

# Pedagogical Strategies and Technological Solutions to Mitigate English Public Speaking Anxiety: A Systematic Review

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**Abstract:** *Public speaking anxiety is a significant barrier to communication and academic achievement among English as a Foreign Language (EFL) and English as a Second Language (ESL) learners. This systematic literature review, adhering to PRISMA guidelines, examines strategies aimed at alleviating this anxiety, with particular attention to the integration of technological innovations. A comprehensive search of databases such as Web of Science, Scopus, and ScienceDirect identified studies published up to 2025 that focused on reducing public speaking anxiety in EFL/ESL learners. The review highlights a range of effective pedagogical strategies, including traditional methods like structured practice, experiential learning approaches that emphasize real-world application, and peer feedback, which fosters a supportive learning environment. Technological tools such as virtual reality (VR) environments, interactive language learning apps, and online platforms are particularly promising. These tools provide immersive, interactive experiences in safe, controlled settings, helping learners build confidence and reduce anxiety. By combining technology with established pedagogical techniques, these approaches address the unique challenges faced by EFL/ESL learners. Future research should focus on assessing the long-term impact of these interventions and exploring emerging technologies to further enhance English public speaking skills and reduce anxiety.*

**Keywords:** English public speaking anxiety, pedagogical strategies, technological solutions, systematic literature review

## 1. Introduction

English public speaking anxiety remains one of the most pervasive forms of social anxiety, deeply affecting individuals across various spheres of life, particularly in academic and professional settings. This anxiety is even more pronounced among EFL/ESL learners, for whom the challenge of public speaking is compounded by the complexities of operating in a non-native language. The dual burden of mastering linguistic intricacies while managing the cognitive and emotional aspects of public speaking can significantly hinder these learners' educational and social integration.

Recent literature underscored the critical nature of this issue, illustrating how public speaking anxiety not only impeded language acquisition and fluency but also contributed to a cycle of avoidance, diminished self-esteem, and reduced participation in academic and professional

opportunities. Studies by Chen (2024) and Rajitha & Alamelu (2023) have highlighted the profound impact of public speaking anxiety on EFL/ESL learners, noting that it can lead to lower academic performance and limit career prospects. Furthermore, research has shown that the fear of negative evaluation, a core aspect of public speaking anxiety, was exacerbated in language learners due to the added fear of making linguistic errors in front of peers and instructors (Hussain et al., 2021).

Addressing the unique challenges faced by EFL/ESL learners requires a nuanced understanding of both the psychological underpinnings of public speaking anxiety and the pedagogical strategies that can mitigate its effects. Traditional approaches, such as cognitive-behavioral therapy, exposure therapy, and systematic desensitization, have been widely documented for their effectiveness in reducing anxiety levels (Reeves et al., 2022). These methods, grounded in gradually exposing individuals to their fear in a controlled environment and helping them reframe their cognitive responses to anxiety-provoking situations, have formed the basis of many interventions aimed at alleviating public speaking anxiety.

However, with the advent of digital technology and its integration into educational contexts, a new frontier has emerged in the battle against public speaking anxiety. Technological interventions, particularly those leveraging VR, language learning apps, and online communication platforms, offer innovative ways to simulate public speaking scenarios and provide learners with opportunities for practice and feedback in low-risk environments (Dhimolea et al., 2022). For instance, VR can create immersive experiences that closely mimic real-life speaking situations, allowing learners to practice and hone their skills without the immediate consequences of real-world failure. Similarly, online platforms facilitated asynchronous communication and collaboration, providing a space for peer feedback and gradual exposure to public speaking tasks.

Despite these advancements, the literature revealed a gap in comprehensive evaluations of how these technological interventions compare with traditional methods in terms of effectiveness and learner outcomes. While individual studies have pointed to the potential benefits of technology-enhanced learning environments for reducing public speaking anxiety (Cai, 2022), there is a need for a systematic review that synthesizes these findings and provides a holistic understanding of the most effective strategies for addressing this issue among EFL/ESL learners.

The present study aimed to fill this gap by conducting a systematic literature review to assess the range of approaches and strategies employed to mitigate public speaking anxiety in EFL/ESL learners, with a specific focus on the integration of technological advancements. By evaluating the efficacy of both traditional and innovative methods, this review sought to identify the best practices and highlight areas for future research. The research questions guiding this study were: What pedagogical strategies have been employed to reduce the public speaking anxiety of EFL/ESL learners? And, how have technological solutions in these strategies contributed to reducing English public speaking anxiety among this demographic?

