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A Systematic Review of the Impact of VR Technology on Higher Education Learners' English Speaking Anxiety: Following PRISMA Guidelines

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Virtual Reality (VR) technology offers promising possibilities for reducing English speaking anxiety among higher education learners. This systematic review follows PRISMA 2020 guidelines to analyze 11 relevant studies investigating VR's impact on speaking anxiety reduction. Findings reveal that VR creates immersive, psychologically safe environments where learners can practice speaking without fear of negative evaluation. The technology demonstrates significant advantages over traditional teaching methods, including the provision of realistic conversational scenarios, opportunities for repeated practice without embarrassment, enhanced learner engagement, and improved accessibility to language learning resources. However, implementation challenges persist, including visual fatigue from prolonged use, unrealistic perceptions of virtual characters, technical difficulties, and potential disconnection from real-world environments. The analyzed studies show methodological limitations, such as small sample sizes, short intervention durations, discrepancies between anxiety levels and speaking abilities, and over-reliance on self-report measures. Future research should employ larger participant groups across diverse educational settings, extend intervention periods to evaluate long-term effects, utilize more objective assessment methods, and implement controlled experimental designs to isolate VR's specific contributions. This review underscores VR's transformative potential in language education while highlighting the need for close collaboration between educators and developers to maximize its educational benefits.

[virtual reality (VR)/English speaking anxiety/higher education/systematic literature review]

I. INTRODUCTION

Over a billion people speak English as their first or second language, and billions of people do so as a third or fourth language (Salomone, 2022). In today's globalized world, developing English communication skills is crucial for expressing our thoughts and interacting with others (Leong & Ahmadi, 2017). Consequently, in non-native English-speaking countries, a wide range of studies have been conducted from diverse teaching methodologies to explore psychological and affective domains, for those aiming to learn English more effectively and efficiently (Dewaele et al., 2018; Ellis, 2015; Gardner & MacIntyre, 1993; Krashen, 1982; Teimouri et al., 2019). Specifically, there have been research studies indicating that affective factors of language learners significantly play an important role in the language acquisition process and academic achievement (Arnold, 2020; Brown, 1973; Larsen-Freeman, 2001). Representative affective factors associated with second language or foreign language acquisition include anxiety, confidence, and learning motivation. Among these affective factors, foreign language anxiety is identified as a primary obstacle impacting foreign language learning achievement (Aida, 1994; Horwitz, 2001; Horwitz et al., 1986; Russell, 2020; Zhang, 2019). Research consistently reports that foreign language anxiety manifests across all linguistic domains, including reading (Gok et al., 2023; Li, 2022; Matsuda & Gobel, 2004), listening (Ji et al., 2022; Kim, 2002; Liu, 2016), speaking (Bashori et al., 2022; Chou, 2018; Pan et al., 2022), and writing (Cheng, 2002; Rasool et al., 2023; Sabti et al., 2019). However, this anxiety is particularly pronounced in relation to speaking skills (Price, 1991; Von Worde, 2003). Speaking requires immediate responses and real-time processing of pronunciation, grammar, and vocabulary choices, and is often performed in front of others. This makes it the most psychologically burdensome area for learners, which presents a significant challenge for them (Horwitz, 2010).

Accordingly, scholars have primarily categorized the factors contributing to learners' speaking anxiety into three areas: the speaking contexts, the audiences, and the learners themselves as speakers (Rajitha & Alamelu, 2020; Woodrow, 2006). Initially, scholars have explored the causes of this anxiety and sought ways to alleviate them, focusing on altering traditional teaching methodologies or simply modifying learning environments (Chen & Hwang, 2020; Chou, 2018; Kasbi & Elahi Shirvan, 2017; Rafada & Madini, 2017; Tee et al., 2020; Tsiplakides & Keramida, 2009). However, in an era when the integration of education and technology is recognized not merely as a trend but has been identified as an essential component (Haleem et al., 2022), the application of technology-enhanced language learning is reported to not only improve learning methods and achievement levels but also contribute to reducing learners' affective barriers (Golonka et al., 2014). For example, gamification utilizes game elements to motivate learners and increase engagement, showing effects in alleviating psychological burdens that occur during the learning process (Alsawaier, 2018).

Additionally, interactive chatbots provide a natural conversational environment, helping learners practice speaking repeatedly without pressure (Jeon, 2024).

Specifically, research involving virtual reality (VR) technology is notable because it supports learners in experiencing visual, auditory, and tactile sensations. While various existing EdTech solutions such as AI-based tutoring systems, video conferencing tools, and language learning applications offer opportunities for speaking practice, VR is distinctive in that it allows learners to repeatedly practice speaking in a psychologically safe environment by directly experiencing an immersive learning environment similar to the real world through wearing various equipment, including head-mounted displays (HMDs) (Kavanagh et al., 2017; McGovern et al., 2020). However, while VR presents an immersive learning environment that can reduce speaking anxiety, it is not without challenges. Studies have highlighted several limitations, including high costs of VR hardware and software, accessibility issues, and technical constraints such as internet connectivity and device compatibility (Lege & Bonner, 2020). Additionally, prolonged use of VR can lead to visual fatigue and simulation sickness, which may hinder learners' engagement (Souchet et al., 2022). From a pedagogical feasibility perspective, VR also presents several challenges. Khukalenko et al. (2022) found that many educators lack adequate training to effectively integrate VR technology into their teaching practices, potentially limiting its educational potential.

Given these considerations, in classroom situations where learners' opportunities or the authentic context for practicing English speaking are restricted due to large class size, time limitations, and language classroom constraints that hinder continuous interaction between teachers and students, it is believed that the integration of VR technology into second language learning will be of great help (Dhimolea et al., 2022; Kaplan-Rakowski & Gruber, 2023; Xie et al., 2021). Despite the growing interest in technology-enhanced language learning, several significant research gaps exist in the literature exploring the impact of VR technology on English speaking anxiety. First, while there are many studies on the use of VR in language learning, research systematically examining its effects on speaking anxiety is relatively scarce. Second, existing research has primarily focused on K-12 educational settings, with limited attention to higher education contexts where professional communication skills are required and anxiety issues arise. Third, studies addressing VR and speaking anxiety generally feature small sample sizes and short intervention periods, limiting their generalizability. Fourth, there is inconsistency in how speaking anxiety is measured across studies, making it difficult to draw reliable conclusions about VR's effectiveness. Therefore, this paper aims to systematically and comprehensively review existing studies on how VR technology has impacted higher education English language learners' speaking anxiety. By synthesizing and analyzing the current knowledge base, this review seeks to address these research gaps and play a critical role in enhancing

understanding within this specific research field. The research questions for this study are as follows.

1. What are the perceived advantages and challenges of utilizing VR technology to reduce higher education learners' English speaking anxiety?
2. How did VR technology reduce higher education learners' English speaking anxiety?
3. What are the limitations of existing studies, and what directions should future research take?

