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Techno-Scaffolding in English Language Learning: A Review at the Secondary Level

Vinothini S[1] & Dr. S. Veena[2]
[1]Research Scholar, Department of Education, Annamalai University
[2]Assistant Professor, Department of Education, Annamalai University
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Abstract

The integration of technology in English language instruction has transformed traditional pedagogical approaches, enabling more personalized and interactive learning experiences. Techno-scaffolding, a blend of technological tools and scaffolding strategies, facilitates learners' gradual mastery of linguistic skills through guided digital environments. This review synthesizes research findings on the application of techno-scaffolding in language learning, particularly at the secondary level. Studies reveal that digital scaffolding through multimedia platforms, adaptive feedback, and collaborative tools significantly enhances learners' engagement, comprehension, and achievement in English. However, disparities in accessibility, teachers' digital competency, and contextual adaptability remain key challenges. The findings consistently demonstrate that techno-scaffolding enhances student achievement, engagement, and autonomy in English learning. However, research gaps remain in longitudinal analysis, comparative approaches, and localized curriculum integration. The review underscores the potential of techno-scaffolding as an effective pedagogical approach for improving English achievement at the secondary level. The review identifies critical gaps in empirical studies focusing on techno-scaffolding among secondary-level students in India, suggesting a need for more experimental research to measure its sustained impact on English achievement.

Keywords: Techno-scaffolding, English language learning, academic achievement, secondary education, digital pedagogy

Introduction

In recent years, technology-enhanced learning has become an integral part of education, particularly in language learning. Techno-scaffolding refers to the strategic use of digital tools and platforms to support learners' cognitive and linguistic development. Scaffolding facilitates gradual skill acquisition by offering structured support, feedback, and adaptive learning pathways (Vygotsky, 1978) The rapid expansion of educational technologies has transformed the landscape of English language teaching and learning. With the advent of digital tools such as interactive learning platforms, multimedia resources, and AI-powered feedback systems, language instruction has shifted from teacher-centered to learner-centered paradigms (Garrison & Kanuka, 2004; Graham, 2013). Scaffolding, rooted in Vygotsky's

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(1978) sociocultural theory, emphasizes the importance of guided support in learners' cognitive development. When integrated with technology, it evolves into *techno-scaffolding,* a pedagogical model that combines digital mediation with instructional guidance to enhance learning outcomes (Azevedo & Hadwin, 2005). For IX standard students, English language learning represents a critical stage for developing academic communication, comprehension, and literacy skills. Techno-scaffolding offers an innovative avenue for engaging these learners through multimodal and interactive means. This review explores global and Indian studies to evaluate how techno-scaffolding influences achievement in English, identifies emerging trends, and highlights areas needing further inquiry. . When integrated with technology, this approach can foster deeper engagement and independent learning. In India, where English remains a key academic and professional language, exploring the effectiveness of techno-scaffolding at the secondary school level is highly relevant. This review synthesizes findings from ten Indian studies conducted between 2018 and 2024 that examine various forms of digital scaffolding and their effects on English language achievement among secondary students.

2. Thematic Review

2.1. Theme I: Digital and Web-Based Scaffolding Techniques

Singh (2018) highlighted how ICT tools enhance students' comprehension and writing skills through interactive modules and feedback mechanisms. The use of digital scaffolds encouraged self-directed learning and increased classroom participation. Similarly, Rani (2019) demonstrated that integrating digital storyboards and peer feedback platforms improved students' grammar and writing proficiency. Both studies confirmed that digital scaffolding promotes learner autonomy and engagement. Prakash and Devi (2021) extended this approach by implementing web-based scaffolding modules that incorporated hyperlinks, comprehension quizzes, and self-assessment trackers. Their findings revealed improved inferential and critical reading comprehension, supporting the notion that online scaffolds promote higher-order thinking in language learning. The Indian experimental study by. Veena (2013) on IX standard students took one of the independent variables as modality used in CAELL, employing the pretest and post-test method. This study, which sampled 240 students, shows that 38.3 percent of the students exhibited a high modality effect and a significant difference in post-test scores in grammar. The study concludes that there were statistically significant differences in the cognitive factor of modality effect on the pupils' post-test scores, attributed to the gender of the experimental group.

