

Enhancing English Oral Communication Skills through Virtual Reality: A Study on Anxiety Reduction and Authentic Learning

Ophelia Hsiang Ling Huang¹

¹ Language Center, Taipei Medical University, Taipei, Taiwan

Correspondence: Ophelia Hsiang Ling Huang, Taipei Medical University, Taipei, Taiwan. E-mail: ofihuang@tmu.edu.tw

Received: March 27, 2024

Accepted: April 16, 2024

Online Published: April 17, 2024

doi: 10.5539/elt.v17n5p1

URL: <https://doi.org/10.5539/elt.v17n5p1>

Abstract

This study delves into the efficacy of a curriculum emphasizing English oral communication, employing virtual reality (VR) technology. Virtual presentations emulate real-world speaking scenarios, such as classroom presentations and elevator pitches, to provide students with authentic experiences in public speaking and interview interactions. Through ongoing pedagogical inquiry, the research endeavors to deepen comprehension among students and educators regarding integrating virtual reality into the English as a Foreign Language (EFL) classroom, explicitly focusing on presentations. The investigation scrutinizes the impact of varied learning environments, particularly the reduction of anxiety and the facilitation of authentic learning through virtual reality, on students' beliefs, confidence levels, and subsequent English language proficiency. By scrutinizing shifts in students' anxiety levels pre- and post-intervention, the study furnishes valuable insights and recommendations for future research and pedagogical practices. These insights aim to equip educators with strategies to mitigate student anxiety, enhance the efficacy of VR applications in language instruction, and enrich overall learning experiences.

Keywords: virtual reality, English oral communication, student anxiety, language proficiency

1. Introduction

In academic discourse, scholars have extensively examined the correlation between learner anxiety and language acquisition efficacy (Brown, 1973; Horwitz, 1986; Bailey, Onwuegbuzie, & Daley, 2000). Anxiety manifestations are often observed across three distinct phases of the language learning process: the input stage, the processing stage, and the output stage (Tobias, 1986). Within the realm of foreign language acquisition, researchers have identified three primary types of anxiety: communication anxiety, fear of negative evaluation, and test anxiety (Horwitz, 1986). Furthermore, scholars have analyzed how anxiety impacts the four essential language skills: listening, speaking, reading, and writing. Notably, anxiety during the output stage tends to be particularly pronounced, attributed partly to the heightened expectations placed on students to deliver coherent communication within limited time constraints (Kim, 2000; Horwitz, 2001; Andrade & Williams, 2009). Compared to English listening and reading proficiencies, anxiety stemming from speaking activities further diminishes learners' self-assurance and motivation. Scholars in Taiwan have highlighted that despite teaching English from elementary school through university, students exhibit a heightened concern for grammatical accuracy and a fear of making errors, leading to reticence in speaking English (Chen, 2010).

Moreover, in the context of foreign language acquisition, learners often experience heightened anxiety during oral communication outside the classroom compared to structured exercises or quizzes within the classroom setting (Woodrow, 2006). This anxiety is exacerbated by the necessity to express oneself in a second language, leading to frustration as learners struggle to translate thoughts from their native language into the target language (Horwitz, 2001). Cheng (1999) further delineates that anxiety in second language classrooms differs from that in other subjects, such as mathematics or science, primarily due to the requirement for students not only to comprehend new language concepts but also to articulate their thoughts in the target language concurrently, thus creating a unique form of situational anxiety.

In empirical studies, anxiety is closely associated with students' proficiency in their second foreign language, particularly in the oral aspect. Eliminating student anxiety within a short timeframe proves challenging. Nonetheless, research indicates that integrating authentic learning within the target language context can enhance

learning motivation and encourage language use for communication. However, executing mission-oriented tasks in traditional course contexts poses difficulties for students. Therefore, enabling learners to engage in language tasks within virtual environments may offer a solution. By experiencing virtual situations, students can better appreciate the benefits of authentic learning. Moreover, the language communication opportunities facilitated by VR can alleviate anxiety in testing, public speaking, and mock interview scenarios—opportunities typically unavailable in traditional classrooms. Consequently, this study aims to investigate how learners can mitigate learning anxiety through virtual reality-based language tasks, focusing on decreasing students' overall anxiety and increasing comfort in speaking in English.

Research questions:

1. Do VR communication tasks effectively reduce anxiety levels among students?
2. How do VR communication tasks impact different aspects of anxiety, such as fear of negative evaluation, test anxiety, and anticipated anxious behaviors?
3. Is there a differential impact of VR communication tasks on test anxiety and comfort in speaking English among students?