II. METHODOLOGY

1. Research Design

This study adopted a systematic literature review approach, aligning its research process with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines (Page et al., 2021).

The reason for adopting this methodology is that individual studies vary in research design, learning environment, and sample characteristics, leading to diverse findings. A systematic literature review is effective in synthesizing and interpreting these findings across different contexts (Paul & Barari, 2022). Additionally, following the PRISMA guidelines ensures transparency and reliability in the literature selection and analysis process (Page et al., 2021).

2. Data Search

The data search was conducted from February 19 to February 22, 2024, through the Internet. The search for academic papers was conducted through two prominent academic journal databases: Web of Science and Scopus. The search strategy involved the use of specific search terms: ("speaking" OR "anxiety" OR "worry" OR "fear") AND ("English" OR "English as a second language" OR "English as a foreign language" OR "ESL" OR "EFL") AND ("university" OR "college" OR "higher education") AND ("VR" OR "virtual reality"). Also, selected keywords needed to be included in the titles and abstracts of the articles. Subsequently, the identified data were organized using EndNote 21, a citation and bibliography management program provided by Clarivate, and Microsoft's Office Excel 2019.

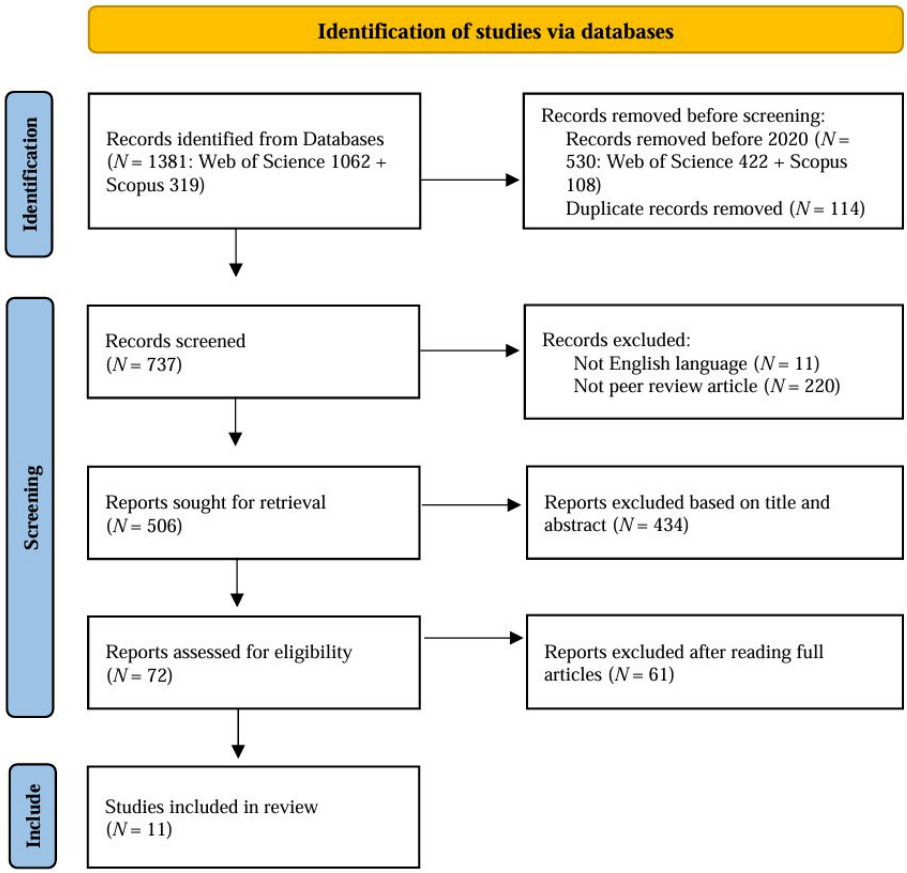
3. Selection and Exclusion Criteria

A total of 1,381 papers were initially identified through database searches in Web of Science and Scopus. The search was limited to publications after the year 2020 to focus on the explosive increase in technology-related research following the COVID-19 pandemic. Although research on VR-based language learning existed before 2020, this study focused on analyzing research that more effectively reflects recent technological developments and educational applications.

From these, 851 papers published after 2020 were targeted. The duplicate removal process was conducted using EndNote 21's automatic duplicate identification function, followed by a manual review to ensure accuracy, resulting in 114 duplicates being subsequently excluded. Afterwards, only research articles written in English and peer reviewed were selected, excluding proceeding papers, and book chapters. This process narrowed to 506 research articles. These articles were then subjected to a review of their titles and abstract.

To ensure a rigorous literature review, clear selection and exclusion criteria were established. The selection criteria covered: 1) studies focusing on English learners, 2) studies for higher education learners, and 3) studies related to speaking anxiety. Conversely, the exclusion criteria were: 1) studies adopting non-educational approaches, such as those from medical or psychological fields, 2) studies primarily focused on teachers or instructors rather than learners, 3) studies limited to a specific, narrow field of inquiry such as EFL programs for soft engineering students, and 4) studies where speaking anxiety was mentioned only incidentally and not the central focus. As a result, a total of 11 papers were finally selected for this systematic literature review. This process is illustrated in Figure 1.

FIGURE 1
PRISMA Flow Chart



4. Data Coding

To extract and synthesize content relevant to the research objectives from the finally selected 11 papers, Microsoft's Office Excel 2019 was utilized for data coding and a coding sheet created by the researcher was used. The coding sheet included bibliographic information (title, authors, publication year, journal name), research questions, research methods (sample, research design, tools for measuring speaking anxiety), major findings, limitations and gaps, implications for future research, and other important issues. (see APPENDIX)

Data extraction and coding were conducted solely by the researcher, and to enhance the reliability of the study, an independent reviewer (another researcher) reviewed the coding results and provided feedback. During the coding process, clear criteria were defined, and consistency was ensured by incorporating feedback from the independent reviewer, thereby

minimizing subjectivity in coding and improving the reliability of the data extraction process.

III. FINDINGS

1. General Characteristics of the Analyzed Studies

All of the literature analyzed was based on an experimental design using VR, and investigated the impact of VR intervention on English speaking anxiety of higher education learners. The number of participants in the experiments varied from a minimum of 6 to a maximum of 93, with most studies targeting less than 30 participants. In most studies, quantitative and qualitative research methods were used in parallel to measure changes in participants' speaking anxiety. As a quantitative method, self-reported questionnaires type, such as speaking anxiety questionnaires, were mainly used. Quantitative data were primarily collected using self-reported speaking anxiety questionnaires, with Horwitz et al.'s (1986) instrument being the most frequently utilized, alongside Woodrow's (2006) SLSAS, McCroskey's (1970) PRPSA scale, and scales by Nunnally and Bernstein (1994) and Melchor-Couto (2017). These scales consist of questions measuring fear of negative evaluation related to communication anxiety, test anxiety, and foreign language anxiety, and use a 5-point Likert scale (ranged from "1: Strongly disagree" to "5: Strongly agree"), with higher scores indicating a higher level of anxiety. Qualitatively, the majority of studies conducted semi-structured interviews, alongside the use of learners' learning logs and researchers' field notes as supplementary data sources. The duration of these studies ranged from 4 to 12 weeks, with participants engaging in the VR environment for less than one hour per week on average.