## **2. Methodology**

In the preparation of this article, we maintained rigorous academic standards to uphold the integrity and accuracy of our research. Adhering to the protocol established at the start, this manuscript was a truthful, detailed, and transparent reflection of our study. It covered all essential aspects of the study, strictly followed the original research design, and reported

findings without deviations (Fan et al., 2022). We employed the PRISMA statement for reporting, enhancing clarity and reproducibility, and ensuring a methodologically sound presentation of our findings. This approach underscored our commitment to transparency and our aim to contribute meaningful, unbiased insights into the scholarly discussion on public speaking anxiety.

## 2.1 Research Design

The methodology of this systematic review was meticulously designed and executed in alignment with the principles outlined in the PRISMA method, as delineated by Moher et al. (2010). This framework was chosen for its exceptional clarity and the strength it lends to systematic review processes, ensuring a comprehensive and transparent approach to reviewing literature. The primary aim was to collate and evaluate research studies focusing on strategies for mitigating public speaking anxiety, particularly in the context of emerging technological innovations, thereby addressing the central research questions of this study. The review protocol was structured into three distinct phases, encompassing a thorough database search, a rigorous screening process for article selection, and an in-depth analysis and interpretation of the selected articles.

## 2.2 Search Strategy

The search strategy, leveraging high-impact electronic databases, was crafted to comprehensively capture literature on public speaking anxiety and its mitigation through technological interventions. A strategic selection of keywords aimed at the intersection of psychological aspects and technological innovations facilitated a targeted retrieval of studies. This meticulous approach ensured the identification of pertinent research (Paul et al., 2021), as detailed in Table 1, by exploring various combinations of these terms to encompass the study's broad scope effectively.

**Table 1: Research Protocol**

Database	Search Strings
Scopus	"public speaking anxiety" AND EFL/ESL AND approaches OR strategies OR instructions OR techniques OR methods OR model AND reduc* OR alleviat* OR lessen* OR mitigat* OR reliev* AND technology OR artificial intelligence OR digital OR "social media" OR internet OR web OR "computer assisted"
Web of Science	"public speaking anxiety" AND EFL/ESL AND approaches OR strategies OR instructions OR techniques OR methods OR model AND reduc* OR alleviat* OR lessen* OR mitigat* OR reliev* AND technology OR artificial intelligence OR digital OR "social media" OR internet OR web OR "computer assisted"
ScienceDirect	"public speaking anxiety" AND EFL/ESL AND approaches OR strategies AND reduce OR alleviate AND technology OR "social media" "public speaking anxiety" AND EFL/ESL AND approaches OR strategies AND reduce OR alleviate AND digital OR "artificial intelligence" "public speaking anxiety" AND EFL/ESL AND approaches OR strategies AND reduce OR alleviate AND internet OR web "public speaking anxiety" AND EFL/ESL AND approaches OR strategies AND reduce OR alleviate AND "computer assisted"
...	...

To ensure a broad and inclusive retrieval of relevant literature, the search strategy was implemented across several high-impact electronic databases (Heath et al., 2022). Specifically, the institutional library's subscriptions to Scopus, Web of Science and ScienceDirect, served

as the primary sources for the literature search. These databases were chosen for their extensive coverage of scientific and scholarly research, encompassing a wide range of disciplines and thus providing a rich repository of articles and conference proceedings pertinent to the scope of this study.

The search strategy employed a carefully curated combination of keywords to capture the multifaceted dimensions of public speaking anxiety and the role of technological interventions in mitigating it. Keywords were strategically selected to encompass both the psychological aspect of public speaking anxiety and the technological innovations aimed at its alleviation. The search terms included, but were not limited to, “public speaking anxiety”, “EFL”, “ESL”, “strategies”, “approaches”, “methods”, “instructions”, “techniques”, “model”, “reduce”, “alleviate”, “lessen”, “mitigate”, “relieve”, “technology”, “social media”, “digital”, “artificial intelligence”, “internet”, “web”, and “computer-assisted”.

These terms were utilized in various combinations and permutations to ensure comprehensive search, capturing the wide array of research focusing on the intersection of linguistic competence, psychological well-being, and technological advancement. The specificity of the search terms was instrumental in filtering through the extensive volume of literature to identify studies that directly addressed the research questions posited by this review.

### 2.3 Eligibility Criteria

The initial retrieval of articles underwent a meticulous selection process, guided by predefined eligibility criteria, to ensure the integrity and quality of this systematic review. This critical phase involved evaluating each study for its relevance, methodological rigor, and contribution to the research question, thereby refining the pool of literature to those studies that most accurately addressed the objectives of our review (Raitskaya & Tikhonova, 2023). The establishment and application of these criteria were essential steps in minimizing bias and enhancing the reliability of our findings, setting a robust foundation for the synthesis of evidence, as shown in Table 2.

