

Technology and Its Impacts on EFL Students' Critical Thinking: A Systematic Literature Review

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Abstract. The prevalence of digital technology has influenced pedagogical approaches and student participation in EFL environments. As technology becomes more embedded in language learning, its impact on students' critical thinking has received attention. This systematic literature review examines the impacts of technology on students' critical thinking and identifies pedagogical strategies that promote critical thinking through effective technology integration. Employing a PRISMA-guided review process, empirical and conceptual literature published between 2011 and 2025 was systematically collected from academic databases and analyzed using thematic synthesis. The findings reveal that technology can enhance critical thinking by fostering inquiry, collaboration, reflective learning, and access to diverse perspectives when integrated through purposeful pedagogical practices. However, an excessive reliance on digital tools, such as search engines, automated translation systems, and generative artificial intelligence, may result in cognitive passivity, reduced metacognitive regulation, weakened evaluative judgment, and diminished learner autonomy. The review further underscores the importance of teacher mediation, inquiry-based learning, and critical digital literacy in maximizing the educational benefits of technology while minimizing potential risks. The review concludes that sustaining critical thinking in EFL classrooms necessitates a balanced, pedagogically guided use of technology and the systematic development of critical digital literacy.

Keywords: critical thinking; educational technology; artificial intelligence; digital literacy; EFL; systematic literature review

1 Introduction

Technology is becoming a necessary component of contemporary EFL instruction, significantly altering how students access information, interact with learning materials, and build knowledge (Chapelle, 2016; Roblyer & Doering, 2013). Learning management systems, mobile apps, online platforms, and AI tools are now extensively integrated into EFL classrooms and are frequently promoted as solutions to enhance efficiency, engagement, and

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students' autonomy (OECD, 2019; UNESCO, 2021). In parallel with this technological growth, critical thinking has been recognized as a fundamental educational objective for students navigating complex, information-rich environments (Ennis, 2018; Facione, 2015).

Critical thinking is widely acknowledged as a deliberate, reflective, and self-regulated process of judgment that encompasses analysis, evaluation, inference, and explanation (Dewey, 1993; Facione, 2015). In the EFL context, critical thinking is vital for achieving academic literacy and communicative competence. Students are required to interpret texts, evaluate arguments, synthesize information, and articulate reasoned perspectives in a second or foreign language (Atkinson, 1997; Cottrell, 2005). Therefore, technology integration in EFL education is often promoted because digital tools can enhance higher-order thinking by providing access to authentic materials, promoting collaboration, and encouraging inquiry-based learning (Akyol & Garrison, 2011; Garrison & Akyol, 2015).

An increasing body of research has raised concerns about the uncritical adoption of technology and the growing tendency of students to over-rely on digital tools (Carr, 2010; Nicholas & Ng, 2012). The immediate availability of information, automated feedback, online translation, and AI-generated content may diminish learners' engagement in reflective and analytical thinking by transferring cognitive responsibility from the learner to the technology (Sparrow et al., 2011). These concerns have become more pronounced with the swift spread of generative AI tools capable of executing complex linguistic and analytical tasks traditionally linked to human reasoning (Kasneci et al., 2023).

Despite the increasing amount of research on technology-enhanced language learning, there are relatively few studies that have systematically synthesized evidence on how technology affects EFL students' critical thinking. Existing research has reported both positive outcomes, such as enhanced inquiry, collaboration, and higher-order thinking, and potential challenges, including cognitive dependency and decreased reflective engagement. However, these findings are scattered across various technological contexts and educational settings. Furthermore, there has been limited focus on identifying pedagogical strategies through which technology can be most effectively used to promote critical thinking while minimizing potential cognitive risks.

Although prior research has explored the correlation of technology and critical thinking in EFL instruction, many of the studies have concentrated on the benefits of digital technology integration or specific instructional interventions. Less attention has been given to synthesizing both the enabling and constraining effects of technology on EFL students' critical thinking within a single review. Additionally, the swift advancement of generative AI has introduced new concerns regarding student autonomy, evaluative judgment, and cognitive engagement that have not been adequately addressed in earlier studies. Therefore, an updated review is necessary to offer a more comprehensive perspective of how technology shapes critical thinking in contemporary EFL environments.

The study conducts a Systematic Literature Review to bridge the gap by reviewing the impacts of technology on EFL learners' critical thinking and to identify pedagogical approaches through which technology can be effectively utilized to foster critical thinking development. Particularly, this study is centred on the research topics listed below.