2. Literature Review

To gain insights into the impact of student anxiety on their oral proficiency, particularly in English presentations and situational conversations, and to explore the influence of virtual reality on language learning, a comprehensive review of relevant literature was conducted. The review focused on three primary contexts: the assessment of anxiety, Authentic Learning in Language Education, and Virtual Reality and Language Education.

2.1 The Assessment of Anxiety

To summarize, mitigating anxiety holds significant importance in college English instruction. However, the evaluation of anxiety poses a necessary challenge. Numerous scholars have delineated various theoretical frameworks for examination. For instance, Horwitz's (1986) Foreign Language Classroom Anxiety Scale (FLCAS) is commonly employed to explore anxiety experienced within the classroom setting. This scale categorizes anxiety into three dimensions: communication anxiety, fear of negative evaluation, and test anxiety. Notably, subsequent scholars have adapted this scale to investigate variations in learning environments and target languages, with some scholars incorporating learner comfort as a fourth dimension (Aida, 1994). This addition is crucial as it acknowledges the importance of assessing learners' ease in utilizing a second language alongside anxiety reduction efforts. Additional assessment tools include the Speaker Anxiety Scale (SA) developed by Clevenger and Halvorson (1992), which focuses on learners' anxiety when presenting on stage and encompasses nine sub-dimensions, such as anxiety before presenting and physical manifestations of anxiety. Similarly, the Public Speaking Anxiety Scale (PSAS) by Yaikhong and Usaha (2012) integrates elements from previous scholars. It evaluates anxiety across four dimensions: communication anxiety, fear of negative evaluation, test anxiety, and comfort in using English. Given the cultural and educational relevance between Japan and Taiwan, with English as the target language, this PSAS version was chosen to align with the study.

2.2 Authentic Learning in Language Education

In recent years, constructivism has influenced language education, extending beyond grammar instruction to emphasize contextualized teaching in authentic environments (Benson, 2001; Mishan, 2005; Henderson, 2012; Lan, 2013; Lan et al., 2015). Within higher education English teaching, there is a growing advocacy for experiential and situated learning, aiming to integrate real-world English communication tasks into instructional practices (Benson et al., 2001). This shift underscores pedagogical priorities such as meaningful contextual learning, practical application of teaching knowledge, student-centered approaches, and cultivating learner autonomy and societal interactions. Authentic learning is particularly vital in language education for several reasons. Firstly, it enhances learners' motivation by facilitating active participation and providing real-life materials that offer practical utility (Mishan, 2005). Secondly, it fosters interaction in language learning by exposing learners to authentic communication dynamics and societal norms within the target language environment (Henderson, 2012). Finally, it promotes learner autonomy by eschewing standardized outcomes in favor of personalized learning experiences that cater to diverse contexts and cultural dynamics (Lan, 2013).

2.3 Virtual Reality and Language Education.

Virtual Reality (VR) utilizes 3D imaging technology and computer equipment to simulate real-world objects, people, and environments (Stendal et al., 2011). Unlike traditional learning environments, VR is not constrained by spatial, temporal, or physical limitations, allowing for customizable scenarios tailored to specific educational needs (Stendal et al., 2011). This flexibility enables students to explore diverse environments and cultures across various fields and engage in remote interactions with individuals worldwide. Research on VR in education highlights its numerous advantages, including the provision of realistic and adaptable learning environments, reduced costs and risks associated with education and training, and increased learner motivation through immersive experiences (Eg, Jauregi, et al., 2011; Wehner et al., 2011; Melchor-Couto, 2017; Radianti et al., 2019; Margherita, 2019; Ying et al., 2019). In language education, VR offers authentic communication opportunities and realistic content, which are considered significant benefits (Von der Emde et al., 2001). Scholars have identified several advantages and disadvantages of VR in language teaching. For instance, the study by Mohammed (2019) demonstrated that learning vocabulary through VR is more effective than traditional methods due to increased eye contact, enhanced interest, and flexible learning pacing. This finding aligns with previous research indicating that students in virtual game environments exhibit improved vocabulary and spelling abilities (Anke et al., 2013). Moreover, VR facilitates the visualization of students' learning data, allowing educators to tailor teaching materials and methods based on individual learning strategies (Hsian et al., 2017).