**Table 2: Eligibility Criteria**

Criteria	Inclusion	Exclusion
Language	English	Non-English
Research method	Quantitative, qualitative, mixed method	Not quantitative, qualitative, mixed method
Context	EFL/ESL context	Non-EFL/ESL context
Article types	Research articles, conference proceedings	Not research articles, conference proceedings
Population	Studies addressing RQs	All studies not addressing RQs
Quality	Scopus-indexed	Non-Scopus-indexed
	Wos-indexed	Non-Wos-indexed
	ScienceDirect-indexed	Non-ScienceDirect-indexed

The study’s inclusion criteria were precisely delineated to align with its objectives (Da Silva et al., 2023). Only English-language articles were selected, reflecting the language preference established during the initial database search. The research focus was narrowly defined to explore strategies aimed at reducing public speaking anxiety, particularly through the lens of technological innovations like social media, digital platforms, artificial intelligence (AI), internet-based tools, and computer-assisted learning. The relevance of each article was carefully evaluated by reviewing its title and abstract, with a deeper analysis of the introduction, discussion, and conclusion sections to confirm detailed discussions on public

speaking anxiety, EFL/ESL, strategies, and technological solutions. Exclusions were made for articles not in English, those diverging from the technological perspective on alleviating public speaking anxiety, or findings not pertinent to the study's core variables.

## **2.4 Screening and Data Extraction**

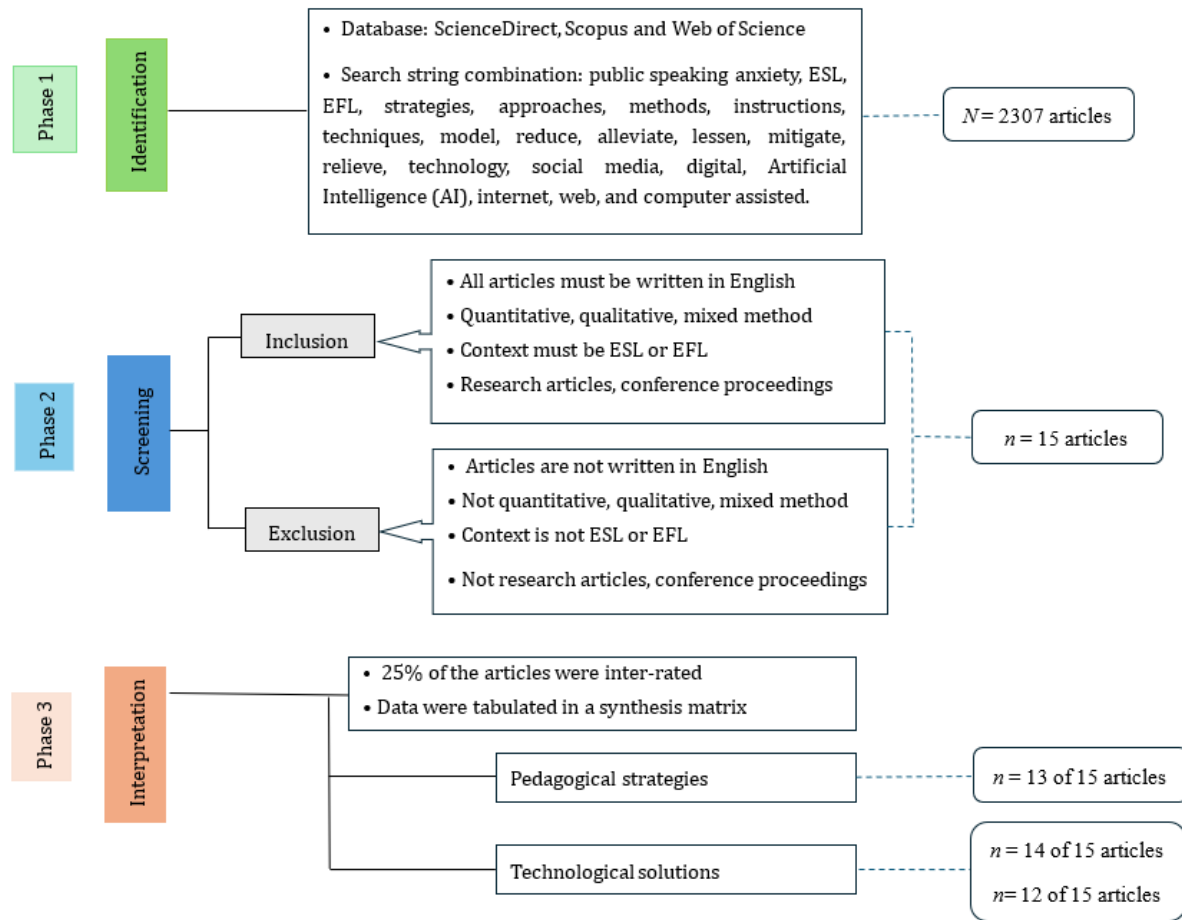
A systematic screening strategy was implemented to assess the titles and abstracts of identified sources against a set of pre-established inclusion criteria. This preliminary step was crucial in determining the relevance and potential contribution of each source towards the study's overarching objectives. The application of these criteria enabled the efficient identification of sources deserving of further investigation. This thorough screening process thus refined the collection of works, ensuring a focus on those studies most relevant to the research interests (Ammirato et al., 2023).

