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Integration of techno-pedagogical approach in English as a second language classroom: a systematic review

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ABSTRACT

The integration of technology in English as a second language (ESL) education is embraced by the educational institution and yet becomes a growing trend in today's 21st century ESL classroom. The integration of techno-pedagogical approach in ESL classroom was critically examined in this systematic literature review by addressing three main research topics, the factors that ensure the effective integration of techno-pedagogical approach, yet the potential benefits and challenges of the implementation of this approach in ESL classroom. To review current studies, preferred reporting items for systematic reviews and meta-analyses (PRISMA) were adopted and two core journal databases, namely Scopus and Web of Science were utilized to review on 30 articles published in 2019-2023. A comprehensive overview that aids in understanding the intricate problems related to technology integration in ESL classrooms for educators and policymakers was provided and the delicate balance needed for integration to be effective, acknowledging the benefits and challenges of implementing techno-pedagogical approaches in ESL classroom was highlighted. Lastly, several recommendations that needed to be the subject of further investigation were made at the conclusion of this study.

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1. INTRODUCTION

The field of English as a second language (ESL) education has witnessed a remarkable transformation with the integration of techno-pedagogical approaches, marking a significant departure from traditional teaching methodologies. The fourth industrial revolution (IR 4.0) is bringing the most recent technological developments to the world [1]. The seamless amalgamation of technology and pedagogy has created new opportunities for creative and dynamic language learning experiences, shaping the way educators engage with diverse learner populations in ESL classrooms. In line with the global commitment to the United Nations 2030 Agenda for Sustainable Development, the fourth sustainable development goal (SDG) emphasizes the importance of ensuring inclusive and quality education for all [2]. This objective emphasizes the necessity of utilizing innovative approaches and technologies to improve educational outcomes and promote possibilities for lifelong learning. The incorporation of techno-pedagogical approaches in the context of ESL stands as a promising avenue to promote equitable access to quality education and to address the diverse learning needs of students within a rapidly evolving educational landscape.

English language is widely spoken around the world which is increasingly gaining the numbers of its users. It is the third most spoken language in the world and English is an international language that is acknowledged all over the world [3]. It is also the official language of over 50 nations. English proficiency is

necessary for various reasons, including communication, employment needs, scientific and technological advancements, and more [1]. It is adopted as "English as a second language" or "Foreign language" (ESL/EFL) to assist for individuals whose first language is not English. English is regarded as being challenging to acquire as a second language [4]. ESL classroom caters to people who are studying the language either in a multilingual setting or in a nation where it is the primary language. Given that the trend of globalization has made English a universal language that is widely spoken by non-native English speakers, it is obvious how important it is to encourage ESL among these individuals. Since English is regarded as a second language in Malaysia and is formally utilized in everyday life, such as business, school, and transportation, it plays a major part in the country's educational system [5].

The field of ESL includes a wide range of pedagogical approaches, techniques, and teaching tactics intended to support non-native English speakers' efficient language learning and competency growth. Acquiring proficiency in the English language is crucial, especially since it is utilized extensively in many fields of education nowadays [6]. Building welcoming and encouraging learning settings that accommodate students varied linguistic and cultural identities is highly valued in the field of ESL. To help non-native English speakers flourish in a variety of academic, professional, and social contexts, the significance of developing effective communication skills and cultural competency is highlighted. By addressing the significance of developing inclusive, student-centered learning settings that promote language competency, cultural awareness, and global citizenship, ESL contributes to the ongoing conversation about effective language teaching [7]. The study of ESL is vital to support effective language acquisition and cross-cultural communication among various populations of non-native English speakers [8].

Technology's constant evolution has given educators a unique opportunity to reinvent traditional language training [9] and investigate cutting-edge approaches that meet the many learning preferences and styles of ESL students [10]. Growing possibilities for teaching English in ESL countries are brought about by the growth of information and communication technologies [9]. As the demand for English language proficiency continues to grow in an increasingly interconnected world, integrating a techno-pedagogical approach in ESL classrooms can help close the gap between traditional teaching method and the digital learning environment. Traditional teaching method is mostly accomplished by open conversation in the classroom between the educators and learners without the integration of technology and information and communication technology (ICT). Educators may establish an interactive and captivating learning environment that encourages critical thinking, creativity, and collaboration among ESL learners. Moreover, the incorporation of technology can enable customized learning opportunities, enabling instructors to customize lessons to match each student's unique requirements and interests.

The Government of Malaysia has implemented multiple measures aimed at promoting increased integration of ICT in order to augment the efficacy of educational and training programs [11]. The Malaysia Education Blueprint 2013–2025 includes leveraging technology to scale up learning quality as one of its important components due to the rapid advancement of technology [12]. ICT should be completely integrated into the curriculum and pedagogy of the educational system as approaching Wave 3 (2021–2025). The Ministry's primary goal is to increase and enhance the use of ICT by educators and students. This will not only continue to extend efforts around distance and self-paced learning, but also improve the curriculum of the educational system to endure the challenges of globalization. Thus, the use of technology in ESL classrooms, guided by Malaysia's Ministry of Education, emerges as a strategic effort that guarantees the relevance and adaptability of ESL education in the 21st century while simultaneously satisfying the need for English proficiency across the globe.

