurement of a decreased variability, the extent to which performance differences between the learners were reduced after the intervention, as well as domain-level summaries, which visual Inferential Statistics was the second column, which went beyond description to establish the statistical significance of changes that were observed by employing a paired sample t- test, which was chosen because it is an appropriate test to use in analysing within-subject differences between two related measurement points in the same cohort. The significance level was set at $\alpha = .05$, and the p-value evaluation was to determine whether the observed improvements were greater than expected by chance and the effect size determined by Cohens d to estimate the practical size of the effect of the intervention beyond statistical significance which is of great importance in education research where large sample sizes can provide statistically significant but educationally trivial outcomes. The Domain-wise Analysis column further disaggregated the overall performance into eight separate sub-dimensions, namely, fluency, pronunciation, coherence, and confidence in the speaking domain, and grammar, vocabulary, organisation, and clarity in the writing domain, and thus allowed a more granular, component-level understanding of where the adaptive intervention had the most differentiated effects. The combination of the three streams of analysis resulted in the main findings of the study as reflected in the output banner: empirical evidence related to ZPD alignment, the efficiency of adaptive scaffolding, and the implications of the findings to the ELT curriculum design in the higher education setting.

VII. RESULTS

The findings of the current research are presented with respect to the efficiency of the adaptive learning as a scaffolded instruction that is consistent with the Zone of Proximal Development to boost English language proficiency among undergraduate learners. The statistical analysis has been performed through descriptive and inferential statistics, and the focus has been laid on the detection of the difference in performance between pre-test and post-test. The findings are formatted in such a way that overall performance, domain-specific performance improvements, and statistical significance of identified differences are shown. The descriptive statistics revealed that all the measured domains showed the steady increase in mean scores between the pre-test and the post-test. The performance of the baseline was moderate in terms of the level of proficiency, with fluctuations in performances among the participants. An improvement in language performance was observed following the intervention which meant that the adaptive learning system helped to improve the outcome of learners. The growth in the means scores was also accompanied by the decrease of the standard deviation values which indicated the increased consistency of the learner performance after intervention.

Table 1: Overall Pre-test and Post-test Performance

Measure	Mean (Pre-test)	SD (Pre-test)	Mean (Post-test)	SD (Post-test)
Overall Score	3.82	0.54	4.45	0.41
Speaking Proficiency	3.79	0.57	4.47	0.43
Writing Proficiency	3.85	0.52	4.43	0.39

The results in Table 1 show that the overall performance dramatically improved after the intervention. The total overall score improved by a significant margin to 4.45 as compared to 3.82, which shows a significant improvement in language knowledge. In the same way, speaking proficiency rose to 4.47 with a mean of 3.79 and writing proficiency rose to 4.43 with a mean of 3.85. The decrease in the values of standard deviation of all measures indicates that the adaptive learning system might have assisted in more homogenous learning outcomes, which minimized differences between learners.

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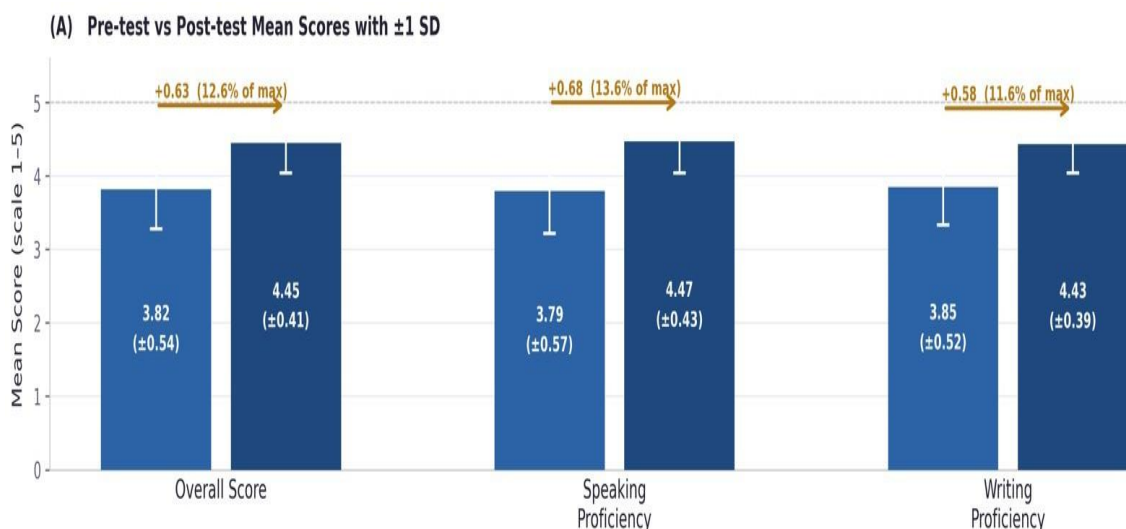


