

Digital Technologies and Student Mental Health: Risks of Social Media and the Promise of Virtual Reality and Autonomous Sensory Meridian Response Interventions

Nurbanu Abueva^{1,2}, Anna Buzelo², Yanqiu Wu³, Zhanar Turniyazova⁴, Dulat Karakushev², Bojan Obrenovic⁵

¹Institute of European Languages, Zhejiang University of Foreign Studies, Yuexiu, People's Republic of China; ²Graduate School of Media and Intercultural Communication, Turan University, Almaty, Kazakhstan; ³Institute of Foreign Languages, Taizhou University, Taizhou, People's Republic of China; ⁴Academic School Psychology and Journalism, Q University, Almaty, Kazakhstan; ⁵School of Business and Management, Q University, Almaty, Kazakhstan

Correspondence: Bojan Obrenovic, Email bojan@inovatus-usluge.hr

Introduction: The rapid growth of social media use among students has raised concerns about its impact on mental health. While excessive engagement can increase anxiety and stress, emerging virtual technologies show potential as tools for psychological support.

Methods: A mixed-methods experimental study was conducted in a university in Kazakhstan, combining quantitative and qualitative approaches. A student survey assessed patterns of social media use and their association with anxiety, stress, and self-esteem. A content analysis of Instagram, TikTok, and Twitter posts identified prevalent mental health themes, formats, and engagement patterns. An experimental intervention tested the effects of virtual reality (VR) meditations and autonomous sensory meridian response (ASMR) content on reducing anxiety and stress.

Results: Higher intensity of social media use correlated with increased anxiety and stress, and lower self-esteem. Both VR and ASMR interventions significantly reduced anxiety, with VR showing the strongest effect. Content analysis revealed that social media can both amplify anxiety triggers and serve as a source of emotional support.

Discussion: Findings align with existing literature linking social media to poorer emotional well-being, while highlighting the potential of immersive digital interventions for stress reduction. The integrated MDI-STUDENT model was developed, combining relaxation techniques, digital hygiene practices, and reflective activities to build resilience.

Conclusion: Excessive social media use is associated with adverse mental health outcomes in students, but structured virtual interventions, especially VR, can mitigate these effects. The study supports integrating digital stress management strategies into university mental health programs.

Keywords: student mental health, social media anxiety, digital detox, virtual reality meditation, ASMR interventions

Introduction

In today's world, digital technologies, particularly virtual reality (VR) and related immersive tools, have become an integral part of daily life, especially among young people.¹ Students represent one of the most active user groups of social media platforms, driven both by educational needs and the desire for socialization and entertainment.²⁻⁴ While these technologies offer numerous opportunities for communication, learning, and socialization, excessive use can also lead to elevated levels of anxiety, stress, and emotional exhaustion.⁵⁻⁸

On one hand, social media facilitates communication, information exchange, and emotional support, which is especially valuable for students coping with academic demands and the challenges of social adaptation.⁹⁻¹² On the other hand, constant social comparison, information overload, cyberbullying, and digital dependency can lead to

heightened anxiety, depressive symptoms, and decreased self-esteem.¹³ Prolonged engagement with social media has also been linked to sleep disturbances, cognitive overload, impaired attention, and emotional exhaustion.¹⁴ Algorithmically curated content feeds may intensify feelings of anxiety and promote upward social comparison, while continuous exposure to informational noise can negatively affect academic performance.¹⁵ This highlights the need to investigate the mechanisms through which social networks influence students' psycho-emotional well-being and to explore strategies for mitigating these negative outcomes.¹⁶

In response to these challenges, innovative digital tools aimed at reducing anxiety, such as VR experiences and media-based content like autonomous sensory meridian response (ASMR) videos, have gained research attention.^{17–20} These technologies show potential to decrease stress, enhance concentration, and improve emotional stability, yet their specific effects on university students remain insufficiently studied.^{17,21,22} Addressing this gap requires empirical evidence on how such interventions can be integrated into strategies for mindful technology use, including digital detox approaches and tools to measure informational overload.