When it comes to using technology in ESL classrooms, the term "techno-pedagogical approach" refers to the methodical and deliberate application of different technological tools and techniques to improve language learning outcomes. It aims to provide a dynamic and engaging learning environment that meets the various requirements and learning styles of ESL students by fusing innovative technology with pedagogical principles. Using a techno-pedagogical approach has been linked to helping ESL students develop digital literacy and 21st-century skills, which will help them navigate and communicate in a technologically advanced world [13]. When educational technology first emerged, content and pedagogical knowledge were not attached to the teaching of technological skills [14]. At that point, it became clear that technology by itself could not advance pedagogy or content understanding, and consideration was given to how technology may be integrated into the teaching and learning process. The evolution of education causes technology be incorporated and used in teaching and learning in today's classrooms [15]. Technology pedagogical and content knowledge (TPACK) which referred to a conceptual framework for analyzing teacher knowledge required for technology integration was then emerged as a new paradigm as a result of this adaptation of technology knowledge to the idea that Shulman [16] describes as pedagogical content knowledge (PCK) [17]. This idea relates to employing carefully chosen technologies in conjunction with appropriate pedagogical approaches and methodologies to teach certain material. TPACK is a combination and synthesis of three main knowledge domains, which are content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). To ensure that students

learn efficiently and effectively, teachers are expected to integrate their expertise in content, pedagogy, and technology into their teaching process. Teachers who have a strong comprehension of TPACK might utilize it pedagogically to improve student learning outcomes and content delivery.

With an emphasis on the transformative potential of technology in enhancing language learning outcomes and fostering a more interactive and inclusive learning environment for ESL students, the integration of the techno-pedagogical approach in ESL classrooms represents a dynamic and evolving paradigm in language education. The use of technology in the classroom has increased the curiosity and exposure of this generation of ESL students to learning. With the use of technology in the classroom and appropriate teaching techniques, students engage with text in an effective manner. To create a dynamic and immersive learning environment, educators must use a variety of pedagogical tools that incorporate technology into lesson design, instructional delivery, and evaluation procedures. Through the development of digital literacy skills, individualized instruction, and collaborative learning, this approach helps ESL students navigate and communicate effectively in the digital age.

This systematic literature review acknowledges a research gap related to the need for a thorough comprehension of the unique opportunities and challenges that come with the successful integration of technology in ESL classrooms. Even though previous research indicates that a techno-pedagogical approach could be beneficial in language learning, there is still a dearth of comprehensive studies on the challenges faced by educators while implementing technology in ESL settings, as well as practical implementation strategies and best practices in integrating technology into ESL learning. Kozikoğlu and Babacan [18] reported opinions of Turkish EFL teachers towards technology were not substantially influenced by factors such as gender, professional development, or project training. According to Mohammadkarimi [19], pre-service teachers and teacher educators are highly proficient in their comprehension of pedagogical content and are familiar with fundamental traditional technologies; nevertheless, their experience with professional technologies is limited. There is a dearth of study on language instruction compared to the abundance of research on TPACK studies in many subjects, especially the social sciences, sciences, and mathematics. Over the previous ten years, there has not been much research on TPACK in language teacher education [20]. In light of this, there is an increasing need for a systematic review that examine the current landscape of techno-pedagogical integration in ESL education. This paper aims to examine the elements that impact the effectiveness of the implementation of techno-pedagogical approach and the potential benefits yet the difficulties of integrating this approach in ESL classroom. Three research questions were formulated for this systematic review:

i) What are the factors that influence the effectiveness of the integration of techno-pedagogical in ESL classroom?
ii) What are the potential benefits of integrating techno-pedagogical approach in ESL classroom?
iii) What are the challenges of integrating techno-pedagogical approach in ESL classroom?

2. METHOD

Preferred reporting items for systematic review and meta-analyses (PRISMA) was used as a framework [21] to conduct this systematic review procedure. This systematic study was carried out by looking for and locating articles about techno-pedagogical skill that integrated in ESL classroom from a variety of databases, including Scopus and Web of Science (WoS). After that, a few stages of identification, screening, eligibility, and exclusion followed in this methodical procedure as shown in Figure 1.

2.1. Phase 1: identification

As outlined in the PRISMA standards, the identification stage is the first step in a systematic review. The identification step involves finding synonyms, related concepts, and variations for the study's primary keywords namely techno-pedagogical, strategy, and ESL. Based on that rationale, the researchers have chosen two databases: WoS and Scopus. Providing additional options for the selected database to search for more pertinent articles to include in the systematic review is the aim of this stage. The keywords from online thesaurus, keywords from prior research, and keywords recommended by databases were all employed in this approach. Additionally, the research question proposed was taken into consideration when developing the keywords [22]. Scopus is a database that combines encyclopedic abstracts and citations with connected scholarly content. In the meanwhile, WoS functions as a database that offers extensive analytical data and a scientific citation search. Because of their comprehensiveness and sophisticated search features, Scopus and WoS are regarded as the top databases for systematic reviews [23]. In order to find the pertinent articles about the integration of techno-pedagogical approach in ESL classroom, keywords were carefully constructed to produce the full search string. Keywords similar and related to techno-pedagogical, approach, and ESL were used and the search string for each database utilized in this investigation is summarized in Table 1.