In the subsequent phase, sources that met the initial criteria were subject to a deeper, more nuanced review. This involved an extensive examination of the full-text articles to confirm their adherence to the inclusion standards. Employing a dual-level approach, the selection process was rigorously focused on including only the most relevant and methodologically sound studies, thereby elevating the quality and pertinence of the research findings (Yan et al., 2024). This procedure was marked by an adherence to methodological integrity and transparency, with the objective of minimizing bias and affirming the reliability of the deduced conclusions.

The study specifically targeted the extraction of information from sources that shed light on strategies linked with technological advancements. The data extraction process was characterized by a meticulous analysis of texts to identify passages that explicitly detailed these strategies (Peters et al., 2024). Initiated by a primary reviewer and followed by an exhaustive verification by a secondary reviewer, this process included an inter-rater reliability test on a selection of articles—about 25%—to guarantee coding consistency and accuracy (Belur et al., 2021). Discrepancies encountered during the extraction were resolved through a consensus-driven method, ensuring a coherent understanding and interpretation of the data across reviewers.

To prevent redundancy, instances where strategies and technological advancements were repeatedly mentioned within the same source were addressed by selecting a single, representative excerpt that most effectively encapsulated the discussed information. This deliberate and detailed approach was intended to secure the extraction of high-quality, relevant data, thus enabling a thorough analysis of the interconnection between strategic implementation and technological advancement in the field under examination. This methodology played a pivotal role in enriching the study's insights into the intricate relationship between strategic maneuvers and technological evolution (Mohamed Shaffril et al., 2021). The flow of records and articles throughout the review process was illustrated in Figure 1.





**Figure 1: PRISMA Flow Diagram in Summarizing Study Selection**

The initial search yielded a substantial number of articles, totaling 2307 from the specified databases. After a thorough process of duplicate removal and the application of inclusion and exclusion criteria, 15 articles were ultimately selected for comprehensive analysis and interpretation in relation to the study's research questions. Among them, 13 articles were about pedagogical strategies used to alleviate public speaking anxiety, 14 articles were related to technological solutions and 12 articles reflected how the integration of technology help reduce public speaking anxiety.

### 3. Results

By meticulously organizing the vast swath of data and findings into a synthesis matrix, an innovative analytical tool was employed, which not only streamlined the comparative analysis but also served as a critical scaffold for the in-depth examination of each study (Yulita & Napitupulu, 2023). This matrix, as depicted in Table 3, is a testament to the methodical approach adopted, presenting a comprehensive cross-study overview that highlights significant patterns, discrepancies, and insights. Such a structured compilation is invaluable, as it enables a clear visualization of the research landscape regarding the use of technology to mitigate public speaking anxiety, facilitating a more effective identification of gaps in the existing literature and pinpointing areas ripe for future inquiry.

Further, this methodological rigor extended beyond mere organization, underpinning the nuanced discussions that were pivotal for advancing the field's understanding of technological interventions in public speaking anxiety. The synthesis matrix acted as a crucial nexus, bringing

together diverse studies, ranging from experimental designs to qualitative research, thus offering a holistic view of the subject matter (Paul & Barari, 2022). Through this lens, the complex interplay between technology, pedagogical strategies, and psychological impacts was dissected, allowing for a layered interpretation of how different technological tools and platforms can be leveraged to not only alleviate anxiety but also enhance speaking performance. This granular analysis, supported by the data aggregated in Table 3, shed light on the efficacy of specific technologies, such as VR, mobile applications, and online platforms, in creating safe, controlled environments where individuals can practice and gain confidence in their public speaking abilities.

Moreover, the synthesis matrix elucidated the trajectory of technological advancements in the domain of public speaking training and anxiety reduction. It underscored the evolution from basic audio-visual aids to sophisticated immersive experiences that mimic real-life speaking scenarios, thereby offering insights into the future direction of research and application. This progression was critical in understanding the shifting paradigms in educational technology and psychology, particularly in how emerging technologies can be tailored to address the nuanced needs of individuals facing public speaking challenges. The findings articulated through this comprehensive examination not only contributed to the academic discourse but also provided practical implications for educators, technologists, and psychologists aiming to harness technology for educational and therapeutic purposes. Hence, Table 3 is not merely an organizational tool but a reflection of the study's depth, bridging theoretical perspectives with empirical evidence to enrich the discourse on combating public speaking anxiety through technological innovation.