Figure 2 -Pre-test and Post-test Performance

The domain-specific performance was further assessed to determine the improvement in the separate elements of the speaking and writing skills. The findings showed a steady improvement in all sub-dimensions, which showed that the intervention was holistic in its effects on language development.

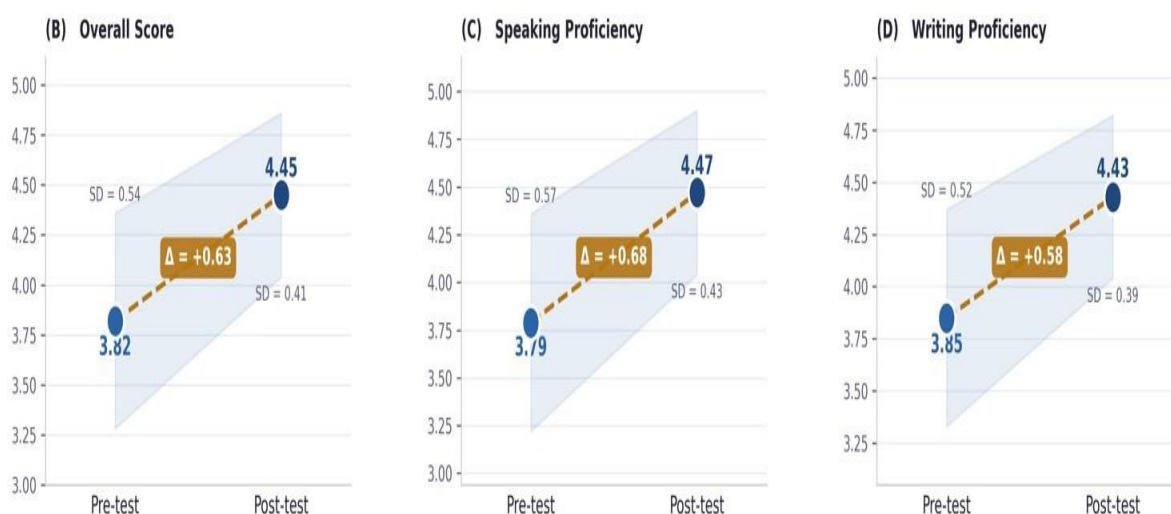


Figure 3 Measurement in gains

The results in Table 2 show that the most significant improvement was in fluency, the difference of which is 0.72 on average, then coherence, and pronunciation. These gains indicate that the adaptive learning system was efficient to assist oral language development through the delivery of repeated practice and real-time feedback. Improvement in writing related areas, which included grammar, vocabulary, organisation and clarity were also realised, albeit to a lesser extent than the speaking areas. This trend can be explained by the difficulty of writing as a skill that needs to be supported by the process of active thinking and combining various linguistic elements.