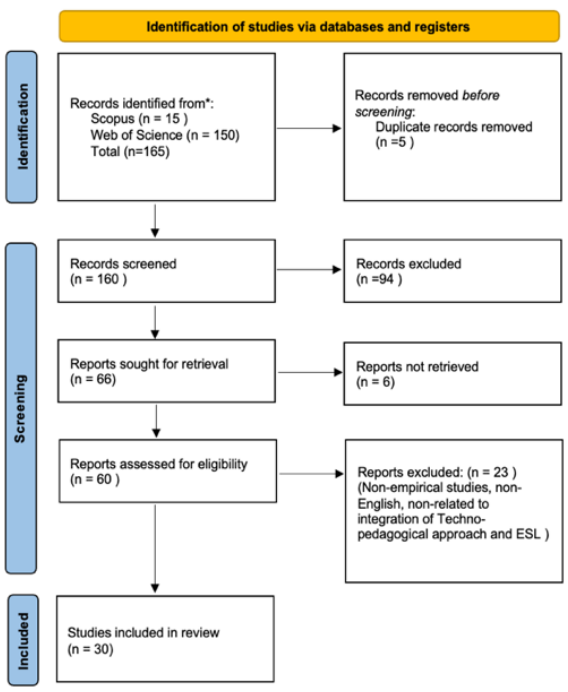

Figure 1. Flow diagram of the study

Table 1. The search string used for the systematic review process

Database	Keyword used
Scopus	TITLE-ABS-KEY(("techno-pedagogical" OR "Technological Pedagogical Content Knowledge" OR "technology pedagogical" OR "techno-pedagogy" OR "technology pedagogy" OR "TPCK" OR "Technological pedagogical and content knowledge" AND "approach" OR "skill" AND "integration" OR "application" AND "ESL" OR "EFL"))
Web of Science	TS = (("techno-pedagogical" OR "Technological Pedagogical Content Knowledge" OR "technology pedagogical" OR "techno-pedagogy" OR "technology pedagogy" OR "TPCK" OR "Technological pedagogical and content knowledge" AND "approach" OR "skill" AND "integration" OR "application" AND "ESL" OR "EFL"))

2.2. Phase 2: screening

The researchers completely identified duplicate papers in WoS and Scopus. The remaining publications underwent a thorough examination to determine whether they satisfied the researchers' criteria. All 165 articles were subjected to the article selection criteria, which were automatically applied in the database using the sorting approach. A total of five duplicate articles were eliminated and the inclusion and exclusion criteria indicated in Table 2 were used to screen the remaining 160 articles.

Researchers should always determine the time range of the articles before examining them, as it is challenging for the authors to read all the articles [24]. Consequently, one of the inclusion criteria was set for the time frame of 2019 to 2023. A total of 94 articles that were published before 2019 were excluded before proceeding to the examination of eligibility.

Table 2. Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Type of article	Journal articles	Review articles, books, book chapters, conference proceedings
Publication year	2019–2023 (5 years timespan)	<2019
Language	English	Non-English
Content	Related to techno-pedagogical approach and the ESL context	Non-related to techno-pedagogical approach and the ESL context

2.3. Phase 3: eligibility

A total of 60 articles were prepared for the eligibility stage, which is the third in the process. All the articles' titles, abstracts, and primary contents were carefully reviewed to make sure they satisfied the inclusion requirements in Table 3 and could be used in the current study to accomplish the research goals. To ensure the

review's quality, only empirically based studies that were published in a journal were considered and only texts written in English were included. Additionally, only articles about integration of techno-pedagogical approach and ESL were chosen. By using this strategy, 30 articles were eliminated and 30 articles were ready to be reviewed.

2.4. Phase 4: inclusion

Following the three stages, only articles that actually satisfied the criterion were included. Books, book series, book chapters, conference proceedings, systematic review articles, non-English publications published before 2019, and non-ESL articles were all crucial criteria for exclusion. Consequently, after the screening procedure, 30 articles were chosen to be reviewed in this systematic literature review. The chosen articles' objectives were all connected to the integration of techno-pedagogical approach in the context of ESL. The results of the research will be enumerated and purposefully addressed in the following section.

3. RESULTS AND DISCUSSION

3.1. Overview of reviewed articles

A total of 30 articles were selected and reviewed in this systematic literature review to examine the factors that influence the integration of techno-pedagogical approach in ESL classroom and the potential benefits and challenges of integrating techno-pedagogical approach in ESL classroom. The distribution of the selected articles published between 2019 to 2023 were shown in Figure 2.

Table 3 shows the number of articles sorted according to the methodology used in conducting the research study. A breakdown of the number of papers according to the research study approaches used is shown. There are three types of research study approaches used by researchers. Ten of the articles use quantitative methods, seven use qualitative methodologies, and thirteen use a mixed-methods approach.