**Table 3: Included Studies**

Theme	Author	Year	Title	Context	Method	Main findings
VR therapy and implementation	Akimoto et al.	2022	A Preliminary Cyber-Physical Study of a VR Training Material for Engineering Students to Give a Presentation in English	EFL	QUAN	The material was designed to simulate academic presentation settings and was tailored to the demands of science and engineering students. We evaluated the benefits of the VR material in reducing engineering students' anxiety when speaking English in an academic setting, especially in situations where they tend to feel uncomfortable, such as responding to a difficult question.
Remote Presentations	Aldukhayel	2022	Remote Presentations: Making L2 Presentations Less Stressful	ESL	Mixed method	The reduction in anxiety is attributed to factors such as the psychological comfort of presenting from a familiar environment (e.g., home), the reduction of physical self-consciousness due to the option of audio-only presentations, and the diminished pressure from a live audience's physical presence.
Practicing in VR	Boetje & Van Ginkel	2021	The added benefit of an extra practice session in virtual reality on the development of presentation skills: A randomized control trial	EFL/ESL	QUAN	The evidence from the study supports the notion that VR technology can be a valuable tool in reducing public speaking anxiety and improving oral presentation skills. By offering a simulated audience for practice, VR provides a unique, stress-reducing environment that allows for repeated exposure and practice, which is critical in skill acquisition and anxiety reduction.



Mobile-based VR application	Chen	2020	Effects of technology-enhanced language learning on reducing EFL learners' public speaking anxiety	EFL/ESL	Mixed method	The study suggests that the immersive experience provided by VR, allowing for realistic simulation of public speaking scenarios, may contribute significantly to reducing learners' anxiety by offering a safe, controlled environment for practice. Additionally, the feedback generated through technology, such as AI in the VR and mobile applications, was recognized as valuable for reducing public speaking anxiety, despite the irreplaceable role of teachers as facilitators being emphasized.
AI applications	El Shazly	2021	Effects of artificial intelligence on English speaking anxiety and speaking performance: A case study	EFL	Mixed method	This study found that learners' speech-related anxieties were not reduced following the interactions with the chatbots.
Zoom application	Hasibuan et al.	2022	Investigating Public Speaking Anxiety Factors among EFL University Students through Online Learning	EFL	QUAN	Key findings indicated that English oral proficiency and unfamiliar speech topics were among the most influential factors on students' public speaking anxiety, particularly during the preparation and performance stages. Additionally, classmates' responses during public speaking emerged as a significant factor across multiple stages, highlighting the impact of peer perception on anxiety levels.
Video-dubbing tasks	Huang	2022	Investigating the influence of video-dubbing tasks on EFL learning	EFL	Mixed method	Completing video-dubbing tasks reduced foreign language anxiety but not English public speaking anxiety.

Online approaches	Ibrahim & Alwi	2017	Public Speaking for Engineering Students in a Blended Learning Environment	EFL/ESL	QUAN	The research concluded that a blended learning environment has a positive impact on reducing public speaking anxiety and enhancing public speaking skills among engineering students. The study highlights the potential of integrating Information and Communication Technology (ICT) tools in education to create a more dynamic and effective learning experience for students, particularly in areas such as public speaking where practice and feedback are crucial for skill development.
VR training	Kaplan-Rakowski & Gruber	2023	The impact of high-immersion virtual reality on foreign language anxiety	EFL	QUAN	VR had the potential to replicate a classroom setting, thereby enabling him to conquer stage fright. Another student remarked that thanks to the repeated public speaking practice sessions, he developed a routine that made him feel less anxious. Yet, a participant who experienced high anxiety during real-life presentations reported that he wanted to use VR as a means to practice for an upcoming foreign language class presentation.
Use of video blogs	Madzlan et al.	2020	Use of Video Blogs in Alleviating Public Speaking Anxiety among ESL Learners	ESL	Mixed method	The findings underscored that vlogs offer a safe and private space for practice, minimizing the fear of judgment and peer pressure typically encountered in traditional classroom settings. This digital platform allowed learners more time to prepare and articulate their thoughts, thereby boosting their confidence in public speaking.