2.2. Theme II: Mobile, Blended, and Software-Based Scaffolding

Several Indian researchers explored the integration of mobile and blended learning strategies as scaffolding mechanisms. Kumar and Sharma (2020) found that a blended learning model combining face-to-face and online instruction enhanced both motivation and language proficiency. Bhat (2020) demonstrated that mobile-assisted language learning (MALL) applications offered real-time vocabulary support, improving retention and pronunciation accuracy. Likewise, Meena and George (2021) evaluated educational software that incorporated feedback and hints to improve grammar comprehension and metacognitive

awareness. These studies collectively indicate that mobile and blended scaffolds not only enhance achievement but also empower students to take control of their learning process.

2.3. Theme III: Interactive, Immersive, and Techno-Pedagogical Scaffolds

Recent research emphasizes interactive and immersive technologies in English classrooms. Patil (2022) explored the role of Google Classroom and Nearpod in facilitating collaborative tasks and multimedia learning, which significantly improved comprehension and grammar performance. Deshmukh (2022) introduced augmented reality (AR) as a novel scaffolding tool that visualized grammar concepts and contextual vocabulary, leading to better engagement and retention. In addition, Nair and Joseph (2023) designed e-learning scaffolds to improve listening comprehension, while Banu and Rajendran (2024) implemented techno-pedagogical scaffolding strategies, including concept mapping and e-feedback. Their studies collectively confirmed that interactive digital scaffolds improve not only academic outcomes but also learners' confidence and motivation.

2.4 Empirical Studies in Secondary Education

Several studies in Asian and Western contexts demonstrate the positive influence of techno-scaffolding on language learning. For instance, Srichanyachon (2014) reported improved writing performance among Thai students using online scaffolding systems. Similarly, Indian studies (Raj & Devi, 2019; Joseph & Thomas, 2021) indicate that multimedia-based scaffolding aids comprehension and pronunciation in English among secondary learners. However, inconsistencies in implementation and teacher preparedness often limit its effectiveness.

2.5 Achievement in English through Techno-Scaffolding

Achievement in English is multifaceted, encompassing linguistic competence, communication skills, and critical thinking. Studies by Lin and Lan (2015) found that digital scaffolding enhances reading and listening comprehension by offering contextualized and adaptive feedback. Moreover, techno-scaffolding supports differentiated instruction, enabling students with varied abilities to progress at their own pace (Nguyen, 2020).

3. Indian Studies

Jena and Gupta (2019) carried out a quasi-experimental study in urban Assam to examine Online Technology-Based Scaffolding (OTBS) and its effects on asynchronous learning performance among school students. The OTBS group (Class VIII) showed statistically significant improvement in learning performance and persistence compared with a traditional group; the authors also report beneficial effects on learners' self-efficacy and persistence. This Indian experimental study is directly relevant to techno-scaffolding because it operationalizes scaffolds via online tools and measures learning gains, though it focuses on Class VIII and asynchronous modalities rather than synchronous classroom scaffolding for Class IX English achievement.

Banaganipalli (2017) presents a conceptual and practice-oriented paper on scaffolding English language learning with ICT in Indian classrooms. The paper synthesizes ways ICT

tools (multimedia, online resources, LMS) can provide cognitive, procedural, and metacognitive scaffolds and offers classroom examples and teacher strategies. While not an empirical classroom trial, this paper provides a useful theoretical and implementation map for techno-scaffolding interventions targeted at secondary students, helping to design contextually appropriate scaffolded digital tasks.

Chaitanya (2024) reviews Mobile-Assisted Language Learning (MALL) applications and interventions used in Indian English education, highlighting case studies where mobile apps (quizzes, micro-lessons, pronunciation tools) scaffold grammar and vocabulary practice. The review reports improved engagement and short-term gains in discrete skills but flags issues of access, teacher facilitation, and assessment of sustained achievement. This study situates mobile platforms as promising techno-scaffolds for adolescent learners and suggests direct applicability to Class IX contexts where smartphones or tablet access exists.

Narayanan (2019) examines computer-aided scaffolding within communicative language teaching (CLT) environments in Indian contexts, arguing that automated prompts, model texts, and peer-review platforms can act as contingent supports for learners' communicative tasks. The article includes classroom vignettes and discusses how teacher mediation and design of tasks influence the effectiveness of computer-based scaffolds. Its strength is practical classroom examples relevant for designing techno-scaffolds for English achievement in secondary classes; a limitation is limited experimental outcome data.

Kaur (2023) provides a review of technology-assisted adaptive language learning systems with several India-context examples; the paper surveys adaptive feedback tools, intelligent tutoring systems and how scaffolding can be automated to match learner proficiency. The review highlights evidence that adaptive scaffolds increase individualized practice and can improve testable components of language achievement when integrated with teacher oversight. This work is helpful for designing techno-scaffolding that adapts to Class IX learners' English proficiency levels.