2. Perceived Advantages of Utilizing VR Technology to Reduce Higher Education Learners' English Speaking Anxiety

1) Superiority in Comparative Studies

According to comparative research results based on modality, VR usage demonstrated a significant reduction in English speaking anxiety compared to traditional learning methods employing videos or audio (York et al., 2021). In particular, when compared with Zoom (a video conferencing platform), the use of VR resulted in substantially lower English speaking anxiety scores (Kaplan-Rakowski & Gruber, 2023). Additionally, practicing within a VR environment proved more effective in alleviating public speaking fear than practicing alone in front of a mirror, as VR reflected real-life scenarios more than classrooms or stages

(Gruber & Kaplan-Rakowski, 2020). This effect was especially pronounced among students who attributed their speaking anxiety to factors like lack of confidence, lack of fluency, and difficulty in maintaining eye contact (Alsaffar, 2021). These findings indicate that the highly immersive learning environment created by VR technology plays a crucial role in diminishing learners' anxiety, thereby facilitating confident speaking skills in authentic contexts. In other words, VR technology can help learners develop language competences more effectively by immersing them to experience a variety of conversation scenarios that they might encounter in real-life situations, providing opportunities to manage anxiety and improve conversational skills.

2) Safe Practice Environment

Repetitive practice and trial and error are fundamental to second or foreign language acquisition, particularly in the development of speaking skills. The provision of a safe practice environment within VR allows learners to build confidence while progressively enhancing their speaking skills (Chen, 2022). In a VR setting, learners can practice freely in a safe space, where they can make mistakes without fear (Alsaffar, 2021). Specifically, even if a learner commits a pronunciation or grammatical error, they do not face the negative evaluations or feedback that might occur in real-life situations (Premkumar et al., 2021). Moreover, VR technology facilitates the use of English under realistic conditions by simulating a variety of social situations (Hung et al., 2023). These experiences prepare learners for diverse speaking scenarios they might face in actual life, thereby helping to alleviate speaking anxiety in genuine contexts. The safe and unrestricted nature of the VR environment makes learners fearless in trying and experimenting with new language skills, encouraging learners to practice more freely. This environment fosters the learners' courage to use language more experimentally, contributing to the development of confidence, a crucial aspect of language learning.

3) Learners' Positive Reactions and Perceptions

Students found classes using VR technology interesting, describing the experience of completing assignments with cutting-edge technology as "new" (York et al., 2021). Participants particularly lauded the interaction within the highly immersive VR environment as impressive, showing enthusiasm for new technologies and a readiness to continue employing VR in their learning (Chen, 2022). The VR using classes, characterized by realistic three-dimensional (3D) environments and interactive elements, offer an immersive experience that makes participants feel as if they are in a real situation. This realism not only stimulated learners' motivation and active participation, thereby enhancing their interest in

language learning, but also deepened their immersion in the learning process, which is effectively alleviating their speaking anxiety (Chen, 2022). These positive outcomes show VR technology's capacity to go beyond its role as a mere educational tool, and has the potential to transform the learning process itself into a rich and enjoyable experience.

4) Enhanced Accessibility to Language Learning

Participants responded that VR technology enables language learning without restrictions of time and place, allowing learners to participate in language learning activities via VR equipment at any time and from any location, in alignment with their schedules (Hung et al., 2023). This flexibility affords learners the opportunity to devise and implement more adaptable learning plans or strategies, highlighting VR's potential as a valuable learning tool, particularly for those facing geographical barriers to accessing language learning resources. VR facilitates experiences of diverse cultures and places beyond geographical limits and fosters interaction with others (Chen & Hwang, 2022). Furthermore, with recent advancements enabling VR operation on smartphones, economic accessibility has significantly improved (Hung et al., 2023; Kaplan-Rakowski & Gruber, 2023). This improvement in accessibility fosters an atmosphere conducive to free language practice, ultimately aiding in the reduction of speaking anxiety. In other words, learners can gain confidence and mitigate language use fears through realistic practice within a virtual setting. Therefore, language learning via VR technology can complement the limitations of traditional learning methods and plays a critical role in not only expanding learners' opportunities and choices but also helping them speak with confidence in real situations. These changes will play an important role in redefining language learning within higher education and enabling learners to actively participate as members of a global community.

3. Perceived Challenges of Utilizing VR Technology to Reduce Higher Education Learners' English Speaking Anxiety

1) Symptoms of Visual Fatigue

Participants who used VR for more than a certain period reported they began to experience symptoms of visual fatigue, including eyestrain, dizziness, and general discomfort, attributed to prolonged focus on the virtual environment (Alsaffar, 2021; Hung et al., 2023). This issue arises from when visual information in the VR environment is processed differently compared to the real world, so the VR users must constantly adjust their eyes to focus on the virtual image. Over time, these efforts can lead to visual fatigue, which not only affects the learner's health conditions but can also be a major obstacle in research that involves

sustained and long-term use of VR technology. Researchers suggest that the best way to reduce these problems requires strict compliance with the guidelines, such as taking regular breaks every 30 minutes under the instructor's supervision, based on the enhanced VR health and safety use guidelines (Hung et al., 2023).

2) Unrealistic Perception of Characters in VR Environments

In VR environments, the challenge of participants recognizing individuals as being unrealistic impacted their sense of immersion and the effectiveness of learning. Participants described entities encountered in VR as "fictitious humans", "fictitious audience", "animated characters", and "avatars" because participants felt the appearance and behavior of these virtual beings was unrealistic (Gruber & Kaplan-Rakowski, 2020; Hung et al., 2023; Monteiro et al., 2023). Furthermore, an instance was noted when a student was talking seriously, a virtual human displayed behavior that did not fit the situation, such as smiling, waving, or rapidly nodding. This misalignment made the learners feel ignored, at times causing them to forget something important when they were trying to say it (Gruber & Kaplan-Rakowski, 2020). The issue arises when virtual humans' facial expressions and gestures show inappropriate or unexpected reactions; the learners feel heterogeneous and it becomes difficult to concentrate on the learning content because interaction through avatars may not be a natural or enjoyable experience for all learners. This phenomenon underscores the importance of realism in VR environments. Therefore, the development of VR content should prioritize the authenticity of virtual characters and their context-appropriate responses to enhance the learning experience.

