Effectiveness of VR Technology Integrated with Flipped Classroom Teaching Model for College Students' Psychological Health Education

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Abstract

Although both virtual reality (VR) technology and the flipped classroom teaching model have shown individual promise in educational settings, there is limited empirical research evaluating their combined effectiveness for enhancing college students' psychological health education. This is especially important as depression and anxiety are increasingly prevalent among Chinese college students. To fill this gap, this study aimed to investigate the effectiveness of VR technology integrated with the flipped classroom teaching model on reducing students' depression and anxiety levels and enhancing student learning achievement. The researcher used a two-group pretest and posttest experimental design to conduct the experiment, while Zung's self-rating depression and anxiety scales were used to test participants' depression and anxiety levels, and learning achievement was tested by the standardized test of psychological health education in Anhui University of Science and Technology. The screening sampling method has been used in the participant selection process to select those who were on a mild depression and anxiety level. 80 participants from Anhui University of Science and Technology were involved in a 10-week experiment. MANOVA has been used to analyze the obtained data. The research findings showed all of the P-values <0.001, indicating that there was a positive influence of VR technology integrated with the flipped classroom teaching model on student depression status, anxiety status, and learning achievement. This study suggested that adopting VR-enhanced flipped classroom practices in psychological health education holds promise for improving both student mental health and academic outcomes, with important implications for curriculum development and educational policy in higher education settings.

Keywords: VR technology, flipped classroom, depression level, anxiety level, learning achievement, psychological health education

1. Introduction

The rapid evolution of educational technology has opened new avenues for enhancing teaching and learning, particularly in the realm of psychological health education. University students in China face mounting academic pressures, social challenges, and mental health concerns, with recent studies highlighting a concerning prevalence of depression and anxiety within this population (Li et al., 2022; Zhang et al., 2022). Traditional passive learning environments often fail to address students' psychological well-being or equip them with practical coping strategies, leaving many at risk for poor academic performance and worsening mental health (Yao et al., 2025). The stigma attached to mental health issues in Chinese culture further reduces students' willingness to seek help, highlighting the need for innovative, engaging interventions within educational settings. (Ye & Ye, 2023). Virtual Reality (VR) holds significant promise as an immersive, interactive tool capable of simulating real-life scenarios, fostering empathy, and providing a safe space for students to explore sensitive mental health content (Zheng et al.,2024). Additionally, the flipped classroom teaching model, where foundational learning occurs outside class, enabling in-class time to focus on problem-solving and discussion, has demonstrated effectiveness in promoting active engagement and deeper understanding, especially in health-related disciplines (Cheng & Chao, 2023). Although both VR and flipped classrooms have independently shown benefits for student motivation, emotional regulation, and academic performance, few studies have examined the combined impact of these approaches in psychological health courses, particularly within the Chinese higher education context.

Given the growing mental health needs of university students and the increasing adoption of innovative instructional models, it is both timely and essential to investigate whether integrating VR technology with the flipped classroom model can produce meaningful improvements in students' psychological well-being and academic success. This research aims to fill this critical gap by experimentally evaluating the effectiveness of a VR Technology Integrated with a flipped classroom teaching model in reducing depression and anxiety levels and enhancing learning achievement among students enrolled in psychological health courses in Chinese higher education institutes.

2. Research objectives

What is the effectiveness of VR technology with the flipped classroom model on reducing students' depression status and anxiety status, and enhancing students learning achievement in psychological health courses in Chinese higher education institutes?