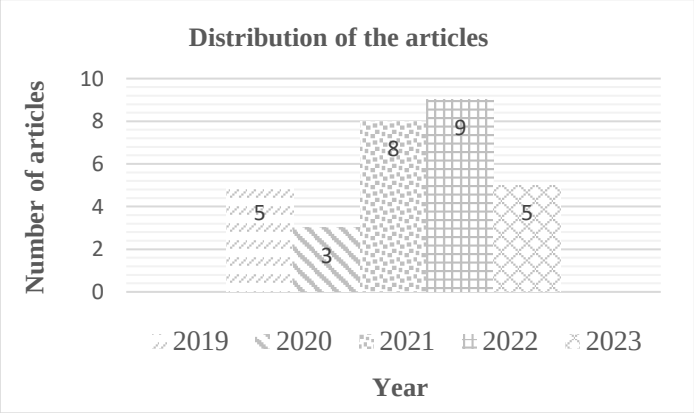

Figure 2. Distribution of the selected articles published between 2019-2023

Table 3. Number of articles based on methods

Method	Number of articles
Quantitative	10
Qualitative	7
Mixed Method	13

3.2. Main findings

The objective of this systematic literature review is to identify the factors that influence the effectiveness of integration of techno-pedagogical approach in ESL classroom, and both the potential benefits and challenges of it. There were 30 articles reviewed and analyzed to answer three research questions (RQ):

i) RQ1: What are the factors that influence the effectiveness of the integration of techno-pedagogical in ESL classroom?
ii) RQ2: What are the potential benefits of integrating techno-pedagogical approach in ESL classroom?
iii) RQ3: What are the challenges of integrating techno-pedagogical approach in ESL classroom?

These studies' categories are further divided into three study constructs of factor, benefit and challenges on the integration of techno-pedagogical approach in ESL classroom. The study constructs are divided and categorized based on the research questions. Table 4 reveals the percentage of articles according to the respective constructs. Out of those three constructs, the most findings were found in research pertaining to factor (28 articles; 90%) and challenge (19 articles; 63%), followed by benefit (12 articles; 40%). Researcher will present the results of the reviewed articles in relation to the three research questions formulated in this systematic literature review.

Table 4. Percentage of articles according to the respective constructs

Construct	Number of articles
Factor	28 (93%)
Benefit	12 (40%)
Challenge	19 (63%)

3.2.1. What are the factors that influence the effectiveness of the integration of techno-pedagogical in ESL classroom?

To promote an efficient and long-lasting integration of technology in ESL instruction and improve language learning results and student engagement, it is imperative to recognize and take into consideration these variables that influence the effectiveness of the integration of techno-pedagogical in ESL classroom. These variables encompass factors include learner characteristics, instructional techniques, technology access, and teacher training. Table 5 shows the 28 articles that discussed on the factors regarding the integration of techno-pedagogical approach in ESL classroom.

Table 5. Findings regarding factor on the integration of techno-pedagogical approach in ESL classroom

Study	Personal	Institutional	Technological
[18]	√		
[19]	√		
[25]	√		
[26]	√		
[27]			√
[28]	√	√	√
[29]	√		
[30]	√	√	√
[31]	√		
[32]	√		√
[33]	√	√	√
[34]	√		√
[35]	√	√	
[36]	√		
[37]	√	√	√
[38]	√		
[39]	√		
[40]	√	√	√
[41]	√		
[42]	√		
[43]	√	√	√
[44]	√		
[45]	√		
[46]	√	√	
[47]	√		
[48]	√		
[49]	√		
[50]	√		√

The identified factors from the reviewed articles were categorized into three main themes, included personal, institutional and technological factors. This is align with the framework for viewing online technologies and implementation practices presented by Sherry and Gibson [51]. Further explanation on the categorized factors will be discussed to provide valuable insights for educators and researchers to enhance ESL instruction through technology integration.

a. Personal factor

When it comes to personal aspects, educators' attitudes and beliefs are crucial in determining how techno-pedagogical approaches are incorporated. A total of 27 reviewed articles mentioned personal factor is one of the crucial factors on the implementation of techno-pedagogical approach in ESL classroom. The degree to which technology is integrated into pedagogical practices is greatly influenced by educators' attitudes towards technology, their opinions of its value in ESL instruction, and their level of comfort utilizing digital tools. Digital technologies can be successfully integrated into ESL classes by teachers that have a positive attitude and are willing to embrace technological developments, resulting in dynamic and interesting learning experiences [34], [40]. Rafiq *et al.* [45] revealed that pre-service teachers possess adequate understanding of the TK and other TPACK domains. Furthermore, the study's assessment of technological preparedness revealed that the pre-service EFL teachers are prepared to incorporate technology into their lessons. However, teachers who show reluctance or opposition to technology may find it difficult to utilize it to its fullest extent, which will impede the successful adoption of techno-pedagogical methods. Previous study [44] also revealed teachers who reported having a high degree of technology-enhanced classroom knowledge, or who had used technology to support their instruction prior to emergency remote teaching (ERT), have less difficulty adjusting to ERT than teachers who reported having a moderate or low level of TPACK.

Additionally, a key factor in the effective integration of techno-pedagogical approaches in ESL classrooms is the technological competency and digital literacy of educators. Effective integration of technology into instructional practices can improve the quality of ESL instruction for teachers who have a solid understanding of digital tools, applications, and multimedia resources [50]. Preservice teachers used advanced technology, such as the Internet and digital video, to instruct their students instead of traditional tools like books, chalk, and whiteboards [38]. Their study's participants also designed instructional materials using her technological knowledge (TK). Teachers created instructional movies for students using a variety of application. For teachers to be equipped with the abilities they need to navigate and make use of a wide variety of digital resources, they must receive sufficient training and participate in professional development programs that emphasize improving educators' technology competencies [30], [46], [48]. To ensure that teachers are prepared to adjust to new technology developments and cutting-edge pedagogical approaches, it is also essential to cultivate a culture of ongoing learning and professional development among them [28].