3) Technical Problems and Accessibility Issues

Learners who are new to VR technology reported that familiarizing themselves to VR devices took longer than anticipated when they first encountered them (Yamanaka et al., 2023; York et al., 2021), with discomfort arising from technical issues like connection failures (Alsaffar, 2021; Hung et al., 2023). These technical problems can interrupt the continuity of the learning process and diminish learner satisfaction. In addition, these technical issues can reduce learning effectiveness, particularly in educational environments where real-time interaction is crucial. Moreover, accessibility issues, preventing some learners from performing even basic operations, restricted the educational use of VR technology. Such obstacles are critical considerations in the integration and application of VR technology within educational frameworks. To address these issues, a collaborative effort between VR technology developers and educators is essential, focusing on user-centric design principles. Additionally, minimizing technical problems and enhancing learner

accessibility through a user-friendly interface, strengthening technical support, and providing sufficient training and practice opportunities before usage are vital steps towards improving the educational experience with VR technology.

4) Loss of Awareness of Time and the Real World

VR technology captivates users with its realistic 3D environments and interactive elements. Due to this high level of immersion, learners have reported that they lost track of time and felt that their connection with the real world became blurred (Kaplan-Rakowski & Gruber, 2023). This effect is particularly pronounced in VR settings that closely mimic the real world, leading users to overlook the boundary between the virtual and the real world. Prolonged immersion in VR can disrupt one's connection to the real world, complicating time management and leading to an underestimation of the virtual experience's impact on real life. Such disconnection may adversely affect learners' daily lives and academic performance, manifesting as difficulties in responding appropriately to real-world problems or situations. To mitigate these issues, instructors must offer clear guidelines for managing VR learning time, including the recommendation of short breaks at regular intervals to ensure a balanced and healthy engagement with both virtual and real-world environments.

4. Mechanisms of VR Technology in Reducing English Speaking Anxiety

Considering previous studies, the mechanism through which VR technology helps reduce education learners' English speaking anxiety can be inferred as follows. Initially, through VR devices, learners are introduced to highly realistic and immersive environments that simulate real-life conditions, being offered a platform for practice that closely resembles actual experiences. This virtual setting affords psychological comfort by providing a safe and controlled space for practice, free from the fear commonly associated with real-life speaking situations. Notably, the VR environment enables learners to practice without the embarrassment of making mistakes in front of others. Consequently, practicing within this virtual area, as opposed to practicing with real individuals, considerably diminishes the fear of error, thereby alleviating speaking anxiety. Making mistakes is not seen as shameful but as opportunities for growth, highlighting indicators in need of improvement where instructors can offer targeted feedback. This process nurtures learners to gradually become more confident in their speaking abilities and cultivate the competence to speak without fear in real-life situations, akin to those encountered in VR. This contributes not only to the enhancement of their speaking skills but also to the development of a positive learning attitude.

5. Limitations of Existing Studies

1) Small Sample Sizes Issues

The reliability of a review and the generalizability of its findings are significantly influenced by sample sizes of reviewed articles. The majority of VR-related literature examined in this review were conducted on a relatively small number of participants ($N <$ 30); applying these results to a broader population might compromise the validity of the findings. A limited sample size diminishes the statistical reliability and may lead to greater variability in research outcomes. Therefore, it is important to undertake studies with larger sample sizes to enhance reliability and validity of research results.

2) Relative Lack of Intervention Duration

In numerous studies reviewed, the duration of educational interventions employing VR technology was relatively brief. Such short intervention periods might not adequately capture the long-term impacts of VR on learners' English speaking skills or their reduction in anxiety. Given that the effects of learning typically unfold over time, designing research with extended intervention durations would facilitate a more precise evaluation of VR technology's potential to alleviate English speaking anxiety among learners.

3) Discrepancy Between Participants' Anxiety Levels and Actual Speaking Ability

There were cases where participants' levels of speaking anxiety did not correspond with their actual speaking proficiency (Chen, 2022; York et al., 2021). These inconsistencies add complexity to the interpretation of results. Such discrepancies may increase the risk of overestimating or underestimating VR technology's effectiveness for specific participant groups, and potentially compromise the reliability of the findings. Therefore, during the participant selection phase, the participant's speaking anxiety level and speaking ability level should be carefully evaluated. Also, experimental designs and research methodologies should be crafted with consideration for the correlation between these two variables to ensure more accurate and reliable outcomes.

4) Limitations of Self-report Questionnaires and Interviews

The self-report questionnaires or interviews used as qualitative assessment methods required participants to evaluate their own level of speaking anxiety and performance (Alsaffar, 2021). This method is subjective and prone to bias due to self-perception accuracy,

social desirability bias, and memory inaccuracies (Hung et al., 2023; Kaplan-Rakowski & Gruber, 2023). Furthermore, the process of applying, translating, and adapting existing questionnaires to fit specific contexts may exacerbate these biases. Therefore, when designing a study, it is critical to aim for objective data collection methods as far as is possible, recognizing the limitations of self-reported data, and using a variety of assessment tools to complement and enhance the validity of the findings. For instance, measuring physiological indicators of anxiety, such as changes in salivary cortisol levels or heart rate variability which are often used in the clinical field, could augment objectivity (Thrasher, 2022).

5) Concerns over Whether Improvements are Attributable to VR Technology Use

The reduction in learners' English speaking anxiety observed in the research results cannot be definitively attributed to the use of VR technology alone. This is because the improvements experienced by the participants could stem from the technology itself or from the consistent practice and effort exerted by learners throughout the research period (Alsaffar, 2021; Barrett et al., 2024; Hung et al., 2023). This presents a challenge in research design, making it difficult to distinctly separate the impact of VR technology from its use. Consequently, to accurately evaluate the influence of VR technology on reducing speaking anxiety, an experimental design that includes a control group and methods for controlling variables other than VR technology use is imperative. Such a design is essential for isolating the effects of VR technology from the benefits of regular practice, thereby providing a clearer understanding of VR technology's specific contributions to learning outcomes.

IV. CONCLUSION AND IMPLICATIONS

This review aimed to investigate the impact of VR technology on higher education learners' English speaking anxiety. To conduct a rigorous systematic literature review, the researcher adhered to the PRISMA 2020 framework. Through a methodical selection process, 11 studies were identified and scrutinized.

A comprehensive, systematic literature review of the selected literature was conducted to closely explore the transformative potential of VR technology in alleviating English speaking anxiety among higher education learners. The main findings are as follows. First, the study revealed the ability of VR to significantly reduce users' speaking anxiety by creating an engaging and immersive environment where learners feel safe. In particular, compared to traditional learning methods, VR technology allows learners to experience various conversation scenarios that can be encountered in real-life situations, in a highly

immersive learning environment. It also enables them to practice freely in a safe space where making mistakes is allowed. This demonstrates its superiority in providing learners with opportunities to manage anxiety and improve conversational skills, thereby enhancing confident speaking abilities in real-life situations. Additionally, the improved engagement and motivation observed among students using VR for language learning highlight the effectiveness of VR in making the learning process more enjoyable and impactful. Lastly, improving accessibility to language learning by creating an atmosphere where learners can freely practice the language without the constraints of time and place ultimately contributes to reducing speaking anxiety.