3. Literature review

3.1 The Current College Students' Depression and Anxiety Problems

Depression and anxiety are among the most prevalent psychological health concerns affecting college students worldwide. Research has repeatedly shown that university students are at a heightened risk for mental health issues compared to the general population (Cuijpers et al.,2021). In China, the situation has become particularly acute in recent years, with studies reporting that approximately 30% of Chinese college students suffer from symptoms of depression, and more than 20% experience significant anxiety (Li et al., 2022; Wen et al., 2022). These high rates are attributed to factors such as academic pressures, fierce competition for employment, familial expectations, challenges of social adaptation, and disruptions from external crises such as the COVID-19 pandemic (Zhan et al., 2021). The consequences of depression and anxiety at this stage of life are profound, affecting students' academic performance, motivation, relationships, and even retention rates (Liu et al., 2022). Depressed students are more likely to display poor academic engagement, diminished concentration, and a general sense of hopelessness that undermines their learning achievement (Mao et al., 2019). Anxiety, in turn, is closely associated with test apprehension and avoidance behaviors, which further jeopardize students' educational outcomes and psychosocial development (Gao, Ping, & Liu, 2020).

Traditional teaching models, which typically emphasize passive learning, memorization, and limited interpersonal interaction, have been criticized for failing to address students' emotional needs and foster essential life skills such as self-regulation and resilience (Jiao, 2025). In the Chinese context, stigma surrounding mental health adds another layer of complexity, as students may be reluctant to seek psychological support, thus leaving many cases underdiagnosed and untreated (Song et al., 2021). Given the magnitude and impact of these problems, there is an urgent need for educational institutions to adopt proactive, innovative interventions that go beyond conventional pedagogies.

3.2 VR Technology and Flipped Classroom

Virtual Reality (VR) technology has emerged as a promising tool in psychological education for supporting students dealing with depression and anxiety. Through immersive, interactive simulations, VR can recreate stress-inducing or emotionally challenging scenarios, such as high-altitude settings, crowded social contexts, or trauma-related situations, in a safe, controlled environment. This allows students to practice coping strategies, mindfulness, and emotional regulation techniques under realistic but manageable conditions (Lege & Bonner, 2020). For example, VR modules may simulate social situations that provoke anxiety, enabling students to rehearse relaxation or exposure techniques with immediate feedback. These practical experiences not only help users gain confidence in their ability to manage symptoms but also destigmatize psychological challenges, as students realize others share similar experiences (Wang, Zhu, & Lin, 2022). In China, the integration of VR in university counseling and psychology courses has shown potential in reducing depressive symptoms and enhancing student engagement with mental health content (Zeng & He, 2021). However, due to the high cost associated with VR technology, students typically access these immersive tools only during scheduled class sessions under the supervision and guidance of their instructors. This classroom-based use ensures that the institution's limited VR resources are managed effectively while also maximizing student learning and safety (Drakatos et al., 2023).

The flipped classroom model, which encourages students to study foundational materials at home and engage in active, collaborative application during class, has also gained traction in Chinese higher education. When combined with VR, this model allows students to access interactive simulations, organizing discussion, analysis, and skills

practice based on those experiences, which could further amplify the effectiveness of VR interventions (Khodabandeh & Mombini, 2024). There were three sessions in the flipped approach: 1) Before class: students are introduced to theoretical materials such as video lectures on cognitive-behavioral strategies or mental health literacy during the session before class (Tunggyshbay, Balta, & Admiraal, 2023). 2) In class, Teachers play a crucial role not only by facilitating meaningful engagement with the virtual scenarios but also by providing immediate support as students navigate potentially challenging psychological content. With the integration of VR experiences in this session, the direct in-class interaction with VR technology allows students to benefit from both hands-on experience and professional guidance, while minimizing logistical and financial barriers commonly associated with individual at-home access (Dai & Kang, 2025). Furthermore, students then engage in active, collaborative applications during classroom sessions, often using VR simulations to practice and reinforce what they've learned (Guo, 2022). 3) After class, the students are required to reflect on what they have learned in the class, and review what they are going to learning for next class with the given learning materials. This learner-centered model fosters more time for group discussion, peer support, and teacher facilitation of coping skill development. Research indicates that students participating in these integrated VR and flipped classroom interventions demonstrate improved self-awareness, decreased anxiety and depressive symptoms, and greater willingness to seek help (Cheng & Chao, 2023). Additionally, these methods help students build social support networks, as sharing experiences and solutions reduces isolation, which is a key risk factor for mental health issues among university students in China.