Several digital mental health programs have been developed in recent years, ranging from scalable mobile mindfulness applications (eg, Headspace, Calm) to targeted interventions such as VR mindfulness environments and digital cognitive-behavioral therapy (CBT) models like STAND (Screening & Treatment for Anxiety and Depression).^{23–25} While these frameworks provide valuable components, such as meditation, breathing exercises, mood tracking, or guided reflection, they typically address isolated aspects of mental health and seldom integrate immersive technologies with structured behavioral change and moderated group support.^{26,27}

The Model of Digital Intervention for Student Emotional and Neuro-Traumatic Tone (MDI-STUDENT) model proposed in this study addresses this gap by combining VR/ASMR immersion, digital detox strategies, reflective journaling, media filtering, and facilitated group discussions into a single, comprehensive program specifically designed for university students. Unlike VR-based interventions that focus primarily on sensory immersion or CBT-oriented programs that emphasize cognitive restructuring, MDI-STUDENT unites sensory relaxation techniques, behavioral feedback loops, and social support within a cohesive framework. This integrative approach aims not only to alleviate acute stress and anxiety but also to foster sustainable digital hygiene and long-term emotional resilience.^{12,27}

The scientific novelty of this study lies in its comprehensive examination of the relationship between social media use and students' mental health, with a focus on usage intensity, anxiety, and self-esteem. Unlike most research emphasizing only negative outcomes, this study also explores the potential of VR meditations and ASMR videos as tools for stress management. The research includes a content analysis of major platforms (Instagram, TikTok, and Twitter) to identify dominant mental health themes, alongside an experimental evaluation of VR and ASMR interventions for anxiety reduction.

This study aims to examine the relationship between social media use and the mental health of university students, and to evaluate the effectiveness of selected digital interventions, specifically VR meditations and ASMR content, in reducing anxiety and stress. In doing so, it provides both empirical analysis and a theory-based framework for intervention. The proposed MDI-STUDENT integrates VR and ASMR technologies, digital detox strategies, and mindfulness-based practices to support students' mental well-being in the digital age. Additionally, the study seeks to develop evidence-based recommendations for mindful technology use, including digital detox strategies and tools for measuring informational overload.

Null Hypothesis (H_0). The intensity of social media use has no significant impact on students' levels of anxiety and stress, and virtual technologies (such as VR meditations and ASMR content) do not exert a measurable effect in reducing anxiety.

Alternative Hypotheses:

H_1 : There is a positive correlation between the intensity of social media use and students' levels of anxiety and stress; that is, the more frequently and longer students engage with social media, the higher their levels of anxiety and stress.

H_2 : Excessive use of social media contributes to a decrease in students' self-esteem, as it reinforces social comparison processes that lead to dissatisfaction with oneself.

These hypotheses are tested through an empirical research design that combines surveys, social media content analysis, and controlled experiments.

Methods

Study Design

This study adopted a mixed-methods sequential design that combined quantitative and qualitative approaches to provide a comprehensive understanding of the relationship between social media use and psychological well-being, as well as the effects of targeted digital interventions. The mixed-methods framework allowed for both numerical measurement of psychological changes and contextual interpretation through qualitative content analysis.

The research was implemented in three consecutive stages. The first stage was a large-scale cross-sectional survey, which quantified levels of social media use, anxiety, stress, and self-esteem among university students. This stage also identified eligible participants for subsequent phases and established baseline relationships between variables. The second stage consisted of a qualitative content analysis of participants' publicly available social media posts, examining thematic and emotional patterns that could contextualize the quantitative correlations found in Stage 1. This provided insight into the possible mechanisms linking social media engagement with psychological outcomes. The third stage was an experimental intervention in which selected students were randomly allocated to one of three conditions: VR meditation, ASMR content, or a control group with no change in digital habits. Over a two-week period, participants in the intervention arms engaged in daily exposure to their assigned activity, with pre- and post-testing of anxiety, stress, and self-esteem. The random allocation and controlled design allowed for causal inference regarding intervention effects.

Details of participant recruitment, measurement tools, content analysis methodology, and intervention protocols are provided in Participants–2.9.