However, several challenges remain that must be overcome to optimize the educational uses of VR technology. The unreality of virtual characters, technical issues, and initial barriers to access pose significant obstacles to the efficient and smooth integration of VR into learning environments. These challenges require the development of VR contents that emphasize realism and naturalness. It is important for VR technology developers and educators collaborate closely to reduce technical difficulties and enhance learner accessibility, thereby ensuring a positive and effective learning experience. Moreover, although the immersive environment of VR may alleviate speaking anxiety, it also raises concerns about potential visual fatigue and a loss of awareness of time and the real world. To mitigate these possible negative effects, the clear guidelines and strategies, grounded in robust VR health and safety protocols, is indispensable.

The limitations identified in the reviewed studies, including small sample sizes, short intervention durations, subjective measurement methods, and questions about whether the actual source of relief may be or not be the VR technology itself, as well as mismatches between participants' reported anxiety levels and their actual speaking abilities, serve as critical indicators for future research directions. Future studies should aim to overcome these limitations and gaps. Specifically, research should involve larger and more diverse participant groups to enhance the generalizability of the findings. Longitudinal and time-series analyses are recommended to assess the long-term effects of VR on speaking anxiety and explore the durability of the benefits observed. Additionally, to enhance the reliability and validity of research outcomes, and to offer a comprehensive evaluation of VR's efficacy, employing a combination of objective and subjective evaluation tools is advised. For instance, measuring physiological indicators of anxiety, such as changes in salivary cortisol levels or heart rate variability, which are often used to measure participant anxiety in the clinical field, could augment the objectivity of these assessments (Thrasher, 2022).

Furthermore, experimental designs that systematically control for confounding variables are essential to clearly distinguish between the use of VR technology and its effects. Many of the reviewed studies did not adequately control for variables such as learners' prior English proficiency, technological familiarity, learning styles, and personal traits. These

confounding variables can influence the effect of VR technology on speaking anxiety, so future research should carefully assess participants' speaking anxiety and abilities and examine the interactions between these factors, while employing methods such as random assignment, pre-post test designs, and analysis of covariance (ANCOVA) to control these variables. Additionally, by clearly differentiating the specific impacts of VR technology from the benefits of consistent practice, researchers can more accurately measure the pure effect of VR technology.

Lastly, this study is an exploratory systematic review that investigates the impact of VR technology on English speaking anxiety among higher education learners and, therefore, does not include quality assessment or risk of bias analysis of the included studies. The aim of this research is to provide foundational material for future systematic reviews and meta-analyses. To overcome the limitations of this study, future research should include qualitative evaluations and risk of bias assessments of the included studies to strengthen the reliability and validity of the findings.

Nevertheless, the findings from this systematic literature review hold significant implications in multiple respects. Firstly, the observed substantial reduction in English speaking anxiety through the use of VR underscores the potential benefits of integrating VR technology into second language learning curricula, particularly those focused on enhancing speaking skills. Such integration not only motivates learners to engage more effectively with the language but also provides a safe space for experimentation, giving them the opportunities to practice and try new language skills confidently. Moreover, this study contributes to the theoretical understanding of VR technology's role in language learning, notably in reducing speaking anxiety. In other words, the educational use of VR technology can play a decisive role in reducing learners' speaking anxiety by not only developing learners' language skills but also providing psychological support and enhancing learning motivation. From a technology development perspective, VR developers are encouraged to prioritize the realism of virtual characters and environments to boost VR's educational effectiveness. Additionally, solving technical and accessibility issues is also essential to facilitate VR's broader implementation in educational fields.

This research confirms VR technology's positive impact on mitigating English speaking anxiety among higher education learners, offering valuable insights into how technological advancements can transform the language learning experience, while also suggesting that VR technology emerges as a powerful tool that can revolutionize language learning in higher education contexts. However, it is imperative to acknowledge and address the various challenges, including technical obstacles, visual fatigue, and ethical considerations, to maximize the educational use of these technologies. Therefore, future research should aim to address this study's limitations and explore sustainable and effective uses of VR in the field of language education. Ultimately, these efforts promise to empower learners to acquire

new languages confidently and communicate more broadly. This study aspires to encourage ongoing exploration and innovation at the intersection of virtual reality and language learning, serving as a foundation for stakeholders, including learners, parents, educators, policymakers, and technologists, to envision and shape the future direction of language education development. The researcher hopes this work will act as a catalyst for continued research and innovation in integrating virtual reality with language learning.

REFERENCES

Aida, Y. (1994). Examination of Horwitz, Horwitz, and Cope' s construct of foreign language anxiety: The case of students of Japanese. *The Modern Language Journal, 78*(2), 155-168. https://doi.org/10.2307/329005

Alsaffar, M. J. (2021). Virtual reality software as preparation tools for oral presentations: Perceptions from the classroom. *Theory and Practice in Language Studies, 11*(10), 1146-1160. https://doi.org/10.17507/tpls.1110.02

Alsawaier, R. S. (2018). The effect of gamification on motivation and engagement. *International Journal of Information and Learning Technology, 35*(1), 56-79. https://doi.org/10.1108/IJILT-02-2017-0009

Arnold, J. (2020). Affective factors and language learning. In M. Simons & T. F. Smits (Eds.), *Language education and emotions: Research into emotions and language learners, language teachers and educational processes* (pp. 18-33). Routledge.

Barrett, A., Pack, A., Monteiro, D., & Liang, H. N. (2024). Exploring the influence of audience familiarity on speaker anxiety and performance in virtual reality and real-life presentation contexts. *Behaviour & Information Technology, 43*(4), 787-799. https://doi.org/10.1080/0144929X.2023.2186145

Bashori, M., van Hout, R., Strik, H., & Cucchiarini, C. (2022). Web-based language learning and speaking anxiety. *Computer Assisted Language Learning, 35*(5-6), 1058-1089. https://doi.org/10.1080/09588221.2020.1770293

Brown, H. D. (1973). Affective variables in second language acquisition. *Language Learning, 23*(2), 231-244.