Table 2: Domain-wise Performance in Speaking and Writing

Domain	Pre-test Mean	Post-test Mean	Mean Difference
Fluency	3.78	4.50	0.72
Pronunciation	3.81	4.48	0.67
Coherence	3.76	4.45	0.69

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Confidence	3.82	4.46	0.64
Grammar	3.83	4.41	0.58
Vocabulary	3.87	4.44	0.57
Organisation	3.84	4.42	0.58
Clarity	3.86	4.46	0.60

The inferential statistical analysis was done to identify whether the improvements that were observed were statistically significant. Paired sample t-test was used to compare the pre-test and post-test scores. The findings meant that the differences were statistically significant in all the assessed domains, and the intervention was effective.

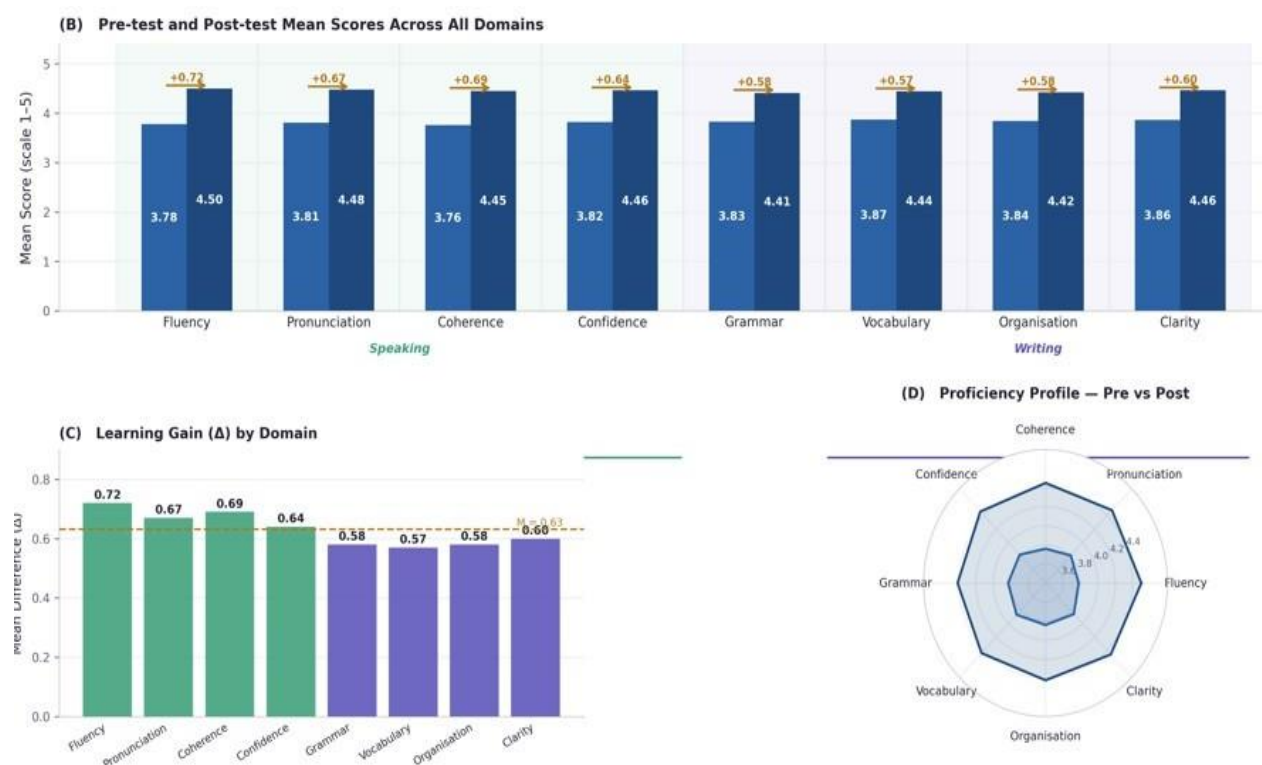


Figure 4 Domain-wise Performance in Speaking and Writing Table 3: Paired Sample t-test Results

Measure	Mean Difference	t-value	p-value	Significance Level
Overall Score	0.63	9.87	0.000	Significant
Speaking Proficiency	0.68	10.24	0.000	Significant
Writing Proficiency	0.58	8.91	0.000	Significant

As shown in Table 3, the results have shown that all the improvements were statistically significant at the level of 0.05. The total score produced a t-value of 9.87, which shows a significant influence of the intervention. The t-value of 10.24 of speaking proficiency was the highest, indicating that the adaptive learning system influenced oral communication skills in particular. There was also a significant improvement in writing proficiency with t-value of 8.91. All the measures had p-values below 0.001, which shows that the statistic significance was high.