Popsispeak	Pontillas	2020	Reducing the Public Speaking Anxiety of ESL College Students Through Popsispeak	ESL	Mixed method	This intervention involved students speaking on various topics using Popsicle sticks with topics attached to them, allowing for a randomized selection. Each student then gave a short speech based on the selected topic, after which they received a motivational letter from the teacher and submitted a reflective journal entry about their performance. This process aimed to improve oral communication skills and reduce public speaking anxiety among the students.
VR training	Sülter et al.	2022	SpeakApp-Kids! Virtual reality training to reduce fear of public speaking in children—A proof of concept	EFL/ESL	QUAN	These findings support the potential of VR technology, particularly the SpeakApp-Kids! application, as an effective tool for reducing public speaking anxiety in children. By providing a safe, immersive environment for practicing public speaking, VR can help alleviate anxiety, improve confidence, and potentially prevent the development of more severe anxiety related to public speaking in the future.
VR assisted distraction	Tatlı & Karadağ	2023	Reducing public speaking anxiety through the use of virtual reality assisted distraction: a systematic pilot study	EFL/ESL	Mixed method	VR-assisted distraction can serve as an effective tool for reducing the anxiety associated with public speaking by diverting the individual's attention away from distressing stimuli and towards an immersive, engaging task within the VR environment. These results suggest that VR technology, by providing a novel and immersive form of active distraction, may offer significant benefits for individuals experiencing fear of public speaking by reducing their anxiety levels more effectively than non-VR methods or no intervention at all.

video-based formative practice	Zheng et al.	2021	Self-assessment first or peer-assessment first: effects of video-based formative practice on learners' English public speaking anxiety and performance	EFL/ESL	Mixed method	By incorporating video technology and Computer-Assisted Language Learning (CALL) tools, the research highlighted those different sequences of obtaining feedback (whether from self or peers first) can affect students' public speaking anxiety and competence differently. This suggests a nuanced approach to implementing formative assessments in language learning contexts, where the sequence of self- and peer-assessment can be strategically chosen based on the desired outcome, be it reducing anxiety or improving performance.
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### **3.1 Pedagogical Strategies to Reduce English Public Speaking Anxiety**

The challenge of public speaking anxiety has prompted the integration of technology into strategies aimed at mitigating its effects. Innovations in VR blended and online learning, and creative interactive techniques have emerged as effective tools. These methods simulated realistic scenarios, provided dynamic learning experiences, and offered private practice spaces, respectively, significantly reducing anxiety and enhancing public speaking skills. This technological integration marked a transformative approach in making the preparation for public speaking more accessible and less intimidating.

#### **3.1.1 VR and Immersive Technologies**

Several studies highlighted the efficacy of VR and immersive technologies in reducing public speaking anxiety. Akimoto et al. (2022), Boetje and Van Ginkel (2021), Chen (2020), Kaplan-Rakowski and Gruber (2023), Sülter et al. (2022), and Tatlı and Karadağ (2023) all documented the benefits of VR for simulating realistic public speaking scenarios. These studies suggested that VR's immersive environment provided a unique, stress-reducing platform for repeated exposure and practice, crucial in skill acquisition and anxiety reduction.

#### **3.1.2 Blended and Online Learning Approaches**

Ibrahim and Alwi (2017) and Aldukhayel (2022) reported on the positive impacts of blended and online learning environments on reducing public speaking anxiety. The integration of ICT tools and Computer-Mediated Communication environments offered learners a dynamic and effective learning experience, reducing physical self-consciousness and the pressure from a live audience's presence.

#### **3.1.3 Creative and Interactive Techniques**

Madzlan et al. (2020), Hasibuan et al. (2022) and Pontillas (2020) explored creative and interactive techniques such as the use of vlogs, Popsispeak and Zoom. These methods provided a safe and private space for practice, minimizing the fear of judgment and peer pressure, thereby enhancing learners' confidence in public speaking.

### **3.2 Technological Solutions to Mitigate English Public Speaking Anxiety**

Technological solutions have not only democratized access to language learning resources but also provided a safe and controlled environment for EFL/ESL learners to practice public speaking without the immediate pressure of real-life audiences. VR offered immersive experiences where learners can engage with virtual audiences of varying sizes and dynamics, helping them to gradually adapt to the stress of public speaking in a measured way. AI-driven platforms can offer personalized feedback on pronunciation, fluency, and even body language, enabling learners to identify and work on their weaknesses at their own pace, thus significantly reducing anxiety over time.

#### **3.2.1 AI and Feedback Mechanisms**

While El Shazly (2021) noted that interactions with AI chatbots did not reduce learners' speech-related anxieties, Chen (2020) emphasized the value of feedback generated through technology, such as AI in VR and mobile applications. This suggested a nuanced impact of AI on public speaking anxiety, highlighting the importance of the type and context of technological integration.