RQ1: What positive and negative impacts of technology on EFL students' critical thinking are reported in the literature?

RQ2: What pedagogical approaches support the effective use of technology for fostering critical thinking in EFL contexts?

2 Method

2.1 Research Design

The study combined theoretical and empirical research to explore the connection between technology and critical thinking in EFL educational contexts, employing a Systematic Literature Review method. The study conformed to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) requirements to preserve transparency, rigour, and reproducibility. SLR was selected for its ability to provide a comprehensive state of knowledge on a specific topic, allowing researchers to systematically discover, assess, and synthesize existing evidence (Page et al., 2021).

The review aimed to identify pedagogical strategies that advance the integration of digital technology in fostering critical thinking, as well as to explore the advantages and disadvantages of technology for EFL students' critical thinking skills.

2.2 Research Strategy

The study utilized five principal scholarly databases: Scopus, Google Scholar, Web of Science, ERIC, and ScienceDirect. The databases were included for their extensive coverage of research in applied linguistics, educational technology, and language instruction.

The search methodology involved the use of keyword combinations pertinent to technology, critical thinking, and language learning. Key search terms included: critical thinking, technology integration, educational technology, digital learning, artificial intelligence, generative AI, EFL, higher-order thinking, and digital literacy.

Boolean operators (AND, OR) were applied to improve retrieval accuracy and refine the search process. Additionally, backward citation tracking was employed to identify relevant papers cited in the chosen articles.

2.3 Inclusion and Exclusion Requirements

The selection of studies adhered to specific inclusion and exclusion requirements for ensuring both relevance and quality. Research was deemed eligible if it was published in reputable conference proceedings or peer-reviewed journals, released between 2011 and 2025, focused on learning environments for EFL, explored the relationship between technology use and metacognition, higher-order thinking abilities, critical thinking, or related cognitive processes, and was available in full-text English versions.

Conversely, studies were excluded if they were not peer-reviewed, concentrated on educational contexts unrelated to language learning, examined technology adoption, acceptance, or attitudes without addressing cognitive or critical thinking outcomes, lacked adequate methodological detail, or were duplicate publications.

2.4 Study Selection Process

153 records from Google Scholar, Scopus, Web of Science, ERIC, and ScienceDirect were found using the primary database search. 115 papers remained for the title and abstract screening stage after 38 duplicate entries were eliminated.

Throughout the screening stage, 43 studies were eliminated because they did not fit the inclusion requirements, primarily due to their insufficient relevance to critical thinking or their focus on educational contexts outside of EFL learning.

The remaining 72 studies were subjected to an eligibility assessment. After a comprehensive review, 31 studies were excluded because they lacked a clear focus on critical thinking, had insufficient pedagogical or cognitive analysis, or provided inadequate methodological information. The final theme synthesis contained 41 studies that satisfied all inclusion requirements.

The selected studies underwent analysis through thematic synthesis. Key insights regarding technology use and critical thinking were identified and assigned initial codes. Codes with similar traits were merged into broader categories, shaped by recurring patterns and conceptual similarities. By comparing and refining these categories, they were structured into overarching themes that illustrate the advantages and disadvantage impacts of technology use in the EFL context.

3 Results and Discussion

3.1 Positive Impacts of Technology on EFL Students' Critical Thinking

The studies reviewed indicate that technology could enhance the growth of students' critical thinking skills when effectively integrated through suitable pedagogical methods. Digital technologies offer students the chance to access a wide range of information, participate in inquiry-based activities, collaborate with peers, and consider their educational experiences. These activities could foster higher-order thinking, including analysing, evaluating, and problem-solving. The literature highlights four primary themes concerning the beneficial effects of technology on critical thinking in EFL students.

3.1.1 *Increasing Information Access and Diverse Perspectives*

Throughout the reviewed studies, the expansion of information access and diverse perspectives was consistently identified as a significant benefit of integrating technology in EFL learning. Researchers discovered that digital technologies offer learners access to authentic materials, multiple viewpoints, and a variety of information sources beyond the traditional environmental setting. This exposure promotes students to compare ideas, evaluate evidence, and construct well-informed arguments, thereby fostering the growth of critical thinking (Akyol & Garrison, 2011; Yang & Wu, 2012). The literature indicates that technology can create more enriched learning environments where students actively engage with diverse perspectives and develop more informed judgments.