In summary, integrating Virtual Reality (VR) into flipped classroom models presents a promising approach for improving the effectiveness of psychological health education. By moving foundational content delivery outside the classroom, the flipped model creates space for meaningful discussions and collaborative problem-solving, thus enhancing student engagement and peer support. The addition of VR's immersive and interactive features allows students to safely navigate realistic psychological scenarios, practice coping and stress management skills, and build self-awareness in a supportive, low risk setting. This innovative combination not only alleviates symptoms of depression and anxiety but also boosts students' learning achievement in psychological health classes.

4. Research Methods

4.1 Participants

The two-group pretest and posttest experimental design has been used to conduct the experiment at Anhui University of Science and Technology in China. The researcher first used the screening sampling method to screen out students with mild depression and anxiety by the university's routine of organizing and Screening Work for Students' Mental Health Status with Zung's Self-Rating depression and anxiety questionnaires. For the students who identified with mild depression and anxiety, the university organizes a psychological course for them to reduce their depression and anxiety. As to those students who identified as having moderate or severe levels, the university recommends that they seek professional psychological counseling. the participants of the experiment in this study are 80 first-year students who were identified as having mild depression and anxiety levels in the screening depression and anxiety work of 2024. These 80 students have been divided into two groups; the simple random sampling method was used to select 40 students for the control group, and the remaining 40 were assigned to the experimental group.

4.2 Research Tools

4.2.1 VR Psychological Health Practice System

VR psychological health practice system, which has been offered by Anhui University of Science and Technology, in the consideration of their students 'psychological health. This VR Psychological Health Practice System utilizes advanced VR technology combining state-of-the-art 6DOF virtual reality headsets and dual controllers offering haptic feedback up to 250 Hz and integrated spatial audio to create immersive environments that realistically simulate specific situations such as high altitudes, social occasions, or traumatic scenes, These virtual scenarios engage students ' senses of vision, hearing, and touch, allowing students to safely experience environments that might trigger anxiety or fear. In addition, the therapist can adjust stressor intensity in real time via a dedicated console while monitoring physiological responses (e.g., heart rate, electrodermal activity), with scenario progression regulated by objective markers such as heart rate variability to gradually reduce anxiety and depression. Students retain full control, with the ability to pause or exit any scenario, avoiding real-world risks or embarrassment. This heightened sense of presence increases attention and engagement, enabling effective learning and interaction with virtual objects and scenarios tailored to diverse psychological needs. Compared with traditional therapy, the flexibility, safety, and realism of VR can offer efficient, immersive solutions for stress reduction, emotion management, and cognitive improvement. The example was of interfaces and functions, which were shown as

follows: Figure 1, Figure 2, and Figure 3:

Figure 1. Functions Interface

Figure 2. Venting for Releasing: Boxing

Figure 3. Emotional Release: Fishing for Relaxing

4.2.2 VR Technology Integrated with Flipped Classroom Teaching Model

The course was organized into three main phases: pre-class, in-class, and post-class sessions, followed by an evaluation component. The pre-class session was delivered online via the Rain Classroom platform, where instructors posted assignments, announced groupings, and delegated responsibilities. During this phase, students were expected to participate in online discussions, identify psychological topics of interest, and collaboratively refine their topic lists under the supervision of group leaders. Teachers collected these issues to be addressed during the

in-class session, either through direct explanation or by facilitating peer discussion. All relevant resources, including manuals, group listings, and reading materials, were made available on the platform, while unresolved issues were communicated to the instructor for in-class resolution.

The in-class session, conducted offline and lasting 45 minutes, commenced with a 5-minute review of assigned readings using Rain Classroom to reinforce students' understanding. This was followed by a 25-minute lecture in which the instructor covered key concepts, addressed questions from the pre-class session, and discussed psychological issues submitted by the students. The final 15 minutes were dedicated to experiential learning, utilizing VR equipment to simulate psychological scenarios, thereby enabling students to experience and express emotions in a controlled environment.