b. Institutional factor

There were eight reviewed articles mentioned institutional factor in integrating techno-pedagogical approach in ESL classroom. In terms of institutional factors, having sufficient resources and infrastructure for technology is essential to facilitating the smooth integration of techno-pedagogical approaches in ESL instruction. Institutions that place a high priority on providing adequate funds and resources for the purchase of contemporary technology tools, digital gadgets, and software programs establish a supportive environment that encourages the efficient use of technology in ESL classes. A strong technical foundation, consisting of dependable internet access, modern hardware and software, and a wide variety of digital resources, is necessary to create a favorable learning atmosphere that encourages interactive and immersive language learning experiences [35], [37]. Farhadi and Ozturk [28] revealed a large number of pre-service teachers felt proficient in utilizing technology tools in EFL classrooms, some felt inadequate within the EFL classroom environment. A study mentioned, "conflict developed when the new physical artifacts such as online teaching platforms and various software were included into the foundational teaching resources. It seemed to be a barrier to the teachers' ability to teach their subjects effectively."

The integration of techno-pedagogical approach in ESL classrooms is greatly influenced by institutional policies and administrative support. Sun and Zou [46] revealed the majority of those interviewed concurred that people in positions of authority had an impact on their readiness to accept online instruction. Furthermore, a culture of technological innovation among educators, new pedagogical practices, and administrative support that emphasizes the use of technology in ESL curriculum can all help to greatly increase the efficacy of techno-pedagogical integration [40], [43], [44]. Building an inclusive and dynamic learning environment that meets the various requirements of students and teachers requires the establishment of a supporting institutional structure that encourages the seamless incorporation of technology in ESL instruction.

c. Technological factor

Regarding technology, the integration of techno-pedagogical approaches in ESL classrooms is greatly influenced by the usability and accessibility of digital tools and applications [27], [28], [33], [50]. A total of 10 articles mentioned how technological factor affects the integration of techno-pedagogical approach in ESL classroom. The involvement of instructors and students with digital materials is facilitated by easily navigable and user-friendly technical tools, which in turn promotes a smooth integration of technology into ESL instruction. Kusuma [33] mentioned in his research study that ICT capabilities, resources, and fulfilment of IT

competencies are the factors influencing the ICT integration in education. In addition, the accessibility and usability of digital tools and applications are improved by their compatibility with a wide range of devices and operating systems. This allows teachers and students to utilize technology in a variety of learning situations. Techno-pedagogical approaches in ESL education can be more effectively and efficiently integrated when accompanied by technological tools that provide interactive and adjustable features, as well as user support and technical aid [27].

The efficiency of techno-pedagogical approaches in ESL classrooms is considerably increased by the inclusion of interactive and collaborative digital learning platforms [41]. A dynamic and interactive learning environment is fostered by educational technology that makes it easier for students and educators to collaborate, communicate, and share knowledge through digital learning platforms that include features like virtual classrooms, online discussion forums, and collaborative project spaces [34]. This improves the quality of their language learning experience. Fostering a dynamic and inclusive learning environment that encourages efficient communication and teamwork among ESL learners requires utilizing interactive and collaborative digital learning technologies. The integration of techno-pedagogical approaches in ESL classrooms is influenced by a complex interaction of institutional, personal, and technological factors. To effectively integrate technology into ESL instruction, instructors and educational institutions must address the different aspects that fall under each of these categories and build a dynamic, inclusive learning environment.

3.2.2. What are the potential benefits of integrating techno-pedagogical approach in ESL classroom?

Table 6 displays the benefits of the integration of the integration of techno-pedagogical approach in ESL classroom based on the reviewed articles. The use of techno-pedagogical approaches in ESL classrooms has an enormous number of potential advantages that enhance language learning encounters and elevate students' overall academic achievements. A dynamic and interactive learning environment that encourages student engagement, motivation, and language competency can be created in the traditional ESL classroom by utilizing technological breakthroughs in pedagogical practices [25]. The potential advantages of incorporating techno-pedagogical approaches in ESL classrooms and benefits that technology presents for enabling efficient language acquisition and all-encompassing language learning experiences are found in the reviewed articles.

Table 6. Findings regarding benefits of the integration of techno-pedagogical approach in ESL classroom

Study	Fostering immersive and interactive language environment	Personalized learning experience	Development of technological competencies and digital literacy skills	Access to a variety of authentic and diverse language learning resources
[19]	√	√	√	
[25]	√			
[26]	√			
[34]	√			
[40]	√	√	√	
[46]	√			
[47]		√		
[44]	√			
[27]	√		√	√
[52]	√			
[53]	√	√		√
[54]		√		√

a. Fostering immersive and interactive language learning environment

Fostering immersive and interactive language learning environments is one of the main advantages of incorporating techno-pedagogical methods in ESL classes as mentioned in 10 reviewed articles. Digital apps, multimedia materials, and technological tools provide a variety of ways for students to interact dynamically and practically with the English language. Students can actively participate in language learning activities, such as virtual simulations, language games, and multimedia content with the usage of interactive learning platforms, language learning software, and online educational resources. The use of technology in the classroom has increased the curiosity and exposure of this generation of ESL students to learning. With the use of technology and appropriate teaching techniques, students engage with text in an effective manner [55]. According to previous research finding [53], students had good attitudes about utilizing WhatsApp applications to increase their vocabulary. Learners had a higher possibility of acquiring vocabulary for speaking fluency because of WhatsApp's accessibility, ease of use, information transformation, and discussion features. Research by Shakir *et al.* [56] also reported that online quiz games can increase ESL students' determination to perform excellently in the classroom when incorporated into ESL instruction. This creates a more immersive and captivating learning environment. Teachers may create an engaging and dynamic learning environment

that increases student involvement and promotes a deeper comprehension of the English language by including interactive learning experiences. Yulia and Amirudin [52] also reported in their research, "by utilizing the Aegisub application to create descriptive writing on a computer rather than on blank paper as is usual, the application may pique students' curiosity and cause them to feel more challenged."