A 2025 article in the *World Journal of English Language* (Menon et al., 2025) reports a quasi-experimental study on technology-assisted English learning among Indian students, using computer-based modules plus teacher scaffolds and measuring pre/post achievement. The study finds modest gains in achievement for blended (teacher + tech) instruction versus teacher-only instruction but emphasizes the crucial role of teacher facilitation and training. This empirical evidence supports the claim that techno-scaffolding (tech tools combined with teacher scaffolds) positively impacts assessed English outcomes in Indian classrooms.

A ResearchGate collection titled "ESL in India: Tech & Multimedia for Multilingual Learners" (2024) synthesizes Indian case studies where multimedia resources, digital labs, and online modules scaffold English language skills in multilingual classrooms. The synthesis highlights improvements in listening comprehension and pronunciation through multimedia scaffolds and notes contextual constraints (regional language medium, infrastructure). For a Class IX techno-scaffolding study, this synthesis provides empirical examples and helps frame contextual variables (medium of instruction, multilingualism) that moderate effectiveness.

An IJELS (2024) article reviewing MALL trends and developments collates Indian and regional implementations of mobile scaffolds (micro-lessons, spaced practice, gamified quizzes) and reports that mobile scaffolds often yield improved engagement and short-term gains on discrete grammar and vocabulary tests. The authors caution that outcome measures are frequently limited to short post-tests, recommending longer-term achievement measures for secondary cohorts (e.g., Class IX). This paper helps frame measurement issues when evaluating techno-scaffolding's effect on English achievement.

A recent India-focused CALL study (2025) explored student perceptions and measured engagement and proficiency indicators in Indian ESL tertiary classrooms using CALL packages; while at a higher level than Class IX, the study's findings about design features (immediate feedback, scaffolded tasks, teacher integration) are highly transferable to secondary English contexts and techno-scaffolding design for achievement measurement. The article provides concrete examples of CALL materials that can be adapted into scaffolded modules for Class IX.

An article on scaffolding fused digital game-based learning reports an experimental intervention where a scaffolding layer integrated into a digital game improved engagement and task success among primary/secondary students. Although the content domain was mathematics, the study demonstrates how scaffolding fused into digital games increases persistence and learning gains an approach readily adaptable to English-language scaffolded gamified modules for Class IX learners.

Overall note on the Indian evidence base: the Indian literature shows several experimental and quasi-experimental studies (e.g., Jena & Gupta, 2019; Menon et al., 2025), conceptual/theory pieces (Banaganipalli, 2017), and several reviews/syntheses on MALL/CALL that are directly relevant to techno-scaffolding. However, there remain few published experimental studies specifically targeted at Class IX English achievement using an explicit "techno-scaffolding" label; many interventions measure short-term gains, focus on tertiary levels, or treat scaffolding implicitly. This gap underscores the justification for a focused Class IX techno-scaffolding experimental study measuring standardized English achievement over time.

4. Research Gaps Identified

Although the reviewed studies affirm the effectiveness of techno-scaffolding in English learning, several research gaps remain as unexplored. Few explored the specific relationship between techno-scaffolding and different dimensions of English achievement within the same cohort. Additionally, comparative studies between rural and urban learners, or between government and private school contexts, are scarce. Finally, limited focus has been given to teacher readiness and training in implementing techno-scaffolding effectively.

- Lack of studies specifically on IX standard students in India using techno-scaffolding (i.e., explicit scaffolding via technology) and measuring achievement in English are rare in this literature review by the investigator.

- Many studies are at tertiary level or address technology broadly without the scaffolded support focus.
- "Scaffolding" in papers often refers to teacher support or general scaffolding, but seldom explicitly "techno-scaffolding" - i.e., guided support mediated via technology.
- The number of Indian empirical experimental studies measuring "achievement in English" (pre-test/post-test) with technology and scaffolding is found as limited.
- This gap itself justifies this research and hence the need for the study in present technology interwoven learning environment is identified in Tamilnadu geographical area.

5. Conclusion

The reviewed literature underscores that techno-scaffolding significantly enhances English language learning among IX standard students by improving motivation, comprehension, and performance. Digital platforms, mobile applications, and interactive tools serve as effective scaffolds that provide adaptive, personalized support. However, future research must adopt a broader and more integrated approach, incorporating diverse learner contexts and longitudinal data. The findings collectively support the inclusion of techno-scaffolding within the mainstream English curriculum as a sustainable model for improving academic achievement and digital literacy in Indian schools.

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