The above literature review encompasses three key domains: anxiety assessment, authentic learning in language education, and virtual reality (VR) in language education. Regarding anxiety assessment, prior studies have underscored the significance of mitigating anxiety in college English instruction, employing various theoretical frameworks and assessment tools such as Horwitz's Foreign Language Classroom Anxiety Scale (FLCAS), the Speaker Anxiety Scale (SA), and the Public Speaking Anxiety Scale (PSAS). However, while these tools offer valuable insights, there remains a need for further exploration, particularly in assessing learner comfort alongside anxiety reduction efforts. Recent trends in authentic language education advocate for contextualized, experiential learning in real-world environments, emphasizing learner motivation, interaction, and autonomy. This shift reflects a pedagogical prioritization of practical application and personalized learning experiences. Finally, in VR and language education, research has highlighted the advantages of VR in providing realistic, immersive learning environments, enhancing learner motivation, and facilitating authentic communication opportunities. Despite these advantages, there remains a gap in understanding the nuanced effects of VR on language learning outcomes, especially in addressing student anxiety and promoting authentic language use within VR environments. Thus, while existing literature offers valuable insights into each domain, the present study aims to contribute by investigating the intersection of these areas, specifically exploring how VR technology can mitigate anxiety and foster authentic language learning experiences in English oral communication contexts.

3. Method

3.1 Participants and Context

The participants in this study consisted of students enrolled in an "English Presentation" course at a Medical University in Taipei, Taiwan. Each class was limited to a small size, with a maximum of 30 students per class, ensuring optimal speaking opportunities. The course, conducted entirely in English, was designed for students with a TOEIC score exceeding 650, indicating a moderate to advanced level of English proficiency or a strong interest in enhancing their English-speaking skills.

3.2 Research Instruments

3.2.1 Anxiety Scale

The pre-and post-tests in this study utilize the EFL Public Speaking Class Anxiety Scale (PSCAS) developed by Yaikhong and Usaha in 2012. This scale comprises 17 items, consisting of 17 items grouped into four factors: Fear of Negative Evaluation and Nervousness, Comfort in Speaking English (scored in reverse), Test Anxiety, and Anticipated Anxious Behaviors. It employs a five-point Likert scale method, where higher scores indicate greater student anxiety levels.

3.2.2 Semi-structured Interviews

During the seventh week of the course, students participate in semi-structured interviews to elucidate the effects of virtual reality on English-speaking anxiety, as well as their experiences and self-reflections during virtual reality immersion.

3.2.3 VR teaching/learning Software

This study's primary virtual reality software is Virtual Speech, developed by a British developer. This software offers a user-friendly virtual reality application designed to enhance speech skills. It was chosen initially for its online interactive training features, presentation upload capability, personal learning progress tracking, and real-time feedback on oral presentations, rendering Virtual Speech a comprehensive platform for language learning.

The virtual reality (VR) tasks or activities employed in the intervention encompass various aspects to provide comprehensive oral communication training. For instance, students may engage in virtual meetings, simulating professional communication within a team setting. They might be tasked with delivering presentations, mirroring scenarios where they present ideas or findings to an audience in academic or business contexts. These presentations may involve using different language styles and techniques, such as formal or informal tones, as well as practical topic discussion and structural arrangements. Additionally, students may participate in simulated job interviews to enhance their oral expression skills in real-world job scenarios. These activities aim to provide authentic communication experiences in a virtual environment while also assisting students in continuously improving their oral expression skills through real-time feedback and progress tracking. Through these virtual reality tasks, students can practice and enhance their speaking abilities in a safe and supportive environment, ultimately helping alleviate anxiety in real-world situations and boosting their confidence.

3.3 Data Collection and Data Analysis

Quantitative and qualitative analyses were employed to assess the effectiveness of the intervention. Quantitatively, SPSS software was utilized to analyze English-speaking anxiety and pre-and post-test results regarding VR exposure. Independent samples t-tests and analysis of variance (ANOVA) were conducted to identify variations in students' levels of English-speaking anxiety. In contrast, regression analysis also explored the predictive effect of virtual reality on anxiety reduction across different dimensions. These quantitative findings inform future interview questions to ensure alignment between student self-assessment and observed behaviors. Qualitatively, the TOEFL iBT Test rubric has already been administered at the beginning and end of the semester to measure student language learning progress. Additionally, the qualitative analysis involved coding interviews and in-class presentation videos, which are ongoing and only partially reported in this study. Later, it can further compare the usefulness of various VR tasks to student speaking ability variations throughout the learning process and then triangulate them with quantitative data.

4. Results

The three research questions mentioned guide the following analysis, allowing for a comprehensive assessment of the impact of the VR communication tasks and the provision of valuable insights into anxiety reduction in the context of English public speaking. As the analysis proceeds, the findings and observations will be presented, addressing each of these questions in turn.