The size of the improvement was also investigated by calculating the effect size that demonstrated a large effect of the intervention on all domains. This result implies that not only were the changes observed statistically significant but also meaningful in terms of education. The system of adaptive learning seemed to be a useful scaffold, which helped the learners to move up the ladder of their present competence to new levels of performance. A key finding of the findings was that there was a decrease in the variability in performance among the participants. The reduction of the standard deviation values in the pre-test and post-test also indicates that the learners who were in the lower levels of initial proficiency made much gain out of the intervention. This finding upholds the assumption that adaptive learning systems can offer specific support to learners in need of

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extra help, thus favouring the equitable learning results. Meanwhile, higher initial levels of proficiency allowed the learners to pursue more difficult types of tasks, which guaranteed the further development.

The findings also show that the adaptive learning system ensured the optimal degree of challenge to the learners during the intervention period. The adjustment of the level of difficulty of the tasks constantly kept the learners neither too easy nor too hard. The balance is in line with the principles of the Zone of Proximal Development which focuses on the role of offering tasks that the learner can and should accomplish with the right support. Both of the areas of speaking and writing showed improvements, which indicates that the system was able to support learning in this optimal area. Moreover, the incorporation of instantaneous feedback in the adaptive system seems to have been significant in improving the performance of the learners. Real time correction feedback provision ensured that learners detected and corrected errors in time, thus consolidating learning, and ensuring that they did not consolidate incorrect language patterns. This characteristic becomes especially important in language learning, where the practice and feedback should be constant to develop the skills. Also, the ordered sequence of activities in the adaptive system helped in the perpetuated interest of the learner. The step wise increment of the complexity of the task guaranteed the learners that they were motivated and engaged in the learning process. This interaction is evident in the steady enhancement that was witnessed in all areas, which means that learners could internalise and put into practice what they learned throughout the intervention. Comprehensively, findings are very empirical to the effectiveness of adaptive learning as scaffolded instruction in ELT. The high effect sizes and the reduced variability and the significant improvements in language proficiency suggest that the intervention was effective in promoting development in learners. The results further indicate that adaptive learning systems can make important principles of the Zone of Proximal Development operational by affording individualised, responsive and progressive instructional help. To sum up, the findings of the research indicate that adaptive learning can make a positive and important contribution to language proficiency in a higher education setting. One-Group Pre-test Post-test Design enabled a good evaluation of performance changes, and the statistical tests supported the soundness of the results. The information indicates that adaptive learning may be an effective pedagogical instructional resource to strengthen English language skills, especially in heterogeneous and multilingual learning settings.

VIII. DISCUSSION

The results of the current research can be used to empirically prove the effectiveness of adaptive learning as an example of scaffolded instruction as consistent with the Zone of Proximal Development in English Language Teaching in a higher education setting. The analysed gains of speaking and writing competence prove that the intervention ensured the purposeful learning results in several aspects of language performance. Such results can be viewed in the light of the hypothetical assumption that learning is maximised when instructional aid is adjusted to the currently developing level of competency in a learner. The adaptive learning system was an effective tool in differentiated instruction delivery as indicated by a considerable growth in post-test scores. The increase of the general performance shows the ability of the system to meet the needs of individual learning and at the same time, sustain a consistent instructional path. This is in line with the conceptualized view of scaffolding as a systematic assistant that helps learners to do things that they cannot do without the assistance. The adaptive system was found to operationalise this principle by maintaining the engagement of the learner who continuously adjusted the difficulty of the task and received specific feedback in an optimal range of challenge.