b. Personalized learning experience

To further accommodate the various learning needs and preferences of ESL students, the integration of techno-pedagogical methodologies enables personalized and adaptive learning experiences, as reported in 5 reviewed articles. To provide individualized learning materials, adaptive assessments, and instruction that is specifically catered to each student's learning style, aptitude, and language proficiency level, adaptive learning technologies and personalized learning platforms make use of data-driven algorithms and customized learning pathways. Huzairin *et al.* [54] revealed that students tend to use their smartphones more frequently to access content and information. By offering tailored language learning exercises, adaptive tests, and focused instructional interventions that cater to each student's unique learning needs, educators may create a more individualized and student-centered learning environment which provide students personalized learning experiences. Liu *et al.* [47] research on how learners' critical thinking disposition influences their micro-lesson learning highlights the importance of taking learner characteristics into account in technology-mediated English teaching and learning. Teachers can provide a safe, welcoming environment in the classroom that encourages students' independence and self-directed language learning by including personalized and adaptive learning experiences. Several research studies [57], [58] has proven that online learning exercises can assist students in developing their vocabulary, grammar, pronunciation, and reading skills in English. In previous study [19], 84% of the research participants which are teachers encourage pupils to use technology to help them independently develop their language abilities.

c. Development of technological competencies and digital literacy skills

The development of technological competencies and digital literacy skills, which are crucial for students' performance in the classroom and workplace in the digital age, is also supported by the integration of techno-pedagogical approaches. There were three reviewed articles mentioned this benefit of integrating of techno-pedagogical approaches in ESL classroom. Students can acquire critical digital literacy skills like information literacy, digital communication, and multimedia creation through technological tools and these abilities are crucial in today's technologically advanced society [27]. In previous research [19], 70% of the participants which are teachers mentioned utilizing technological tools and resources to continuously improve language instruction will support students' professional development. Teachers may give students the skills they need to use a wide variety of digital resources, communicate successfully in digital spaces, and critically assess online content by including digital literacy skills into ESL training [40], [59]. This provides students the tools they need to succeed in a world increasingly connected by technology and gets them ready for the needs of the workforce of the 21st century. The development of 21st-century abilities, such as communication, teamwork, creativity, and critical thinking, is also facilitated by the integration of techno-pedagogical approaches and is crucial for students' success both academically and professionally [60]. These critical 21st-century skills will equip them for the demands of the global workforce and the difficulties of the digital age.

d. Access to a variety of authentic and diverse language learning resources

The use of techno-pedagogical methodologies expands students' exposure to real-world language usage and cultural contexts by improving their access to a variety of authentic and diverse language learning resources, supported by three reviewed articles [27], [53], [54]. Research by Huzairin *et al.* [54] reported that the participants' most common online informal learning activities on their smartphones include searching for study-related information, using online dictionaries, checking information unrelated to studies, listening to lectures, and reading emails. Students have access to a wide selection of authentic language materials, such as e-books, audiovisual content, and online articles, that expose them to actual language usage and cultural nuances through online language learning platforms, digital libraries, and multimedia resources. Teaching language involves more than just helping students acquire the material; it also includes assisting them to build communication skills [61]. Teachers can establish a thorough and immersive language learning environment that exposes students to real-world language contexts, cultural diversity, and authentic language usage, ultimately improving their language proficiency and cross-cultural communication skills. This can be achieved by integrating a variety of language learning resources. Research by Pragasam and Sulaiman [27] mentioned 67% of their research participants concur that technology makes reading easier, where students use educational technology to make reading texts easier to understand. With the use of technology, such as instructional videos and online games, students can apply language skills more effectively.

3.2.3. What are the challenges of integrating techno-pedagogical approach in ESL classroom?

Table 7 shows the challenges of the integration of techno-pedagogical approach in ESL classroom. A total of 19 reviewed articles mentioned the challenges on integrating technology into ESL construction. Six challenges were found in the reviewed articles, which included technical issue, time constraint, teachers' digital literacy, content quality and relevance, students' digital literacy and teachers' perspective.