4.1 Recruitment

Data preprocessing involves several steps. Firstly, responses were restricted to students who completed both pre- and post-surveys. Secondly, columns unrelated to the PSCAS survey were excluded. Finally, responses from different terms within the specified school year were aggregated. Following these procedures, the dataset comprised responses from 43 students who fulfilled the criteria of completing both pre- and post-surveys.

4.2 Statistics and Data Analysis

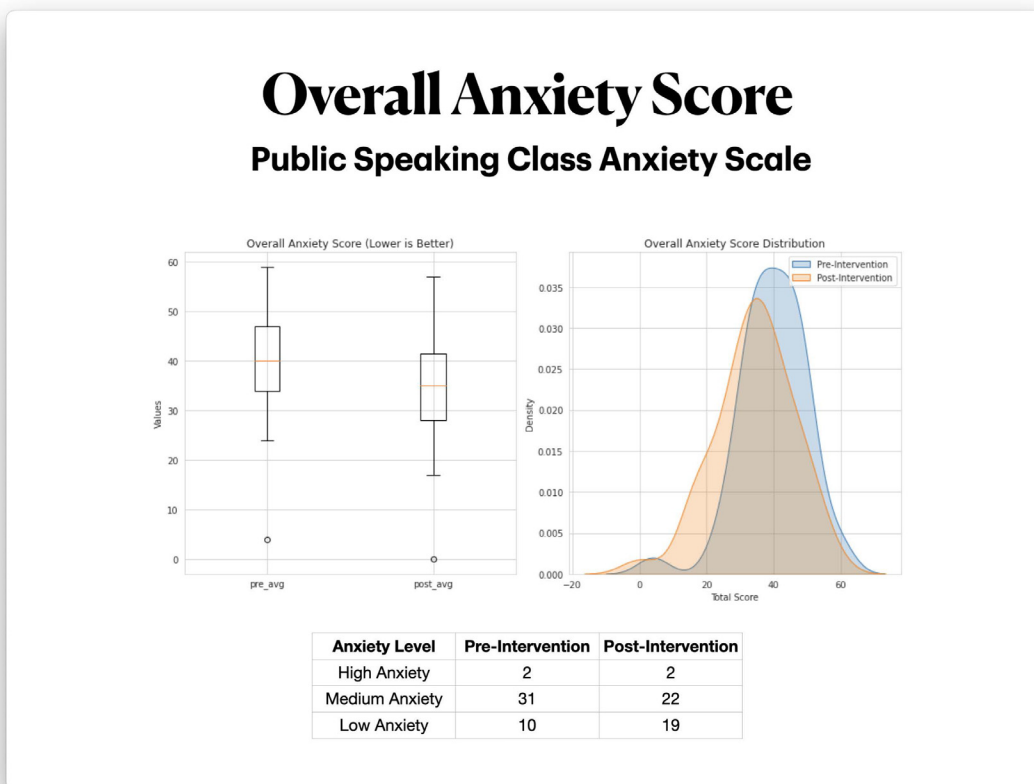


Figure 1. Overall Anxiety Score

Before the intervention, the dataset comprised responses from 43 participants, with a mean score of 39.70 and a standard deviation of 9.94. The minimum score recorded was 4, while the maximum was 59. The first quartile (25%) of scores was 34, with the median (50%) at 40, and the third quartile (75%) at 47. Following the intervention, 43 participants were assessed again, yielding a mean score of 34.16 and a standard deviation of 11.62. The lowest score observed post-intervention was 0, and the highest was 57. Quartile scores post-intervention were 28 for the first quartile, 35 for the median, and 41.50 for the third quartile. The Wilcoxon signed-rank test was employed to evaluate the effectiveness of the VR intervention aimed at reducing anxiety, as measured by the PSCAS Anxiety Score and various factors, including Fear of Negative Evaluation and Nervousness, Comfort in Speaking English (Scored in Reverse), Test Anxiety, and Anticipated Anxious Behaviors (as shown in Figure 1.). The null hypothesis for each test posits that the median difference between paired pre- and post-intervention scores is zero, implying no effect of the intervention.

Table 1. PSCAS Anxiety Score

	Group	N	Mean Rank	Sum of Ranks	p-value
PSCAS Anxiety Score	Negative Rank	32	24.40625	144	0.000201275
	Positive Rank	9	18		
	Ties	2			

The analysis of PSCAS Anxiety Scores (see Table 1.) involved 32 participants showing a decrease in scores post-intervention (Negative Rank), 9 participants with increased scores (Positive Rank), and 2 participants with no change (Ties). The sum of ranks for the hostile ranks was 144, with a mean rank of 24.41, suggesting a predominant decrease in anxiety scores. In contrast, the positive ranks were fewer in number and sum, indicating fewer instances of increased anxiety scores post-intervention. The obtained p-value of 0.000201275, substantially below the conventional alpha level of 0.05, signifies a statistically significant decrease in anxiety scores following the intervention (M = 24.41, SD = 5.63, p < .001).