Chen, M. R. A., & Hwang, G. J. (2020). Effects of a concept mapping-based flipped learning approach on EFL students' English speaking performance, critical thinking awareness and speaking anxiety. *British Journal of Educational Technology, 51*(3), 817-834. https://doi.org/10.1111/bjet.12887

Chen, M. R. A., & Hwang, G. J. (2022). Effects of experiencing authentic contexts on English speaking performances, anxiety and motivation of EFL students with

different cognitive styles. *Interactive Learning Environments, 30*(9), 1619-1639. https://doi.org/10.1080/10494820.2020.1734626

Chen, Y. C. (2022). Effects of technology-enhanced language learning on reducing EFL learners' public speaking anxiety. *Computer Assisted Language Learning*, *37*(4), 789-813. https://doi.org/10.1080/09588221.2022.2055083

Cheng, Y. S. (2002). Factors associated with foreign language writing anxiety. *Foreign Language Annals, 35*(6), 647-656. https://doi.org/10.1111/j.1944-9720.2002.tb01903.x

Chou, M. H. (2018). Speaking anxiety and strategy use for learning English as a foreign language in full and partial English-medium instruction contexts. *Tesol Quarterly, 52*(3), 611-633. https://doi.org/10.1002/tesq.455

Dewaele, J.-M., Witney, J., Saito, K., & Dewaele, L. (2018). Foreign language enjoyment and anxiety: The effect of teacher and learner variables. *Language Teaching Research, 22*(6), 676-697. https://doi.org/10.1177/1362168817692161

Dhimolea, T. K., Kaplan-Rakowski, R., & Lin, L. (2022). A systematic review of research on high-immersion virtual reality for language learning. *Tech Trends, 66*(5), 810-824. https://doi.org/10.1007/s11528-022-00717-w

Ellis, R. (2015). *Understanding second language acquisition* (2nd ed.). Oxford university press.

Gardner, R. C., & MacIntyre, P. D. (1993). On the measurement of affective variables in second language learning. *Language Learning, 43*(2), 157-194. https://doi.org/10.1111/j.1467-1770.1992.tb00714.x

Gok, D., Bozoglan, H., & Bozoglan, B. (2023). Effects of online flipped classroom on foreign language classroom anxiety and reading anxiety. *Computer Assisted Language Learning, 36*(4), 840-860. https://doi.org/10.1080/09588221.2021.1950191

Golonka, E. M., Bowles, A. R., Frank, V. M., Richardson, D. L., & Freynik, S. (2014). Technologies for foreign language learning: A review of technology types and their effectiveness. *Computer Assisted Language Learning, 27*(1), 70-105. https://doi.org/10.1080/09588221.2012.700315

Gruber, A., & Kaplan-Rakowski, R. (2020). User experience of public speaking practice in virtual reality. In R. Z. Zheng, (Ed.), *Cognitive and affective perspectives on immersive technology in education* (pp. 235-249). IGI Global. https://doi.org/10.4018/978-1-7998-3250-8

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers, 3*, 275-285. https://doi.org/10.1016/j.susoc.2022.05.004

Horwitz, E. (2001). Language anxiety and achievement. *Annual Review of Applied Linguistics, 21*, 112-126. https://doi.org/10.1017/S0267190501000071

Horwitz, E. K. (2010). Foreign and second language anxiety. *Language Teaching, 43*(2), 154-167. https://doi.org/10.1017/S026144480999036X

Horwitz, E. K., Horwitz, M. B., & Cope, J. (1986). Foreign language classroom anxiety. *The Modern Language Journal, 70*(2), 125-132. https://doi.org/10.2307/327317

Hung, S. T. A., Chen, W. J., & Chien, S. Y. (2023). Virtual reality is not always a cure-all: Evidences from a quasi-experiment of EFL business speaking courses. *Interactive Learning Environments*, *32*(8), 4426-4442. https://doi.org/10.1080/10494820.2023.2200811

Jeon, J. (2024). Exploring AI chatbot affordances in the EFL classroom: Young learners' experiences and perspectives. *Computer Assisted Language Learning, 37*(1-2), 1-26. https://doi.org/10.1080/09588221.2021.2021241

Ji, S., Qin, X., & Li, K. (2022). A systematic review of foreign language listening anxiety: Focus on the theoretical definitions and measurements. *Frontiers in Psychology, 13*, 859021. https://doi.org/10.3389/fpsyg.2022.859021

Kaplan-Rakowski, R., & Gruber, A. (2023). The impact of high-immersion virtual reality on foreign language anxiety. *Smart Learning Environments, 10*(46), 1-18. https://doi.org/10.1186/s40561-023-00263-9

Kasbi, S., & Elahi Shirvan, M. (2017). Ecological understanding of foreign language speaking anxiety: Emerging patterns and dynamic systems. *Asian-Pacific Journal of Second and Foreign Language Education, 2*(2), 1-20. https://doi.org/10.1186/s40862-017-0026-y

Kavanagh, S., Luxton-Reilly, A., Wuensche, B., & Plimmer, B. (2017). A systematic review of Virtual Reality in education. *Themes in Science and Technology Education, 10*(2), 85-119. https://www.learntechlib.org/p/182115/

Khukalenko, I. S., Kaplan-Rakowski, R., An, Y., & Iushina, V. D. (2022). Teachers' perceptions of using virtual reality technology in classrooms: A large-scale survey. *Education and Information Technologies, 27*, 11591-11613. https://doi.org/10.1007/s10639-022-11061-0

Kim, J. (2002). Anxiety and foreign language listening. *English Teaching, 57*(2), 3-34. http://kate.bada.cc/wp-content/uploads/2015/02/kate_57_2_1.pdf

Krashen, S. (1982). *Principles and practice in second language acquisition*. Pergamon Press Inc.

Larsen-Freeman, D. (2001). Individual cognitive/affective learner contributions and differential success in second language acquisition. In M. P. Breen (Ed.), *Learner contributions to language learning* (pp. 12-24). Pearson.

Lege, R., & Bonner, E. (2020). Virtual reality in education: The promise, progress, and challenge. *JALT CALL Journal, 16*(3), 167-180. https://doi.org/10.29140/jaltcall.v16n3.388

Leong, L. M., & Ahmadi, S. M. (2017). An analysis of factors influencing learners' English speaking skill. *International Journal of Research in English Education, 2*(1), 34-41. https://sid.ir/paper/349619/en

Li, R. (2022). Foreign language reading anxiety and its correlates: A meta-analysis. *Reading and Writing, 35*(4), 995-1018. https://doi.org/10.1007/s11145-021-10213-x

Liu, M. (2016). Interrelations between foreign language listening anxiety and strategy use and their predicting effects on test performance of high-and low-proficient Chinese university EFL learners. *The Asia-Pacific Education Researcher, 25*(4), 647-655. https://doi.org/10.1007/s40299-016-0294-1

Matsuda, S., & Gobel, P. (2004). Anxiety and predictors of performance in the foreign language classroom. *System, 32*(1), 21-36. https://doi.org/10.1016/j.system.2003.08.002

McCroskey, J. C. (1970). Measures of communication-bound anxiety. *Speech Monographs, 37*, 269-277. https://doi.org/https://doi.org/10.1080/03637757009375677

McGovern, E., Moreira, G., & Luna-Nevarez, C. (2020). An application of virtual reality in education: Can this technology enhance the quality of students' learning experience? *Journal of Education for Business, 95*(7), 490-496. https://doi.org/10.1080/08832323.2019.1703096

Melchor-Couto, S. (2017) Foreign language anxiety levels in Second Life oral interaction. *ReCALL, 29*(1), 99-119. https://doi.org/10.1017/S0958344016000185