#### **3.2.2 VR's Immersive and Distraction Capabilities**

Studies by Kaplan-Rakowski and Gruber (2023), Sülter et al. (2022), and Tatlı and Karadağ (2023) underlined VR's potential to provide immersive environments and distraction

techniques that effectively reduced public speaking anxiety. The capability of VR to simulate realistic scenarios and divert attention away from distressing stimuli offered a promising avenue for anxiety reduction.

### **3.2.3 Video Technology and Self-Assessment**

Zheng et al. (2021) discussed the role of video technology and CALL tools in formative practice and assessment. The study highlighted how different sequences of feedback, self-assessment or peer-assessment, can impact learners' anxiety and performance, indicating the strategic use of technology in assessment processes.

### **3.2.4 Studies Indicating No Effectiveness**

Two studies conducted by El Shazly (2021) and Huang (2022) reported no significant reduction in public speaking anxiety following their interventions. These findings suggested the complexity of addressing public speaking anxiety and the need for further research to understand the conditions under which certain interventions may or may not be effective.

These findings have outlined the diverse strategies employed to reduce public speaking anxiety among EFL/ESL learners and the significant role that technological advancements have played in enhancing these strategies. While VR and online learning environments have shown promise in creating safe, immersive spaces for practice and feedback, the integration of AI and video technology requires careful consideration of context and learner needs. The findings underscored the importance of adopting a nuanced, learner-centered approach to the design and implementation of interventions aimed at reducing public speaking anxiety. Further research is necessary to explore the long-term effects of these strategies and the potential of emerging technologies to address the needs of diverse learner populations.

## **4. Discussion**

The exploration into the integration of technology for alleviating public speaking anxiety among EFL/ESL learners reveals a multifaceted landscape characterized by both promise and complexity. As technological advancements continue to reshape educational methodologies, particularly through immersive experiences such as VR and AI-driven interventions, educators encounter a spectrum of opportunities and challenges. The convergence of pedagogical theory with innovative technologies necessitates a nuanced understanding of their effectiveness, impact, and limitations in fostering language proficiency and addressing public speaking apprehensions.

### **4.1 Integration of Technology in Public Speaking Anxiety Alleviation**

The quest to mitigate public speaking anxiety in EFL/ESL learners through the lens of educational technology offers a vibrant tableau of traditional pedagogy and cutting-edge innovation. This literature review embarks on a comprehensive journey, revealing the spectrum of technological interventions—from VR and blended learning platforms to the dynamic realms of online environments and interactive digital techniques. These tools, when synchronized with forward-thinking educational methodologies, herald a transformative era in education. They mark a shift towards immersive learning experiences, making the acquisition of language and public speaking skills more engaging and centered around the learner's needs and experiences. The utilization of such technological advancements not only aligns with but actively propels the pedagogical shift towards a more engaging, interactive, and learner-focused educational landscape. In particular, the application of VR in simulating public speaking scenarios exemplifies the potent blend of technology and pedagogy. This immersive



technology creates a safe, controlled environment where learners can repeatedly practice and master their public speaking skills without the immediate pressure and anxiety of real-life situations (Boetje & Van Ginkel, 2021). Grounded in the principles of exposure therapy, VR provides a platform for gradual desensitization to the fears surrounding public speaking, offering a promising avenue for anxiety reduction, which is in line with the findings of the study conducted by Akimoto et al. (2022).

#### **4.2 Effectiveness and Impact of Technological Interventions**

Emerging technologies, particularly immersive VR and AI are reshaping the educational landscape by enhancing learning outcomes in unprecedented ways. The application of VR in public speaking training is supported by a robust body of research, evidencing its efficacy in crafting realistic, controlled scenarios for learners to refine their oratory skills. This can be corroborated by Kaplan-Rakowski and Gruber's (2023) view that this methodological approach, deeply rooted in psychological principles, enables learners to confront and gradually overcome their speaking anxieties in a supportive, immersive environment. Despite the promising aspects of these technologies, the review also draws attention to the varied outcomes and complexities associated with their integration into learning environments. It underscores the imperative for personalized educational strategies that acknowledge the diverse needs, learning preferences, and cultural backgrounds of students. Such tailored approaches are essential for harnessing the full potential of technological interventions, ensuring they contribute meaningfully to the reduction of public speaking anxiety and the enhancement of language proficiency (Chen, 2020).

#### **4.3 Challenges and Limitations in Technological Integration**

The exploration into AI-driven interventions for public speaking anxiety reveals a landscape filled with both innovation and challenges. The variability in the effectiveness of AI chatbots and automated feedback mechanisms highlights the critical need for aligning technological implementations with educational objectives and learner expectations. This is congruent with El Shazly (2021) who emphasized that this alignment is crucial for ensuring that technology acts as a catalyst for learning, fostering an environment where pedagogical goals are met with the support of digital tools. However, the integration of such technologies is not without its challenges. The review sheds light on the necessity for a strategic and thoughtful inclusion of digital tools in the educational process, aimed at not only enhancing pedagogical outcomes but also engaging learners in meaningful and culturally responsive ways. This calls for a careful examination of the technological tools at our disposal, ensuring they are used to complement and enhance traditional teaching methodologies, rather than serving as mere novelties.