Table 2. Four Factors of Anxiety

	Group	N	Mean Rank	Sum of Ranks	p-value
Factor 1: Fear of Negative Evaluation and Nervousness	Negative Rank	22	29.3636364	147	0.0098418
	Positive Rank	12	21.25		
	Ties	9			
Factor 2 (Reversed): Comfort in Speaking English (Scored in Reversed)	Negative Rank	27	27.6851852	77.5	0.00045064
	Positive Rank	5	26.5		
	Ties	11			
Factor 3: Test Anxiety	Negative Rank	25	25.64	179	0.04130162
	Positive Rank	9	28.8888889		
	Ties	9			
Factor 4: Anticipated Anxious Behaviors	Negative Rank	26	25.7884615	188.5	0.01343716
	Positive Rank	11	23.1363636		
	Ties	6			

In Table 2., significant reductions were observed in Factor One: Fear of Negative Evaluation and Nervousness, with a p-value of 0.0098418 confirming improvements among 22 participants. The mean rank and sum of ranks indicate a meaningful decrease in related anxieties post-intervention. Factor Two, representing Comfort in Speaking English (Reversed), demonstrated a significant increase in comfort levels ($p = 0.00045064$), underscoring the intervention's efficacy in addressing this anxiety. The analysis reveals a notable shift towards enhanced comfort in speaking English among participants. Factor Three, Test Anxiety, exhibited a statistically significant reduction ($p = 0.04130162$), suggesting the intervention's role in moderately alleviating testing-related pressure and anxiety. Finally, Factor Four, Anticipated Anxious Behaviors, saw a significant decrease ($p = 0.01343716$) post-intervention, indicating improved coping mechanisms.

Overall, the analysis revealed noteworthy trends regarding the impact of the intervention on students' anxiety levels. Specifically, a higher mean negative rank than the mean positive rank across all factors suggests that, on average, the decrease in anxiety scores outweighed any increases. Additionally, the more significant number of hostile ranks compared to positive ranks across all factors indicates that more students experienced an anxiety reduction. The Wilcoxon signed-rank test results further bolstered these findings, affirming the intervention's effectiveness in reducing anxiety levels, both in overall PSCAS Anxiety Scores and across specific anxiety-related factors. This comprehensive examination validates the success of this VR intervention in achieving its anxiety reduction objective. It delineates areas of substantial impact, offering valuable insights for future interventions targeting student anxiety alleviation.

4.3 Interviews

Eighteen students were selected as interviewees due to their notably above-average improvement in pre-and post-test results. The results underscore the students' positive perceptions of virtual reality, alleviating anxiety and enhancing confidence. They highlight the ease with which students can practice oral expression within virtual environments, coupled with the insightful feedback provided, contributing to a strengthened confidence in their English language abilities. Interviewees emphasized confidence, immediate feedback, and realistic presence in VR experiences. VR boosted confidence, provided valuable real-time feedback, and offered an authentic stage-like environment, enhancing language learning. Here are some excerpts:

Student A remarked: Engaging in English oral practice through virtual reality (VR) has significantly bolstered my confidence. Within the virtual environment, I can practice speeches and conversations without external audience pressure, fostering a sense of relaxation and ease. Real-time feedback allows me to better comprehend my strengths and areas for improvement, further enhancing my self-assurance.

Student B shared: Previously, I always felt highly anxious speaking English in public settings. However, through virtual reality experiences, I have begun to perceive an improvement in my oral proficiency. Within the virtual realm, I can simulate diverse scenarios, better preparing myself for communication encounters in real-life situations. It is not like rehearsing in front of the mirror. This newfound readiness has instilled greater confidence in facing challenges associated with English communication.

Student C articulated: Engaging in English oral practice via virtual reality has evoked excitement and positivity within me. Within the virtual domain, I can surmount difficulties that may arise in real-world contexts, thereby bolstering my confidence. Furthermore, receiving timely feedback aids in better understanding my performance and guides improvement. This affirmative experience instills confidence in enhancing my English oral proficiency.

Student D expressed: The VR simulations provided an incredibly realistic stage presence, replicating the feeling of being in front of an audience. This immersive experience allowed me to gain valuable experience in delivering presentations and engaging in conversations, all within a safe and controlled environment. As a result, I felt more confident and prepared when faced with similar situations in real life. The virtual reality platform enhanced my skills and instilled a sense of self-assurance in my abilities.