Following the in-class session, the teacher initiated an online discussion on Rain Classroom focused on students' VR experiences, encouraging reflection, peer exchange, and the formulation of additional questions, while also reminding students about impending homework deadlines. In the evaluation phase, the instructor assessed students' anxiety, depression, and learning achievement using standardized tests to determine the effectiveness of the instructional model. The structure of this model is depicted in Figure 4.
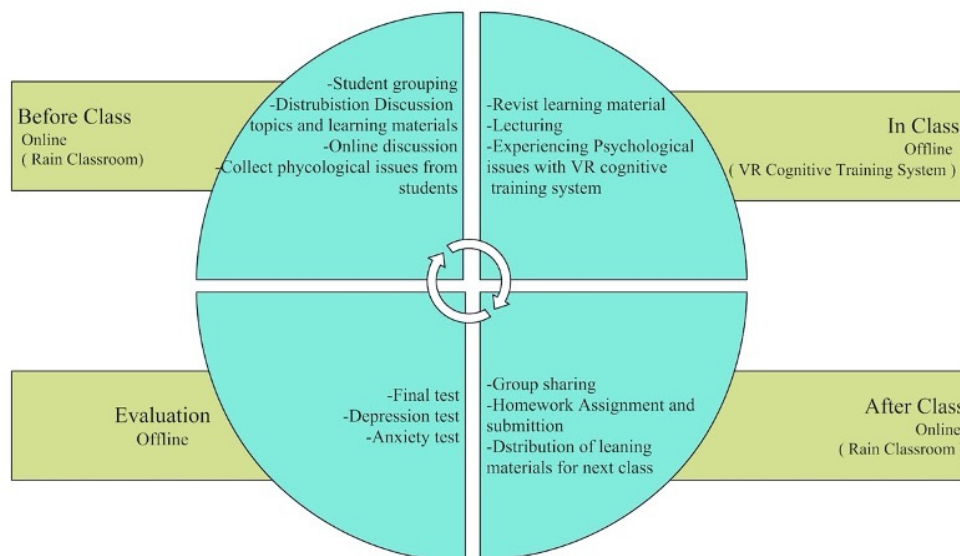

Figure 4. VR Technology Integrated with Flipped Classroom Teaching Model *(Wu, Sitthiworachart,& Ratanaolarn, 2025)*

4.2.3 Zung Self-Rating Depression Scale

The Zung Self-Rating Depression Scale (SDS), developed by Zung(1965), is a widely used self-administered questionnaire designed to assess the level of depressive symptoms in individuals. The SDS is valued for its simplicity, ease of use, and applicability in both clinical and research contexts. Comprising 20 items that address affective, psychological, and somatic aspects of depression, each item is rated on a 4-point scale reflecting frequency of symptoms. The total raw score ranges from 20 to 80. The resulting raw score is then multiplied by 1.25 to yield an index score ranging from 25 to 100. This index score is subsequently interpreted to assess the severity of depressive symptoms. The interpretation criteria were: < 50: Normal range. 50-59: Mild depression. 60-69: Moderate depression. ≥ 70: Severe depression. With higher scores indicating greater severity of depression (Chen et al., 2021).

4.2.4 Zung Self-Rating Anxiety Scale

The Zung Self-Rating Anxiety Scale (SAS), developed by Zung(1971), is a widely used self-administered instrument designed to assess the severity of anxiety symptoms in individuals. The scale consists of 20 items that evaluate both psychological and somatic symptoms of anxiety, such as nervousness, trembling, and feelings of fear. Each item is rated on a 4-point Likert scale based on the frequency of symptoms experienced, ranging from "a little of the time" to "most of the time." The resulting raw score is then multiplied by 1.25 to yield an index score ranging from 25 to 100. This index score is subsequently interpreted to assess the severity of anxiety symptoms. The interpretation

criteria were: < 50: Normal range. 50-59: Mild depression. 60-69: Moderate depression. ≥ 70: Severe depression. With higher scores indicating greater severity of anxiety (Dunstan & Scott, 2020).