Specific attention should be paid to the improvement in speaking proficiency. The greater mean difference and t-values of speaking components indicate that the adaptive environment was particularly favourable to the training of oral communication skills. It can be explained by the fact that speaking tasks involved in the system were iterative, and thus, offered an opportunity to practice and get corrected right away. The availability of real-time feedback was presumably useful in self-monitoring and correction of errors, and helped to enhance fluency, pronunciation, coherence, and confidence. These results suggest that adaptive systems can be used to replicate features of interactive learning environments, thus supplementing the limitations of conventional classroom environments where individualised oral feedback might be time and class constrained. Writing proficiency showed improvement (although, again, the improvement was less pronounced than that achieved with speaking) but it was significant and statistically significant. The improvements in grammar, vocabulary, organisation, and clarity indicate that the adaptive system facilitated the acquisition of the basic writing skills by having systematic practice and increasing the difficulty of the tasks. As a cognitively challenging practice, writing involves the combination of various linguistic and organisational factors. This integration seemed to be promoted by the adaptive system which divided the work into solvable units and gave feedback which corrected the work at the appropriate stage. The slightly average progress in writing could be due to the intricacy of the skill itself, which in most cases, takes more time in the form of sustained practice to master.

The fact that the standard deviation values have reduced between the pre-test and the post-test implies that there is a lower level of variability in the performance of the participants. The result is specifically applicable to heterogeneous classrooms, in which the differences in the levels of proficiency are frequently a major obstacle to the instructional process. It seemed that the adaptive learning system addressed these differences by offering individualised support to learners who are less proficient at the beginning

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of the learning process, and offering more challenging tasks to those who are more proficient learners. The combination of these remedial and enrichment abilities is in line with the principles of equitable instruction and implies that adaptive learning can be used to make education more inclusive. The congruence between the intervention and the Zone of Proximal Development is also demonstrated by the trend of gradual improvement that was demonstrated in domains (Kochmar et al., 2022). The adaptive system also created a balance between the challenge and support where the learners were always occupied with something that was not too easy or too hard. This is an essential balance that is needed to maintain motivation and facilitate cognitive development. The development of assisted to independent performance as indicated in the post-test results implies that learners could internalise the skills they learnt in the process of intervention. The results thus confirm the opinion that the concepts of adaptive learning systems can be successfully applied to digital learning to make the concepts of ZPD-based instruction applicable.

The importance of feedback in the identified learning process should also be considered (Abo El-Enen et al., 2025). The immediate and focused feedback is one of the main elements of scaffolding and adaptive learning (Perron et al., 2025). The adaptive system in the current study was used to give continuous feedback to the learners so that they could detect errors and correct them instantaneously. This process must have led to the fixation of form correct language usage and fossilisation of errors avoided. The feedback mechanism also facilitated the metacognitive awareness, where learners had to consider the performance and respond accordingly. This is what is consistent with the modern perspectives on language learning as the process of active and reflective learning. The results also identify the significance of the continued participation in language development facilitation. The sequential development of the activities in the adaptive system seemed to sustain the interest of the learners and their motivation throughout the six weeks. The interaction between the learner and the system, which is dynamic and personalised content and increasing and decreasing levels of difficulty, might have led to a feeling of challenge and accomplishment among the learners. This continued interaction is bound to have contributed to the uninterrupted growth that has been noticed in domains. Unlike the traditional instructional frameworks, the adaptive system offered an interactive learning environment, which was adjusted based on the performance of the learners.