3.1.2 *Supporting Inquiry-Based Learning*

Among the reviewed studies, inquiry-based learning became a prominent theme. The literature consistently demonstrates that digital technologies enhance investigation, problem-solving, and information gathering by allowing students to independently explore questions and efficiently access pertinent resources. Studies indicated that technology-supported inquiry activities promote engagement in analysis, interpretation, and evaluation, which are essential components of higher-order thinking (Hmelo-Silver et al., 2007). The findings imply that technology can be a valuable instrument for fostering active knowledge construction and critical inquiry in an EFL context.

3.1.3 Promoting Collaborative Knowledge Construction

The studies reviewed underscored the significance of technology in fostering collaborative knowledge construction. Digital learning environments offer learners the chance to share perspectives, negotiate meanings, and substantiate their viewpoints through interaction and collaborative activities. These experiences promote reflective dialogue and critical evaluation of ideas, both are crucial elements of critical thinking skills (Wu et al., 2011). Overall, the literature suggests that technology-mediated collaboration can enhance critical thinking by exposing learners to diverse perspectives and fostering reasoned discussion.

3.1.4 Enhancing Reflective Learning

The importance of technology in promoting reflective learning is a recurrent theme discovered in the reviewed studies. Researchers have noted that digital tools, including blogs, online journals, and discussion platforms, encourage learners to express their reasoning, assess their learning experiences, and monitor their cognitive processes. These reflective practices were consistently linked to the development of metacognitive awareness and critical thinking (Teng & Zhang, 2020). Overall, the literature indicates that technology can facilitate reflection by offering structured opportunities for students to examine and refine their thinking.

3.2 Challenges and Risks of Technology Use

Although technology offers potential advantages in fostering critical thinking, the reviewed studies also identified several challenges associated with its application in EFL learning. Notably, an excessive or uncritical dependence on digital tools may diminish students' involvement in higher-order cognitive processes and restrict opportunities for independent reasoning. The literature outlined four primary risks linked to technology use: cognitive passivity and a transition from reasoning to information retrieval, decreased metacognitive regulation, reliance on automated and AI-based tools, and diminished evaluative judgment. These findings underscore the necessity of ensuring that technology serves to complement, rather than supplant, learners' cognitive engagement.

3.2.1 Cognitive Passivity and Shift from Reasoning to Retrieval

Cognitive passivity was identified as a prevalent concern in the reviewed studies. Researchers consistently noted a transition from reasoning-based engagement to information retrieval, particularly in technology-rich learning environments (Carr, 2010; Nicholas & Ng, 2012). Instead of actively analysing and evaluating information, students frequently approached tasks as exercises in finding readily available answers from digital sources. This trend was particularly pronounced in EFL contexts, where linguistic challenges prompted students to rely on technological assistance rather than engage in deeper cognitive processing ((Lai & Gu, 2011; Li & Hafner, 2022). Overall, the literature indicates that excessive reliance on easily accessible information may restrict opportunities for critical analysis and independent reasoning.

3.2.2 Reduction of Metacognitive Regulation

Another recurring concern involves the reduction of metacognitive regulation, which is widely recognized as a fundamental component of critical thinking (Facione, 2015). Several

studies have indicated that extensive reliance on digital tools and automated support systems diminishes students' involvement in planning, observing, and assessing their own learning processes (Azevedo et al., 2010; Winne, 2017). Although students were often able to complete tasks successfully, they frequently exhibited limited awareness of the strategies employed and struggled to justify their decisions or reflect on alternative approaches. This decline in metacognitive engagement may impede the growth of self-regulated learning and critical thinking abilities over time.

3.2.3 *Dependency on Automated and AI-Based Tools*

Recent scholarly work has underscored an increasing reliance on automated and AI-driven tools, especially generative artificial intelligence, which is adept at producing complex linguistic and analytical outputs (Kasneci et al., 2023; Lee, 2023). These technologies are capable of delivering immediate solutions to intricate tasks, including writing assistance, content creation, and information synthesis. While these tools offer significant support for learning, an over-dependence on them may diminish opportunities for students to practise independent reasoning and problem-solving. Several studies indicated that students frequently accept AI-generated responses with minimal questioning or verification, which may undermine their cognitive autonomy and critical engagement with information.