Table 7. Findings regarding challenges of the integration of techno-pedagogical approach in ESL classroom

Study	Technical issue	Time constraint	Teachers' digital literacy	Content quality and relevance	Students' digital literacy	Teachers' perspective
[18]			√			
[19]	√					
[25]			√			
[28]	√		√			
[32]	√		√			
[33]	√		√		√	
[34]			√			
[35]			√			
[36]			√			√
[37]	√	√		√		
[38]			√			√
[39]		√	√	√	√	√
[40]			√			√
[46]			√			√
[49]			√			
[45]						√
[44]			√	√		√
[30]	√	√	√			
[52]	√			√		

a. Teachers' digital literacy

Teachers' digital literacy is the main challenge of the implementation of tech-pedagogical approach in ESL classroom, as 15 reviewed articles reported this issue. Teachers that are skilled and confident are necessary for the successful incorporation of technology in ESL courses. Various skill levels are listed in "techno-pedagogical competences" [25]. Karamifar *et al.* [25] have ranked the needs for handling basic tools and applications and solving simple technical pedagogical skills is crucial. Nevertheless, a lack of experience with the newest educational technology or inadequate training for incorporating them into their pedagogical approaches may provide difficulties for teachers. Kulaksiz [32] research participant mentioned, "I used to be apprehensive about using the applications we used in the training and learning how to utilize them. I began to feel more secure about my skills after realizing how they performed in class." Kozikoglu and Babacan [18] research reported, to foster positive attitudes through the usage of technology, teachers needed support in technological literacy during their training. Sun and Zou [46] research study interview reported if the teacher candidates had a high degree of TPACK, they would be more likely to use online resources in their lessons. "They believed that they would use online teaching technologies more frequently if they had better TPACK." The rapid evolution of technology makes it challenging for educators to stay abreast of the latest tools and strategies, emphasizing the need for ongoing professional development. Kusuma's finding [33] revealed that ICT integration in English education in Indonesia was not that adequate and the research participants asserted that the primary cause of this issue was the lecturers' inadequate ICT proficiency in utilizing those resources in the classroom. Educators were not utilizing digital technologies to their full potential and did not possess the skills needed to embrace and incorporate them into their teaching [62]. To tackle these obstacles, educators need thorough professional training program that enhance their technology skill.

b. Technical issue

Technical issue and the prevalence of infrastructure and access inequalities is also the main obstacles to implement techno-pedagogical approach in ESL classroom, as mentioned in 7 reviewed articles. Not every student has equal access to technology, despite its widespread use. According to Hockly [63], developed nations are typically connected with higher resource contexts, which are linked to higher levels of technology use. Several nations in Southeast Asia, are classified as developing or sub-developed countries. Student engagement with online resources can be negatively impacted by a digital gap caused by limited access to computers, the internet, or other digital devices. According to Gillett-Swan [64], increased internet access will give students more chances to access a greater range of engaging online content and more synchronous tools.

Additionally, there may be problems with internet connectivity's dependability and availability in specific areas or schools. Mohammadkarimi [19] mentioned in his study reporting that teachers frequently encounter difficulties when attempting to troubleshoot printers, scanners, projectors, and internet connections. The number of online activities and collaborative learning opportunities that can be facilitated by suitable infrastructure can be restricted, making it more difficult to integrate technology into ESL training. Research by Chen *et al.* [30] reported the participant in his research expressed serious concern on the technical issue while implementing online teaching activity, "In the event of network outages or bottlenecks, neither I nor the students could respond quickly enough to each other." ICT resources and accessibility are the two main elements that have a significant impact on the success of ICT integration in education, among many other aspects [65]. As Kusuma [33] reported, every ICT integration in education requires a satisfactory level of ICT resources and accessibility. Unexpected technical difficulties may cause a disruption in the flow of learning and result in the loss of critical teaching time. To reduce the impact of technology disruptions, educators need to be ready to handle typical technical issues and have backup plans ready.

c. Time constraint

Time constraint is also a critical challenge in integrating a techno-pedagogical approach in ESL classrooms, as reported in 3 reviewed articles. This restriction has a big influence on how well technology is used in the teaching and learning processes, especially on ESL educators' professional development. It takes careful planning to develop lessons that cover the appropriate language learning objectives and successfully integrate technology. Technical difficulties like device malfunctions, software glitches, or internet connectivity problems can interrupt a lesson and take up critical class time to troubleshoot. Teachers need to strike a balance between the time needed for technology integration and the time allotted for language education. Time limits make content curation to be difficult. Educators require time to develop or modify materials and exercises that maximize the use of technology. As mentioned in research study [38], educators required additional time to fully comprehend the materials before creating the instructional materials. To ensure that online materials are in keeping with students' language skill levels, cultural backgrounds, and curriculum objectives, teachers must choose and modify them wisely. Some educators might choose to use well-known resources that can be easily incorporated into classes rather than exploring new topics. Zhang and Fang [40] mentioned as the video lecture approach carried out by participants was limited not only by time but also by its one-way transmission and lack of interactivity with students due to time constraint. The short amount of time available makes it difficult to include digital literacy skills into ESL instruction. It takes specialized instructional time to teach kids how to use digital platforms, critically assess online content, and behave responsibly when using technology.

Due to time restrictions, teachers could be forced to prioritize traditional curriculum content above the explicit teaching of critical digital literacy skills. To address this issue, enhancing teachers' tech competency can be achieved by making professional development a priority and providing teachers with effective training modules. The burden on ESL teachers can be reduced by making well-selected resources easily accessible and encouraging a collaborative lesson planning culture. As mentioned in previous study [25], in order to help teachers adapt new technology knowledge to fit their teaching context, it would appear effective to modify training program to their levels and needs while also making them more relevant. Training program and workshops for teachers to improve their skill with educational technology necessitate time commitments. It could be difficult for ESL teachers to set aside enough time for thorough training, which could leave them unconfident and not prepared to incorporate technology into their lessons with ease.