5. Discussion

This study sought to assess the efficacy of a Virtual Reality (VR) intervention in mitigating diverse forms of anxiety among students, utilizing the PSCAS Anxiety Score and examining its effects on specific anxiety-related factors. The results revealed substantial decreases in anxiety levels following the intervention, offering significant insights into the complex dynamics of anxiety reduction within educational contexts.

5.1 Effectiveness of VR Intervention in Reducing General Anxiety Levels

The first research question directly explores the overarching goal of the intervention, focusing on whether the VR tasks designed to improve English presentation skills also succeeded in reducing students' anxiety levels, as measured by the PSCAS Anxiety Score and various anxiety-related factors. The effectiveness of the VR intervention in alleviating student anxiety levels is unequivocally affirmed. The noteworthy decline in the PSCAS Anxiety Score, evidenced by a p-value of 0.000201275, signifies a significant reduction in overall anxiety levels among participants. This outcome underscores VR's success in fulfilling its primary goal of mitigating anxiety, especially within English presentations. The observed decrease in anxiety scores post-intervention, accompanied by a higher sum and mean rank of hostile ranks, further underscores the intervention's effectiveness.

5.2 Impact on Specific Aspects of Anxiety

Beyond the general effect on anxiety levels, the second research question delves into the nuanced impact of the course on distinct dimensions of anxiety. It investigates whether the VR intervention's effects were broad-based or if they were particularly effective in addressing specific types of anxiety more than others. The intervention had a significant and diverse impact on aspects of anxiety, encompassing fear of negative evaluation, comfort in speaking English, test anxiety, and anticipated anxious behaviors. The observed significant changes across all factors, with p-values ranging from 0.00045064 to 0.04130162, underscore the comprehensive effectiveness of the VR tasks. Particularly noteworthy was the substantial effect observed in 'Comfort in Speaking English (Scored in Reverse),' indicated by a highly significant p-value of 0.00045064. This suggests that VR notably enhanced students' comfort levels with English communication, a crucial aspect for reducing overall communication-related anxiety.

5.3 Differential Impact on Test Anxiety and Comfort in Speaking English

The third research question aims to compare the effectiveness of the intervention across different aspects of anxiety, specifically focusing on test anxiety versus comfort in speaking English. It seeks to understand if the VR's task design was more conducive to alleviating performance-related anxiety or was equally effective in enhancing comfort in communication skills in English. Noteworthy trends emerge after comparing VR's impact on test anxiety versus comfort in speaking English. While both areas exhibited significant improvement, the more pronounced effect on comfort in speaking English implies the efficacy of the course's practical components, likely emphasizing real-life communication scenarios. This differential impact underscores the significance of

tailored interventions targeting specific anxiety triggers, such as fear of real-time communication, which may be addressed more effectively than generalized test anxiety.

5.4 Comparison between Quantitative and Qualitative Data

Utilizing virtual reality (VR) experiences shows substantial promise in alleviating anxiety among non-native English speakers, as evidenced by qualitative interviews and quantitative survey data. Qualitative interviews revealed that VR environments provide a secure and supportive space for learners to engage in English oral expression, fostering confidence through immersive experiences and real-time feedback mechanisms. Additionally, quantitative survey data demonstrated significant improvements in anxiety levels among participants exposed to VR interventions, particularly in enhancing students' comfort level with English communication. The convergence of findings from qualitative and quantitative analyses underscores the potential of VR integration in language education to mitigate anxiety and enhance learners' confidence and proficiency in diverse communicative contexts. These results contribute significantly to the pedagogical discourse within language education, highlighting the efficacy of VR in providing a secure learning environment, real-time feedback mechanisms, and diversified practice scenarios.

6. Conclusion

The examination of anxiety scores both pre- and post-course reveals a notable decline in anxiety levels following the intervention, with the post-intervention distribution displaying a leftward skew indicative of reduced anxiety. Observations indicate the effectiveness of VR communication tasks, particularly in enhancing students' comfort in speaking English. Initial anxiety levels were highest in Fear of Negative Evaluation and Anticipated Anxious Behaviors. At the same time, there was a significant increase in comfort in speaking English and a decrease in test anxiety post-course. However, there remains room for improvement in addressing Fear of Negative Evaluation and Anticipated Anxious Behaviors, which maintained a medium anxiety level post-intervention (see Figure 2.).