4.2.5 Final Test Paper for Learning Achievement

the standardized test of psychological education towards Chinese college students in Anhui University of Science and Technology has been adopted to measure the achievements of the course of psychological education in the experiments. There are 26 tested items, 100 score in total, including 10 multiple choices items (2 score per item, 20 score in total), 10 true or false items (2 score per item, 20 score in total, 5 short-answer items (5 score per item, 20 score in total), and 1 essay items (40 score per item, 40 score in total). Furthermore, the rubric score has also been designed for the researcher to better understand the level of students' achievements. the rubric score is as followed: 90-100; Excellent; 80-89 good; 60-79; qualified;0-59 unqualified.

4.3 Data Collection

o find the effectiveness of the new teaching model on students' achievement, and depression and anxiety status. A 10-week experiment has been conducted at Anhui University of Science and Technology. Firstly, the first-year students in Anhui University of Science and Technology needed to participate in the screening for depression and anxiety work in 2024. Students who identified with mild depression and anxiety levels according to the Zung self-Rating depression and anxiety scale have been voluntarily invited into the experiments. Secondly, the voluntary participants have also been invited to attend the pretest of psychological knowledge to find their psychological foundation. the duration of each course is 45 minutes, one week per time, 8 times in total. Lastly, the students were invited to take the posttests of the Zung Self-Rating Depression Scale and the Zung Self-Rating Anxiety Scale, and the final test of the course. The experimental process is shown in Figure 5, and the students who participated in the activities in the experiment are shown in Figure 6.
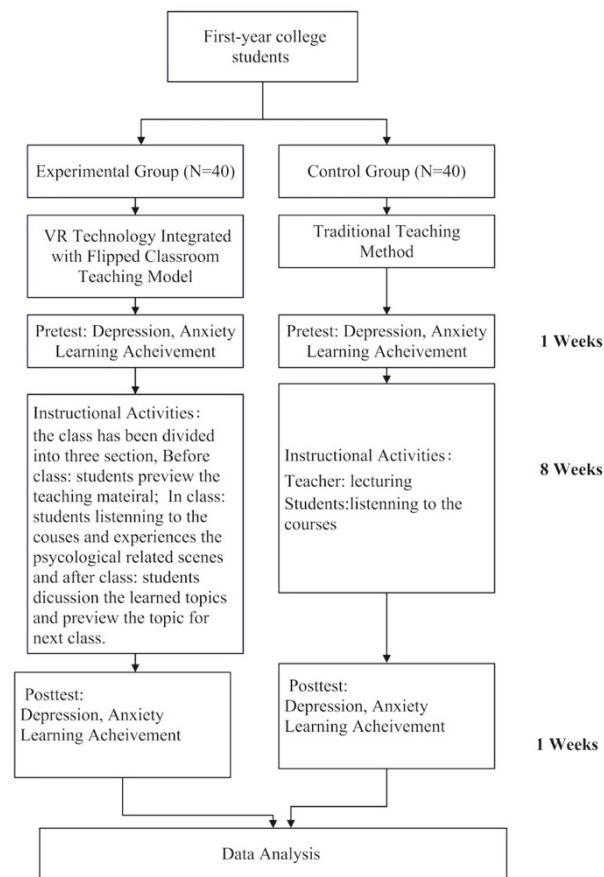

Figure 5. Experiment Process

Figure 6. Example Photos in Experiment

4.4 Data Analysis

This study aimed to compare the impact of the VR Technology Integrated with the Flipped Classroom Teaching Model on students' levels of depression, anxiety, and learning achievement between an experimental group and a control group. To ensure that both groups had similar starting points, the researcher initially used an independent-samples t-test to analyze the pretest scores for the three variables, verifying that there were no significant baseline differences in knowledge. Following the intervention, we employed multivariate analysis of variance (MANOVA) to examine posttest outcomes for depression, anxiety, and learning achievement in both groups. Utilizing MANOVA enabled a comprehensive assessment of the effectiveness of the VR-Integrated flipped classroom model relative to traditional teaching methods, as it accounted for all outcome measures.