Monteiro, D., Wang, A., Wang, L., Li, H., Barrett, A., Pack, A., & Liang, H. N. (2023). Effects of audience familiarity on anxiety in a virtual reality public speaking training tool. *Universal Access in the Information Society*, *23*, 23-34. https://doi.org/10.1007/s10209-023-00985-0

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., & Moher, D. (2021). Updating guidance for reporting systematic reviews: development of the PRISMA 2020 statement. *Journal of Clinical Epidemiology, 134*, 103-112. https://doi.org/10.1016/j.jclinepi.2021.02.003

Pan, H., Xia, F., Kumar, T., Li, X., & Shamsy, A. (2022). Massive open online course versus flipped instruction: Impacts on foreign language speaking anxiety, foreign language learning motivation, and learning attitude. *Frontiers in Psychology, 13*, 833616. https://doi.org/10.3389/fpsyg.2022.833616

Paul, J., & Barari, M. (2022). Meta-analysis and traditional systematic literature reviews—What, why, when, where, and how?. *Psychology & Marketing, 39*(6), 1099-1115. https://doi.org/10.1002/mar.21657

Premkumar, P., Heym, N., Brown, D. J., Battersby, S., Sumich, A., Huntington, B., Daly, R., & Zysk, E. (2021). The effectiveness of self-guided virtual-reality exposure

therapy for public-speaking anxiety. *Frontiers in Psychiatry, 12*, 694610. https://doi.org/10.3389/fpsyt.2021.694610

Price, M. L. (1991). The subjective experience of foreign language anxiety: Interviews with highly anxious students. In E. K. Horwitz & D. J. Young (Eds.), *Language anxiety: From theory and research to classroom implications* (pp. 101-108). Prentice Hall Inc.

Rafada, S. H., & Madini, A. A. (2017). Effective solutions for reducing Saudi learners' speaking anxiety in EFL classrooms. *Arab World English Journal, 8*(2), 308-322. https://dx.doi.org/10.24093/awej/vol8no2.22

Rajitha, K., & Alamelu, C. (2020). A study of factors affecting and causing speaking anxiety. *Procedia Computer Science, 172*, 1053-1058. https://doi.org/10.1016/j.procs.2020.05.154

Rasool, U., Qian, J., & Aslam, M. Z. (2023). An investigation of foreign language writing anxiety and its reasons among pre-service EFL teachers in Pakistan. *Frontiers in Psychology, 13*, 947867. https://doi.org/10.3389/fpsyg.2022.947867

Russell, V. (2020). Language anxiety and the online learner. *Foreign Language Annals, 53*(2), 338-352. https://doi.org/10.1111/flan.12461

Sabti, A. A., Md Rashid, S., Nimehchisalem, V., & Darmi, R. (2019). The Impact of writing anxiety, writing achievement motivation, and writing self-efficacy on writing performance: A correlational study of Iraqi tertiary EFL Learners. *SAGE Open, 9*(4). https://doi.org/10.1177/2158244019894289

Salomone, R. (2022). *The rise of English: Global politics and the power of language*. Oxford University Press.

Souchet, A. D., Lourdeaux, D., Pagani, A., & Rebenitsch, L. (2022). A narrative review of immersive virtual reality' s ergonomics and risks at the workplace: Cybersickness, visual fatigue, muscular fatigue, acute stress, and mental overload. *Virtual Reality, 27*, 19-50. https://doi.org/10.1007/s10055-022-00672-0

Tee, X. T., Joanna, T. A. T., & Kamarulzaman, W. (2020). A systematic review of self-coping strategies used by university students to cope with public speaking anxiety. *English Language Teaching, 13*(10), 57-73. https://eric.ed.gov/?id=ej1272166

Teimouri, Y., Goetze, J., & Plonsky, L. (2019). Second language anxiety and achievement: A meta-analysis. *Studies in Second Language Acquisition, 41*(2), 363-387. https://doi.org/10.1017/S0272263118000311

Thrasher, T. (2022). The impact of virtual reality on L2 French learners' language anxiety and oral comprehensibility: An exploratory study. *CALICO Journal, 39*(2), 219-238. https://doi.org/10.1558/cj.42198

Tsiplakides, I., & Keramida, A. (2009). Helping students overcome foreign language speaking anxiety in the English classroom: theoretical issues and practical

recommendations. *International Education Studies, 2*(4), 39-44. https://eric.ed.gov/?id=EJ1065743

Von Worde, R. (2003). Students' perspectives on foreign language anxiety. *Inquiry, 8*(1), 1-15. https://eric.ed.gov/?id=EJ876838

Woodrow, L. (2006). Anxiety and speaking English as a second language. *RELC Journal, 37*(3), 308-328. https://doi.org/10.1177/0033688206071315

Xie, Y., Chen, Y., & Ryder, L. H. (2021). Effects of using mobile-based virtual reality on Chinese L2 students' oral proficiency. *Computer Assisted Language Learning, 34*(3), 225-245. https://doi.org/10.1080/09588221.2019.1604551

Yamanaka, T., Miyazaki, Y., Yamazaki, A. K., Murakami, K. H., Kimura, S., Yamashita, M., & Kondo, Y. (2023). Testing virtual reality for eliminating Japanese university students' English-speaking anxiety: Cases of international conference and restaurant. *International Journal of Learning and Teaching, 9*(1), 49-55. https://doi.org/10.18178/ijlt.9.1.49-55

York, J., Shibata, K., Tokutake, H., & Nakayama, H. (2021). Effect of SCMC on foreign language anxiety and learning experience: A comparison of voice, video, and VR-based oral interaction. *ReCALL, 33*(1), 49-70. http://doi.org/10.1017/S0958344020000154

Zhang, X. (2019). Foreign language anxiety and foreign language performance: A meta-analysis. *The Modern Language Journal, 103*(4), 763-781. https://doi.org/10.1111/modl.12590

APPENDIX

Summary of Reviewed Studies

No.	Citation (APA 7th)	Methodology	Samples	Key Findings	Limitations
1	York, J., Shibata, K., Tokutake, H., & Nakayama, H. (2021). Effect of SCMC on foreign language anxiety and learning experience: A comparison of voice, video, and VR-based oral interaction. ReCALL, 33(1), 49-70.	Experimental study (3×3 factorial design) + Questionnaire (FLCAS)	N = 30 (Japanese university students, avg. age 21.3)	All synchronous CMC (SCMC) modes (voice, video, VR) significantly reduced foreign language anxiety, but no statistically significant difference between modalities. VR was perceived as the most enjoyable and effective learning environment.	Small sample size, participants' English proficiency not assessed, short-term study, technical limitations of VR.
2	Chen, Y. C. (2022). Effects of technology-enhanced language learning on reducing EFL learners' public speaking anxiety. Computer Assisted Language Learning, 37(4), 789-813.	Experimental study (Comparison of 3 groups) + Questionnaire (PRPSA) + Semi-structured interviews	N = 33 (University students, A2-B1 level)	VR-based learning was the most effective in reducing public speaking anxiety (PSA). AI-based feedback contributed to anxiety reduction. All groups showed PSA reduction, but no significant difference in final speaking performance.	Small sample size, short study duration (4 weeks), long-term effects of TELL not examined.
3	Alsaffar, M. J. (2021). Virtual reality software as preparation tools for oral presentations: Perceptions from the classroom. Theory and Practice in Language Studies, 11(10), 1146-1160.	Case study (Qualitative research) - Learning logs, surveys, interviews, researcher observations	N = 7 (Chinese university students who under AEP course, 20-22 years old)	Practicing presentations using VirtualSpeech VR increased students' presentation confidence. Most students reported that VR practice helped reduce their real-life public speaking anxiety.	Small-scale case study, short study duration (16 weeks), potential VR-related issues (motion sickness, technical difficulties).