Overview

Across the Board Improvements

Category	Pre-Intervention	Post-Intervention	Δ
Factor 1	3.372093	3.055814	0.316279
Factor 2	2.604651	3.005814	0.401163
Factor 3	3.038760	2.821705	0.217054
Factor 4	3.372093	3.069767	0.302326

Anxiety Level	Raw Score Range	Mean Score Range
High	> 68	> 4
Medium	51 - 68	3 - 4
Low	< 51	< 3

- **Communication Anxiety and Anxious Behaviors have the same Highest Anxiety Level to start with (Factor 1 & 4)**
- **Students are more Comfortable to Speak (Factor 2)**
- **Students have less Test Anxiety to start with (Factor 3)**

Figure 2. Overview of the Improvements

Based on the discussion presented, we offer practical recommendations and research directions to reduce student anxiety levels and enhance course effectiveness. Firstly, we suggest designing different VR tasks to address Factor One (Fear of Negative Evaluation) and Factor Four (Anticipated Anxious Behaviors), which still exhibit moderate anxiety levels among students. Secondly, given that Factor Three (Test Anxiety) remains relatively unchanged, we recommend prioritizing efforts to manage students' test-related stress and improve their coping mechanisms. We propose implementing ongoing assessment methods to monitor long-term changes in student anxiety levels beyond the VR intervention. For further research, we suggest exploring additional factors influencing anxiety levels, such as gender, different English background proficiency, distance learning methods, and overall student satisfaction, to tailor interventions more effectively to diverse student groups.

Furthermore, conducting in-depth analyses of individual student data can help identify outliers and trends, enabling more targeted intervention strategies. Finally, analyzing correlations between different anxiety factors can enhance our understanding of the complexity of anxiety issues and provide better guidance for future intervention efforts. These recommendations and research directions aim to assist educators in effectively reducing student anxiety, improving effectiveness while applying VR to language teaching, and enhancing overall learning experiences. In a nutshell, we underscore the importance of adopting a comprehensive approach to VR intervention in anxiety management. We also offer valuable directions for future research to deepen our understanding of anxiety dynamics within EFL public speaking contexts. The results of this study hold significant implications for enhancing students' academic success and well-being.

7. Implication and Limitation

The pedagogical implications discussed emphasize the significance of employing multifaceted virtual reality (VR) interventions to manage anxiety in public speaking contexts in English as a Foreign Language (EFL). Practical recommendations include designing diverse VR tasks targeting specific anxiety factors and prioritizing alleviating test-related stress to reduce student anxiety levels and effectively enhance course effectiveness. Additionally, in curriculum design and teaching material planning, the integration of VR technology into classrooms should be customized while considering learning effectiveness mechanisms and assessment rubrics (develop differentiated VR teaching tasks based on students' CEFR level). This integration provides rich practical exercises and feedback mechanisms to enhance students' learning experiences and skill development. However, research limitations encompass differences in self-esteem among culturally diverse and high-achieving students, which may affect their acceptance and effectiveness of VR interventions. Hence, further research is warranted to tailor teaching strategies and intervention measures to meet the needs of students from diverse cultural backgrounds and academic achievement levels and to explore the influence of cultural factors on the effectiveness of VR interventions.

Acknowledgments

I want to express our sincere gratitude to the Taipei Medical University Grants (Award No. 106-6801-003-112) and the Ministry of Education, Republic of China (Award No. 110-6801-001-400) for their generous support and provision of research funding for this project. Their contributions have been instrumental in the successful completion of this study.

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>
- Alfadil, M. (2020). Effectiveness of virtual reality game in foreign language vocabulary acquisition. *Computers & Education*, 153, 103893. <https://doi.org/10.1016/j.compedu.2020.103893>
- Andrade, M., & Williams, K. (2009). Foreign language learning anxiety in Japanese EFL university classes: Physical, emotional, expressive, and verbal reactions. *Sophia junior college faculty journal*, 29(1), 1-24.
- Bailey, P., Onwuegbuzie, A. J., & Daley, C. E. (2000). Correlates of anxiety at three stages of the foreign language learning process. *Journal of language and social psychology*, 19(4), 474-490. <https://doi.org/10.1177/0261927X00019004005>
- Benson, P. (2013). *Teaching and researching: Autonomy in language learning*. Routledge. <https://doi.org/10.4324/9781315833767>
- Berns, A., Gonzalez-Pardo, A., & Camacho, D. (2013). Game-like language learning in 3-D virtual environments. *Computers & Education*, 60(1), 210-220. <https://doi.org/10.1016/j.compedu.2012.07.001>