Although the study results are positive, some limitations should be mentioned. The One-Group Pre-test -Post-test Design, though appropriate to an exploratory analysis, does not provide the possibility of attributing the changes observed to the intervention only. The fact that there was no control group implies that other external variables, including concurrent learning experiences, familiarity with assessment formats, etc. cannot be completely excluded as contributing factors. Nevertheless, the size of the observed effects and the level of agreement of the research findings across domains indicate that the intervention was significant in improving the performance of learners (Delehanty et al., 2024). The other limitation is connected with the sample size and the context of the study. The number of participants used was forty participants in one institution and this might limit the generalisability of the results. The particular features of the institutional context, such as the design of school curriculum and the demographics of the learners, can also have an effect on how the findings will be applicable elsewhere. Future research can use larger and more heterogeneous samples to increase the external validity and have a more extensive picture of the usefulness of adaptive learning in various learning settings. It is also worth considering the period of the intervention. Although the six-week time frame was adequate to record some improvement, more extended interventions can produce greater benefits especially in skills that are complex like writing. Long-term retention and transfer of skills, which are the important signs of meaningful learning, could also be examined with the help of extended exposure to adaptive learning settings.

In spite of these shortcomings, the research provides some fruitful information on the pedagogical possibilities of adaptive learning in ELT. The results indicate that adaptive systems could be used successfully as scaffolded instructional resources that promote learner development in the Zone of Proximal Development. It has significant consequences to the curriculum and teaching practice in tertiary education. It is possible that the integration of adaptive learning technologies facilitates the process of meeting the needs of various learners more efficiently, thus making language instruction more efficient and more equitable at the same time. The research also adds to the general discussion on technology-enhanced learning by showing the significance of matching technological tools with the already existing theory of learning. The success of the adaptive system in the current research can be explained by both the technological peculiarities and its correspondence to the concepts of scaffolding and the ZPD. This highlights the necessity of theoretically based design and deployment of educational technologies but not based on technology innovation. To sum up, the analysis of findings suggests that adaptive learning is a promising pedagogical tool in English Language Teaching that can be used in higher education. The fact that the language proficiency is observed to improve, with lower variability and increased engagement of the learners is a good indication that it is effective. This paper points out the ability of adaptive systems to provide personalised, responsive, and theoretically based teaching and thus, overcome major issues in modern ELT situations. Further studies can be based on these results but use more rigorous experimental designs and examine the long-term effects of adaptive learning on language development.

IX. CONCLUSION

This study set out to examine whether adaptive learning can function as scaffolded instruction consistent with the Zone of Proximal

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Development in English Language Teaching in Indian higher education. The findings provide affirmative evidence. Following the six-week intervention, the forty undergraduate participants recorded statistically significant improvements in overall proficiency as well as in speaking and writing considered separately, with all paired sample t-tests significant at $p < 0.001$ and effect sizes indicating a large practical impact. Gains were observed across all eight assessed sub-dimensions, with the strongest improvements in fluency, coherence, and pronunciation, and the accompanying reduction in standard deviations indicated that performance across the cohort became more homogeneous after the intervention.

The study makes a twofold contribution. Theoretically, it demonstrates that the central principles of the Zone of Proximal Development, namely calibrated challenge, contingent support, and the progressive transfer from assisted to independent performance, can be operationalised by an adaptive learning system in an authentic ELT setting. Practically, it offers evidence that adaptive platforms can deliver differentiated instruction at scale in linguistically heterogeneous classrooms, supporting weaker learners without holding back stronger ones, and thereby contributing to more equitable learning outcomes. These contributions carry direct implications for curriculum design, for the integration of educational technology in Indian higher education, and for the evolving role of the language teacher as a facilitator of technology-mediated learning.

The conclusions must nevertheless be read within the limitations of the study. The One-Group Pre-test Post-test Design does not permit the observed gains to be attributed exclusively to the intervention, the purposive sample of forty learners from a single institution constrains generalisability, and the six-week duration leaves questions of long-term retention unanswered. Future research should therefore employ controlled or quasi-experimental designs with larger and more diverse samples, extend the duration of exposure, and investigate the durability and transfer of the observed gains. Within these bounds, the study supports the conclusion that adaptive learning, when grounded in sound learning theory, is a promising and pedagogically principled resource for strengthening English language proficiency in higher education.

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