4	Chen, M. R. A., & Hwang, G. J. (2022). Effects of experiencing authentic contexts on English speaking performances, anxiety and motivation of EFL students with different cognitive styles. Interactive Learning Environments, 30(9), 1619-1639.	Quasi-experimental study (Pre-post tests) + Questionnaire (GEFT, FLCAS) + Speech assessment	N = 93 (University students in tourism and restaurant English courses)	Interactive Spherical Video-Based VR (ISVVR) improved English speaking performance and reduced anxiety. Field-Independent (FI) learners benefited more than Field-Dependent (FD) learners. Learning motivation increased in the ISVVR environment.	FD learners were more distracted by complex visual elements. Individual differences in VR technology use. Long-term effects not verified.
5	Hung, S. T. A., Chen, W. J., & Chien, S. Y. (2023). Virtual reality is not always a cure-all: evidences from a quasi-experiment of EFL business speaking courses. *Interactive Learning Environments*, *32*(8), 4426-4442.	Quasi-experimental study (Pre-post tests) + ANCOVA analysis + Semi-structured interviews	N = 40 (University students, 17-22 years old)	No significant difference in speaking ability, anxiety, or emotions between the VR-based group and the traditional PPT-based learning group. However, qualitative data suggested that VR was useful as a practice tool, potentially reducing anxiety and increasing motivation.	Short study duration (14 weeks), difficulty in verifying long-term effects. Some participants experienced motion sickness, and technical issues reduced learning efficiency.
6	Gruber, A., & Kaplan-Rakowski, R. (2020). User experience of public speaking practice in virtual reality. In R. Z. Zheng, (Ed.), Cognitive and affective perspectives on immersive technology in education (pp. 235-249). IGI Global.	Qualitative research (Semi-structured interviews, participant observations)	N = 12 (University students, avg. age 23.16)	Practicing in a high-immersion VR environment increased "Sense of Presence" and "Plausibility Illusion," which contributed to reducing public speaking anxiety. Repeated VR exposure enhanced realism and immersion.	Small sample size, voluntary participation may limit representativeness, individual differences in VR proficiency not considered.

7	Kaplan-Rakowski, R., & Gruber, A. (2023). The impact of high-immersion virtual reality on foreign language anxiety. Smart Learning Environments, 10(46), 1-18.	Quasi-experimental study (Between-group comparison, repeated measures design) – Multivariate regression analysis	N = 20 (University students, B1-B2 level)	The VR-based group had significantly lower Foreign Language Anxiety (FLA) scores than the Zoom-based control group. VR provided a realistic presentation environment while reducing anxiety.	Small sample size, short study duration (3 months), potential bias in self-reported data, prior VR experience may have influenced results.
8	Barrett, A., Pack, A., Monteiro, D., & Liang, H. N. (2024). Exploring the influence of audience familiarity on speaker anxiety and performance in virtual reality and real-life presentation contexts. Behaviour & Information Technology, 43(4), 787-799.	Quasi-experimental study (Repeated measures design) – Surveys (PSA, motivation, confidence, focus) – Speech assessment (fluency, word count)	N = 10 (University students at a British university in China)	Participants reported the highest public speaking anxiety (PSA) when presenting to an unfamiliar audience. Anxiety was lower when presenting to a virtual audience. However, VR presentations had lower fluency, while real-life presentations had faster speech rates.	Small sample size (N=10), limited verification of cross-condition effects, unclear whether VR-real-life differences were due to specific variables.
9	Premkumar, P., Heym, N., Brown, D. J., Battersby, S., Sumich, A., Huntington, B., Daly, R., & Zysk, E. (2021). The effectiveness of self-guided virtual-reality exposure therapy for public-speaking anxiety. Frontiers in Psychiatry, 12, 694610.	Quasi-experimental study (Pre-post tests) + Self-report questionnaires + Heart rate monitoring	N = 32 (University students with high public speaking anxiety)	Self-guided VR exposure therapy (VRET) gradually reduced public speaking anxiety by adjusting virtual audience size, reactions, and distance. Anxiety reduction was maintained post-study and at a one-month follow-up. Heart rate and self-reported anxiety levels gradually decreased.	Short study duration (2 weeks), no control group, lack of consideration for individual differences in VR adaptation, long-term effects not verified.

10	Monteiro, D., Wang, A., Wang, L., Li, H., Barrett, A., Pack, A., & Liang, H. N. (2023). Effects of audience familiarity on anxiety in a virtual reality public speaking training tool. Universal Access in the Information Society, 23, 23-34.	Quasi-experimental study (Repeated measures design) + Analysis of heart rate, speech duration, and word count	N = 10 (University students, B1-level English learners)	Participants with moderate speaking anxiety felt more comfortable presenting to familiar audiences (3D-scanned faces) than to unfamiliar ones (generic models). However, no significant effects were observed in high- or low-anxiety participants. Familiar faces alone did not directly reduce anxiety.	Small sample size (N=10), long-term effects not tested, limited expressiveness of virtual audience faces may have reduced realism and immersion.
11	Yamanaka, T., Miyazaki, Y., Yamazaki, A. K., Murakami, K. H., Kimura, S., Yamashita, M., & Kondo, Y. (2023). Testing virtual reality for eliminating Japanese university students' English-speaking anxiety: Cases of international conference and restaurant. International Journal of Learning and Teaching, 9(1), 49-55.	Quasi-experimental study (Pre-post surveys) + Quantitative analysis (Wilcoxon signed-rank test) + Open-ended survey analysis	N = 69 (Japanese university students, STEM majors)	VR-based presentation and restaurant simulations reduced speaking anxiety for some students. However, those with higher English listening scores experienced increased anxiety post-experiment. User feedback indicated discomfort with VR (motion sickness, interface issues).	Differences in anxiety levels based on English proficiency, particularly increased anxiety in higher-level students. Technical issues (motion sickness, usability difficulties) may have limited learning effects.

Examples in: English
Applicable Language: English
Applicable Levels: Tertiary

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