- Berti, M. (2019). Italian open education: virtual reality immersions for the language classroom. *New case studies of openness in and beyond the language classroom*, 37-47. <https://doi.org/10.14705/rpnet.2019.37.965>
- Brown, H. D. (1973). Affective variables in second language acquisition. *Language learning*, 23(2), 231-244. <https://doi.org/10.1111/j.1467-1770.1973.tb00658.x>
- Chen, C.-M. (2010). *Empowering English for Taiwan*. Taipei: Linking.
- Cheng, Y.-S. (1999). The Essence of Second Language Classroom Anxiety. *English Language Teaching*, 23(4), 1-15.
- Clevenger, T., & Halvorson, S. K. (1992). Converting the PRCA-State version 2 to the speech anxiety scale. Tallahassee, The Florida State University.
- Henderson, M., Huang, H., Grant, S., & Henderson, L. (2012). The impact of Chinese language lessons in a virtual world on university students' self-efficacy beliefs. *Australasian Journal of Educational Technology*, 28(3). <https://doi.org/10.14742/ajet.842>
- Horwitz, E. (2012). Language anxiety and achievement. *Annual review of applied linguistics*, 21, 112-126. <https://doi.org/10.1017/S0267190501000071>
- 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>
- Jauregi, K., Canto, S., De Graaff, R., Koenraad, T., & Moonen, M. (2011). Verbal interaction in Second Life: Towards a pedagogic framework for task design. *Computer Assisted Language Learning*, 24(1), 77-101. <https://doi.org/10.1080/09588221.2010.538699>
- Kim, J. H. (2000). *Foreign language listening anxiety: A study of Korean students learning English*. The University of Texas at Austin.
- Lan, Y. J., Chen, N. S., Li, P., & Grant, S. (2015). Embodied cognition and language learning in virtual environments. *Educational Technology Research and Development*, 63, 639-644. <https://doi.org/10.1007/s11423-015-9401-x>
- Lan, Y. J., Fang, S. Y., Legault, J., & Li, P. (2015). Second language acquisition of Mandarin Chinese vocabulary: Context of learning effects. *Educational Technology Research and Development*, 63, 671-690. <https://doi.org/10.1007/s11423-015-9380-y>
- Legault, J., Zhao, J., Chi, Y. A., Chen, W., Klippel, A., & Li, P. (2019). Immersive virtual reality as an effective tool for second language vocabulary learning. *Languages*, 4(1), 13. <https://doi.org/10.3390/languages4010013>
- MacIntyre, P. D., & Gardner, R. C. (1991). Language anxiety relates to other anxieties and to processing in native and second languages. *Language Learning*, 41(4), 513-534. <https://doi.org/10.1111/j.1467-1770.1991.tb00691.x>
- Melchor-Couto, S. (2017). Foreign language anxiety levels in Second Life oral interaction. *ReCALL*, 29(1), 99-119. <https://doi.org/10.1017/S0958344016000185>
- Mishan, F. (2005). *Designing authenticity into language learning materials*. Intellect Books.
- Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, 147, 103778. <https://doi.org/10.1016/j.compedu.2019.103778>
- Stendal, K., Molka-Danielsen, J., Munkvold, B. E., & Balandin, S. (2011). Initial experience with virtual worlds for people with lifelong disability: Preliminary findings. NOKOBIT 2011: Proceedings of the 2011 Norsk konferanse for organisasjoner bruk av informasjonsteknologi, 105-118. <http://hdl.handle.net/10536/DRO/DU:30062167>
- Tobias, S. (1986). Anxiety and cognitive processing of instruction. In S. Tobias (Ed.), *Self-related cognitions in anxiety and motivation*, 45-64. Psychology Press. <https://doi.org/10.4324/9780203781609>
- Von der Emde, S., Schneider, J., & Kötter, M. (2001). Technically speaking: Transforming language learning through virtual learning environments (MOOs). *The Modern Language Journal*, 85(2), 210-225. <https://doi.org/10.1111/0026-7902.00105>

- Wehner, A. K., Gump, A. W., & Downey, S. (2011). The effects of Second Life on the motivation of undergraduate students learning a foreign language. *Computer Assisted Language Learning*, 24(3), 277-289. <https://doi.org/10.1080/09588221.2010.551757>
- 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., Ryder, L., & Chen, Y. (2019). Using interactive virtual reality tools in an advanced Chinese language class: A case study. *TechTrends*, 63, 251-259. <https://doi.org/10.1007/s11528-019-00389-z>
- Yaikhong, K., & Usaha, S. (2012). A Measure of EFL Public Speaking Class Anxiety: Scale Development and Preliminary Validation and Reliability. *English Language Teaching*, 5(12), 23-35. <http://dx.doi.org/10.5539/elt.v5n12p23>

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).