d. Content quality and relevance

Digital content and internet resources are frequently incorporated into ESL sessions as part of technology integration. It can be difficult to guarantee these resources' quality, cultural relevance, and language appropriateness [38], [40], [44], [52]. Instructors must take the effort to choose materials that are appropriate for the language skills and cultural backgrounds of their pupils. As reported in a study [58], sometimes error happens in the system that used in techno-based classroom. The number of resources available online does not automatically imply that they are appropriate for ESL students. As reported in previous study [40], choosing the right amount of subjects and resources and modifying them to fit the technological specifications of each video lecture were the main challenges in producing video lectures. Careful assessment and modification of the content is required to fulfil the various demands of the pupils, considering elements like linguistic intricacy, cultural awareness, and suitability for the ESL setting.

e. Students' digital literacy

Students' digital literacy presents another difficulty when integrating a techno-pedagogical approach, mentioned by Kusuma [33]. Even though technology can be an effective teaching tool, not all students are adept at using computers or online resources. Students who are not digitally literate may find it difficult to

interact with online materials, work together on digital platforms, or communicate clearly in virtual settings. Some students will encounter difficulties when they were assigned tasks involving the use of other instruments, particularly ones they are unfamiliar with [33]. To guarantee that students have the abilities they need to navigate the digital world, ESL teachers must integrate digital literacy into their curriculum. This entails knowing how to utilize different software programs, assessing online content critically, and acting morally and responsibly when using the internet. Students' involvement and participation in digital learning activities are influenced by their attitudes and opinions about technology. Students are more likely to gain from the incorporation of techno-pedagogical approaches if they exhibit a favorable attitude towards technology and a willingness to investigate and experiment with digital tools. The efficacy of combining techno-pedagogical approaches is largely dependent on the unique learning preferences and demands of each student. Digital learning experiences must be customized to fit a variety of learning modalities, which requires an understanding of the students' unique learning preferences, styles, and skills. Student engagement, motivation, and overall learning results can be greatly improved by providing personalized learning experiences that are tailored to each student's specific requirements, interests, and talents [37]. Therefore, the key to developing a supportive and encouraging learning environment that facilitates the successful integration of techno-pedagogical approaches is to cultivate a positive technology mentality among educators and students. Furthermore, embracing students with strong ICT understanding will positively impact future ICT implementation [66].

f. Teachers' perspective

One major obstacle to integrate techno-pedagogical approach in ESL classrooms is the perspectives of the teachers, as reported in 7 reviewed articles. There are several reasons why educators can be reluctant to adopt technology, such as a lack of experience, workload, or doubts about the effectiveness of digital technologies for language acquisition. This is consistent with previous research showing that teachers' use of technology is positively correlated with their opinion of the relevance or value of technology in the curriculum [67]–[69]. Study by Rafiq *et al.* [45] demonstrated that EFL pre-service teachers that had high TPACK are technologically ready in the classroom, indicating that they are psychologically ready to instruct in an online environment and possess the TPACK domains required for instruction. To overcome these obstacles, educators need focused professional development that attends to their worries and increases their comfort level when it comes to using technology. Teachers may feel that integrating technology is time consuming if they are not properly trained or if the tools are not incorporated into their current teaching methods. A thorough needs assessment and well planned mini-workshops or seminars were found to be essential in assisting instructors in adjusting to the "new normal pedagogy" [44]. Addressing teachers' perspectives, involves not just giving them the tools they need, but also fostering a culture that appreciates and encourages the use of techno-pedagogical approaches while highlighting the ways in which these approaches can improve ESL lesson outcomes. The right use of technology should be viewed as a contextualized approach that can support students' success [39].

4. CONCLUSION

In conclusion, this systematic literature review has addressed three important research topics and offered a thorough investigation of the integration of a techno-pedagogical approach in ESL classroom. The results highlight the delicate balance needed for integration to be effective, acknowledging the benefits and drawbacks of using techno-pedagogical approaches in ESL instruction. The factors affecting this integration's efficacy were examined and found that personal, institutional, and technological factors interact in a complicated way. The possible advantages of implementing techno-pedagogical approach in ESL instruction were emphasized by highlighting fostering immersive and interactive language learning environment, providing personalized learning experience, development of technological competencies and digital literacy skills and enhance students' accession to authentic and diverse language learning resources. However, the challenges of integrating techno-pedagogical approach in ESL classroom were also reported, such as teachers and students' digital literacy, technical issue, time constraint, teachers' perspective, and the content quality of the internet resource. Targeted interventions, such as specialized professional development and fair access to technology will be necessary to address the issues that have been highlighted.

For educators, policymakers, and academics, the synthesis of the literature offers insightful information that helps them grasp the complex issues surrounding technology integration in ESL classrooms. It is crucial to exercise caution while choosing suitable technology resources, like language learning applications and interactive platforms, in order to effectively engage students and to cater to diverse proficiency levels. The requirement for context-specific techniques that consider the distinctive qualities of ESL learning environments is further highlighted by the recognition of the variety of factors impacting the efficacy of techno-pedagogical integration. This systematic literature review contributes to the existing body of knowledge by consolidating current insights into the integration of techno-pedagogical approaches in ESL classrooms. The synthesis of research findings serves as a valuable resource for educators attempting to improve their teaching

approaches and for scholars trying to pinpoint deficiencies and opportunities for future development in this developing discipline. The insights learned from this assessment will ultimately direct efforts to successfully utilize technology's potential in the dynamic context of ESL instruction, as it continues to play a crucial role in education.

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