5. Results

5.1 Result of Pre-test

Table 1 displays the results of the normality test conducted on the pre-test data for Students' depression status (DS), anxiety status (AS), and learning achievement (LA) in the psychological health course, comparing both the experimental group (EG) and control group (CG). The Shapiro-Wilk test revealed that the p-values for the experimental group ranged from 0.064 to 0.263, while those for the control group ranged from 0.066 to 0.235. All p-values exceeded the threshold of 0.05 (P > 0.05), indicating that the pretest data for Students' depression status, anxiety status, and learning achievement in both groups adhered to a normal distribution. These results imply that the assumptions of normality were met, thereby permitting further parametric analyses with confidence.

Table 1 also illustrates the descriptive statistics for the pre-test data on DS, AS, and LA for both the experimental group (EG) and the control group (CG). The findings indicate that each group comprised 40 students, the means of DS and AS scores for the experimental group were respectively 55.09 and 55.34, while the control group had a mean of DS and AS scores of 55.38 and 55.43. These four means were greater than the 50, which have been considered as mild depression levels and anxiety levels. It suggests that both groups have significant potential for improvement in SD and AS, given that the normal level score is lower than 50. Additionally, the results reveal that the DS, AS, and LA of the control group were only marginally superior to those of the experimental group. As to LA, 63.05 for EG, 63.25 for CG, it indicated that the knowledge of students in psychological health is insufficient due to the total score of the LA being 100.

Table 1. Normality Test of Pre-Test

Variables	Group	Shapiro-Wilk			Descriptive statistics		
		Statistic	df	P	N	Means	SD
DS	EG	0.955	40	0.115	40	55.09	2.088
	CG	0.948	40	0.066	40	55.38	1.882
AS	EG	0.948	40	0.064	40	55.34	2.136
	CG	0.952	40	0.088	40	55.43	2.147
LA	EG	0.966	40	0.263	40	63.05	3.595
	CG	0.964	40	0.235	40	63.25	3.410

The Table 2 presents the results of the independent sample T-test conducted on the pre-test data for DS, AS, and LA. Levene's test indicated that the pre-test scores for DS, AS, and LA exhibited equal variances between the groups, thereby satisfying the assumption of homogeneity of variance (P = 0.573,0.910,0.616 > 0.05). The T-test results revealed p-values of 0.264, 0.423, and 0.400, all of which are greater than 0.05. Hence, there was no significant difference in DS, AS, and LA between the experimental group and the control group. These findings suggest that the students in both groups were at comparable levels of DS, AS, and LA.

Table 2. Independent Sample T Test of Pre-Test

Variables	Levene's test for equality of Variance			T-test for Equality Mean		
		F	Sig	t	df	P
DS	Equal Variances assumed	0.321	0.573	-0.633	78	0.264
AS		0.013	0.910	-0.196	78	0.423
LA		0.253	0.616	0.255	78	0.400

5.2 Result of Post-test

Table 3 displays the results of the normality test conducted on the post-test data for Students' depression status (DS), anxiety status (AS), and learning achievement (LA) in the psychological health course, comparing both the experimental group (EG) and control group (CG). The Shapiro-Wilk test revealed that the p-values for the experimental group ranged from 0.178 to 0.224, while those for the control group ranged from 0.087 to 0.204. All p-values exceeded the threshold of 0.05 (P > 0.05), indicating that the pretest data for Students' depression status, anxiety status, and learning achievement in both groups adhered to a normal distribution. These results imply that the assumptions of normality were met, thereby permitting further parametric analyses with confidence.

Table 3. Normality Test of Post-Test

Variable	Group	Shapiro-Wilk		
		Statistic	df	P
DS	CG	0.952	40	0.087
	EG	0.962	40	0.192
AS	CG	0.954	40	0.105
	EG	0.964	40	0.224
LA	CG	0.963	40	0.204
	EG	0.961	40	0.178

Table 4 presents the results of the factor analysis conducted on the posttest scores for Students' depression status (DS), anxiety status (AS), and learning achievement (LA). The outcome of Box's test of equality of covariance matrices revealed that there was no significant difference between the groups' covariance matrices. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy yields a value of 0.675, suggesting adequate sampling.