#### **4.4 Addressing Biases and Methodological Challenges**

The critical examination of potential biases and the internal validity of study findings is pivotal for a nuanced understanding of technology's role in alleviating public speaking anxiety. The review points out the reliance on self-reported measures of anxiety and the possibility of publication bias, alongside the variability in the methodological rigor of included studies. These factors present significant challenges in synthesizing research findings and call for a more inclusive and diverse approach to future research endeavors. Addressing these challenges requires a concerted effort to ensure that research methodologies are robust, comprehensive, and reflective of the global learner population (Qiu et al., 2022). By doing so, the educational technology community can provide deeper insights into the efficacy of technological interventions and their long-term impacts on reducing public speaking anxiety among EFL/ESL learners.

#### **4.5 Future Directions in Educational Technology**

The discussion of research limitations, including measurement imprecision and potential test overlaps, underscores the need for methodological advancements in the study of educational technology. Rigorous study designs, precise anxiety measurement tools, and the clear articulation of intervention effect sizes are essential for advancing the field. These methodological enhancements are crucial for ensuring the reliability and validity of future research findings, paving the way for a deeper understanding of how technological interventions can best support language learning and public speaking skill development (Lee et al., 2022).

Standing at the forefront of educational innovation, the integration of technology in EFL/ESL education promises a future where public speaking anxiety is significantly reduced. Such a future hinges on a nuanced, evidence-based approach that aligns technology with pedagogical theory and learner needs. Collaboration between educators, researchers, and technologists is essential in navigating the evolving educational landscape. The successful adoption of innovative technologies into language learning requires a strategy that merges empirical evidence with user-centered design, ensuring interventions are tailored to the diverse backgrounds of learners. Continuous feedback loops between students, educators, and technology developers are vital for refining these tools. Within this collaborative framework, technology evolves from a supplementary role to a foundational element of a dynamic, responsive approach to language education, equipping EFL/ESL learners with the confidence and skills to tackle public speaking challenges, thereby transforming their educational experiences and future prospects.

#### **5. Conclusion**

In the realm of language education, particularly for EFL/ESL learners, the phenomenon of public speaking anxiety represents a formidable challenge, significantly hindering not only linguistic proficiency but also the confidence necessary for effective communication. This systematic review meticulously examines the convergence of pedagogical strategies and technological advancements aimed at mitigating public speaking anxiety, with a focus on assessing the effectiveness of these interventions in the EFL/ESL learning context.

The core objective of this study was to explore and synthesize the array of approaches and technological innovations employed to alleviate public speaking anxiety among EFL/ESL learners. Through a rigorous analysis aligned with PRISMA guidelines, the review unveiled a diverse spectrum of interventions ranging from traditional pedagogical methods to cutting-edge technological tools like VR, language learning apps, and online peer interaction platforms. These interventions have shown promising results in creating immersive, interactive learning environments that significantly reduce learners' anxiety levels by providing safe spaces for practice and feedback.

The review's findings underscore the pivotal role of technology in enhancing traditional public speaking anxiety reduction strategies, offering innovative pathways that cater to the unique needs of EFL/ESL learners. Technological interventions, particularly those leveraging VR and online platforms, stand out for their potential to simulate real-life speaking situations, thus providing learners with invaluable opportunities for repeated practice and feedback in stress-free environments. This integration of technology into language education not only facilitates a more engaging and effective learning experience but also opens new avenues for future

research, particularly in exploring the long-term efficacy of these interventions and the potential of emerging technologies.

Furthermore, this review highlights the importance of a nuanced, learner-centered approach in the design and implementation of public speaking anxiety reduction strategies. It calls for further exploration into how these strategies can be tailored to address the varied needs and preferences of EFL/ESL learners, ensuring that interventions are not only effective in reducing anxiety but also accessible and engaging for learners with diverse backgrounds and learning styles.

In conclusion, this systematic review provides a comprehensive overview of the strategies and technological interventions for reducing public speaking anxiety among EFL/ESL learners, offering valuable insights for educators, researchers, and technology developers. The integration of technology into language education, as evidenced by the reviewed interventions, holds great promise for enhancing learners' confidence and speaking proficiency. As the field continues to evolve, it is imperative that future research builds on these findings to further refine and expand the repertoire of effective interventions, ultimately contributing to the advancement of language education and the empowerment of learners to overcome the challenges of English public speaking anxiety.

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