3.2.4 *Weakening of Evaluative Judgement*

The literature highlights concern about the diminishing of evaluative judgment, especially concerning the assessment of the credibility and quality of information sourced digitally (Metzger & Flanagin, 2015; Wineburg & McGrew, 2017). Frequently, students favoured convenience, speed, and accessibility over accuracy and reliability when choosing information. This inclination was particularly pronounced in online settings marked by an abundance of information and varying degrees of source credibility. Consequently, students were less inclined to critically evaluate evidence, recognize bias, or confirm the trustworthiness of information, thereby compromising a crucial aspect of critical thinking and academic literacy.

3.3 Synthesis of Findings

The literature reviewed indicates that technology has both enabling and limiting impacts on EFL Students' critical thinking. On one hand, technology could enhance accessibility to information sources, support inquiry-based learning, foster collaboration, and encourage reflective learning practices. These benefits provide students with opportunities to participate in higher-order cognitive processes, including analysing, evaluating, and problem-solving. On the other hand, an excessive dependence on digital tools may result in cognitive passivity, decreased metacognitive regulation, reliance on automated systems, and diminished evaluative judgment. The findings collectively imply that technology does not inherently enhance or impede critical thinking. Instead, its impact is significantly influenced by how it is incorporated into teaching and learning processes. Therefore, pedagogical practices are essential in determining whether digital technology operates as an instrument for the growth of critical thinking or as a source of cognitive dependency.

3.4 Discussion

The findings of this review illustrate that technology provides a multifaceted impact on the growth of EFL students' critical thinking. On one side, digital technologies can enhance critical thinking by offering access to a wide range of information, facilitating inquiry-based learning, encouraging collaboration, and promoting reflective learning practices. These benefits are consistent with constructivist theories, which highlight active engagement, knowledge construction, and reflection as crucial elements of learning (Dewey, 1993; Vygotsky, 1978). By engaging meaningfully with digital resources and learning tasks, students can cultivate higher-order cognitive skills including analysing, evaluating, and problem-solving. These findings corroborate prior research indicating that technology-enhanced learning environments could positively influence critical thinking when thoughtfully integrated into teaching practices (Yang & Wu, 2012).

The findings of this review both affirm and expand upon previous research in the area of technology-enhanced educational instruction. In alignment with earlier studies, it was observed that technology facilitates inquiry, collaboration, and reflective learning, all of which are instrumental in fostering critical thinking development (Teng & Zhang, 2020; Yang & Wu, 2012). However, as compared to many previous studies that predominantly concentrated on the advantages of technology integration, this review underscores the increasing challenges linked to an over-reliance on digital tools, especially generative artificial intelligence. By synthesizing both the positive and negative impacts documented in the literature, the review offers a more nuanced understanding of how technology can both support and limit critical thinking in the EFL context.

The review indicates that technology does not inherently foster critical thinking. Over-reliance on digital tools can result in cognitive passivity, diminished metacognitive regulation, dependency on automated and AI-driven systems, and impaired evaluative judgment (Kasneci et al., 2023). These challenges imply that the implication of technology on critical thinking is primarily influenced by its usage rather than the technology itself. Consequently, effective pedagogical strategies, such as purpose-driven technology integration, inquiry-based learning, teacher mediation, and the cultivation of critical digital literacy, are crucial to ensure that technology enhances rather than supplants students' cognitive engagement. In this context, technology should be regarded as a facilitator of critical thinking rather than a replacement for the thinking process.

4 Conclusion

This systematic literature review explored the impacts of technology on the EFL students' critical thinking and identified pedagogical strategies that facilitate the effective incorporation of digital technology in language instruction. The results demonstrate that digital tools can positively influence the development of critical thinking by broadening access to information, supporting inquiry-based learning, fostering collaboration, and promoting reflective learning practices. These opportunities enable students to be involved in higher-order cognitive activities, including analysing, evaluating, and problem-solving.

However, this review also highlighted several challenges associated with technology use, including cognitive passivity, decreased metacognitive regulation, reliance on automated and AI-based tools, and diminished evaluative judgment. The findings indicate that technology is neither inherently advantageous nor disadvantageous to critical thinking. Instead, its impact largely depends on how it is embedded into pedagogical practices. Thus, to ensure that digital technology operates as an instrument for growing rather than replacing students'

critical thinking, EFL teachers should intentionally integrate technology and promote critical digital literacy.

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