Table 4. Results of the Assumption Test of MANOVA on Post-Test

Variable	Box's Test of Equality of Covariance				
DS, AS & LA	**Box's M**	**F**	**df 1**	**df 2**	**P**
	4.185	0.668	6	44080.302	0.675

Table 5 presents the results of the multivariate analysis conducted on the posttest scores for Students' depression status (DS), anxiety status (AS), and learning achievement (LA). The multivariate tests demonstrated that the group factor had a significant effect on DS, AS, and LA, indicating notable differences in the posttest scores between the two groups. These results suggest that differences in instructional methods or interventions may have contributed to the observed variations in Students' depression status, anxiety status, and learning achievement.

Table 5. Results of Multivariate Test on Post-Test

	Effect	Value	F	P
Group	Pillai's Trace	0.922	298.718[b]	<.001
	Wilks' Lambda	0.078	298.718[b]	<.001
	Hotelling's Trace	11.791	298.718[b]	<.001
	Roy's Largest Root	11/791	298.718[b]	<.001

Table 6 summarizes the results of the MANOVA conducted on the post-test scores for Students' depression status (DS), anxiety status (AS), and learning achievement (LA). The analysis revealed significant differences between the two student groups. For DS, the experimental group (EG) achieved a mean score of 35.69 (SD = 2.37), while the control group (CG) attained a mean of 45.38 (SD = 2.05). Levene's test supported the assumption of homogeneity of variances across groups (W =0.759, P=0.386 > .005), and the ANOVA demonstrated a significant effect of group on DS (F = 383.535, P<0.001), with the experimental group outperforming the control group. These results suggest that the implementation of VR Technology Integrated with Flipped Classroom Teaching Model had a substantial positive effect on Students' depression status (DS).

Similar findings emerged for AS. The experimental group reported a mean AS score of 36.44 (SD = 2.49), compared to 45.28 (SD = 1.97) in the control group. Levene's test supported the assumption of homogeneity of variances across groups (W = 2.609, P = 0.110>0.05). ANOVA results indicated a significant effect of the intervention on AS (F = 309.776, P < 0.001), with the experimental group achieving significantly lower AS scores than the control group. These findings underscore the positive influence of VR Technology Integrated with the Flipped Classroom Teaching Model on students ' anxiety status.

Lastly, in LA, the experimental group reported a mean LA score of 91.75 (SD = 4.45), compared to 81.30 (SD = 3.31) in the control group. Levene's test supported the assumption of homogeneity of variances across groups (W =0.030, P = 0.863>0.05). ANOVA results indicated a significant effect of the intervention on LA (F = 190.576, P < 0.001), with the experimental group achieving significantly higher LA scores than the control group. Collectively, these findings underscore the positive influence of VR Technology Integrated with the Flipped Classroom Teaching Model on Student learning achievement.

Table 6. Results of the MANOVA on Posttest

Descriptive statistics					Levene's Test		ANOVA					Result
DV	G	n	X	SD	W	P	SS	MS	F	df	P	
DS	CG	40	45.38	2.05	0.759	0.386	1876.953	1876.953	383.535	1	<.001	EG<CG
	EG	40	35.69	2.37								
AS	CG	40	45.28	1.97	2.609	0.110	1564.238	1564.238	309.776	1	<.001	EG<CG
	EG	40	36.44	2.49								
LA	CG	40	81.30	3.31	0.030	0.863	2184.050	2184.050	190.576	1	<.001	EG>CG
	EG	40	91.75	4.45								

6. Discussion

The positive outcomes observed in this study, notably the significant reduction in depression and anxiety levels through The positive outcomes observed in this study, notably the significant reduction in depression and anxiety levels through the VR Technology Integrated with Flipped Classroom Teaching Model, support the view that technology-enabled active learning environments can promote student psychological well-being. Multiple studies highlight the therapeutic potential of VR in mental health contexts. For example, Wong et al. (2022) demonstrated that VR-based interventions can effectively reduce symptoms of anxiety and depression, thanks to their immersive nature and the ability to safely simulate real-world experiences. Furthermore, in blended learning environments, VR engagement has been shown to enhance emotional regulation and foster empathy, leading to improvements in overall affective states (Baghaei et al.,2021). This synergy between digital immersion and student-centered pedagogies echoes findings from Khodabandeh & Mombini (2024), who reported that the psychological support offered by interactive technologies can buffer against academic stressors.

Complementing these mental health benefits, the flipped classroom model's positive impact on learning achievement

has been widely documented. Its structure, which shifts information delivery outside the classroom and devotes in-class time to active problem-solving, has repeatedly been shown to enhance students' academic performance and engagement (Guo, 2022). In health professions education, Del Brío-Alonso et al. (2023) observed that students in flipped classes showed greater improvements in knowledge retention and practical skills than those in traditional lectures. Integrating VR amplifies these effects, as seen in the studies by Tunggyshbay, Balta & Admiraal (2023), which found that students benefit from repeated, self-paced practice and highly visualized content, both critical factors in complex subject areas like psychological health.

Moreover, the cultural context of Chinese higher education is relevant. In China, a growing body of research documents the challenges university students face in their mental health and academic achievement (Li et al., 2022). Innovative teaching models like the one researched here are especially pertinent, as they align with university-level priorities for improving both cognitive and emotional outcomes (Song et al., 2021). This aligns with Cheng and Chao's (2023) advocacy, suggesting that incorporating technology into the curriculum can help reduce the stigma associated with seeking mental health support. Utilizing VR and flipped learning models enables individuals to privately and stigma-free explore psychological concepts and coping strategies. The consistency of these research findings with both domestic and international research reinforces the validity of the VR Technology Integrated with Flipped Classroom Teaching Model and suggests its scalability for broader adoption.

7. Limitations

This study has several limitations, Firstly, it was conducted at a single university with a relatively small sample size, which may limit the generalizability of the results; Secondly, the reliance on self-reported measures for depression and anxiety might cause the possibility of response bias; Thirdly, the intervention period was relatively short, so the long-term effects still remained unclear; the participants were all students with mild depression and anxiety, which may not reflect the experiences of those normal students; and external factors influencing psychological health and academic performance were not controlled. Fourth, each VR session in the class only lasts for 15 minutes, which may reduce the overall effectiveness of the VR experience in positively influencing students' psychological health, as shorter exposure durations may constrain student engagement and potential positive outcomes.

8. Implication

The findings of this study indicated that integrating VR technology with the flipped classroom teaching model can effectively reduce depression and anxiety levels while enhancing learning achievement among college students. These results suggest that adopting such innovative approaches in psychological health education could offer valuable benefits for student well-being and academic success. Consequently, educational institutions and policymakers should consider incorporating VR-enhanced, interactive teaching methods into mental health curricula to create more engaging and supportive learning environments. Additionally, this approach may serve as a model for other universities and educators aiming to address the growing mental health challenges faced by college students, ultimately contributing to improved overall educational outcomes and student quality of life.

9. Conclusion

This study conducted an experiment with two groups to investigate the effectiveness of a VR Technology Integrated with Flipped Classroom Teaching Model for psychological health courses in Chinese higher education. The results revealed that this innovative pedagogical approach not only significantly reduced students' depression and anxiety levels but also enhanced their academic achievement compared to traditional teaching methods. By merging immersive VR experiences with active, student-centered learning, the model provided a supportive environment that fostered emotional well-being and deeper engagement with psychological health content. Overall, this study suggests that adopting VR-enhanced flipped classroom practices in psychological health education holds promise for improving both student mental health and academic outcomes, with important implications for curriculum development and educational policy in higher education settings.

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