Participants

Participants were recruited from enrollment lists of university in Kazakhstan using a computer-generated random selection of student ID numbers. An initial invitation was sent via institutional Email to 500 full-time students who met the inclusion criteria of (1) full-time enrollment and (2) active social media use (≥ 1 hour/day). Students with diagnosed mental disorders were excluded to minimize confounding effects. Participation was voluntary, and informed consent was obtained from all students prior to data collection.

From the invited cohort, 250 students completed the full baseline survey, forming the sample for the correlational analysis. Demographic characteristics reflected a typical university student population in terms of gender distribution and fields of study. From the survey respondents, 100 eligible volunteers were randomly assigned, via a computer-generated allocation sequence, to one of three experimental conditions: VR meditation ($n = 33$), ASMR content ($n = 33$), or a control group with no change in digital behavior ($n = 34$). All intervention participants met the same inclusion and exclusion criteria as the survey sample and had no prior regular engagement with VR meditation or ASMR.

Sample Size and Power Calculations

A priori sample size calculations were conducted in G*Power 3.1 ($\alpha = 0.05$, two-tailed). For the survey, detecting a medium correlation ($r = 0.30$) with 80% power required $N = 84$; the achieved sample ($N = 250$) provided $>99\%$ power to detect even small-to-medium correlations ($r \geq 0.18$). For the experiment, a one-way ANOVA with three groups requires $N \approx 159$ (≈ 53 per group) to detect a medium effect ($f = 0.25$) with 80% power. Although the achieved group sizes ($n = 33$ – 34) were below this threshold for strictly medium effects, they were sufficient for medium-to-large effects, as evidenced by the observed post-test effect size ($\eta^2 = 0.231$; $f \approx 0.55$), which yielded $\approx 99.9\%$ power.

Survey Instruments

The survey included three standardized psychological measures: the Beck Anxiety Inventory (BAI) for assessing anxiety symptoms, the Perceived Stress Scale-10 (PSS-10) for measuring perceived stress levels, and the Rosenberg Self-Esteem Scale (RSES) for evaluating global self-esteem.^{28–30} Each instrument was administered in its validated version and

scored according to established guidelines. In addition, participants answered structured questions on daily social media use, including average hours spent per day and the primary platforms used.

Social Media Content Analysis

A content analysis was conducted on three major social media platforms, Instagram, TikTok, and Twitter (X), to identify dominant mental health-related themes and characterize how such content is presented and engaged with online. Posts were sampled from three months preceding data collection to ensure topical relevance. Eligible posts were identified using a predefined set of popular hashtags and keywords related to anxiety, stress, and emotional well-being, including #anxiety, #stress, #mentalhealth, #ASMR, #psychology, #burnout, #overthinking, and #mindfulness. From the eligible pool, 500 posts were selected through systematic random sampling. Posts were included if they were publicly accessible, originated from non-private accounts, and were directly related to mental health topics; advertisements, reposts, and unrelated content were excluded. Each post was evaluated for its primary theme (eg, anxiety, stress, self-help, personal experience), content format (video, image, text, or story), delivery type (informative, motivational, personal narrative, or therapeutic), and user engagement (likes, comments, shares). Coding was performed independently by two trained researchers using a standardized codebook developed during a pilot analysis, and inter-rater reliability was calculated to ensure consistency. This approach enabled a systematic assessment of the frequency, framing, and audience interaction patterns of mental health content, offering insights into how digital environments may shape students' perceptions and attitudes toward mental well-being.

Experimental Study

To examine the effects of virtual relaxation technologies on student well-being, 100 participants were randomly allocated to one of three groups: VR meditation ($n = 33$), ASMR content ($n = 33$), or Control ($n = 34$). The VR group used an Oculus Quest 2 headset with 20-minute immersive guided meditations in 360° natural settings (eg, beach, forest), combining mindfulness voiceovers, ambient sounds, and breathing/relaxation cues. The ASMR group watched 20-minute curated high-definition videos on a laptop with headphones, featuring whispering, tapping, fabric brushing, and slow hand movements from popular ASMR channels to elicit relaxation and maintain engagement. The control group maintained their usual digital habits without introducing new practices.

All participants completed baseline assessments using the BAI, PSS-10, and RSES prior to the intervention. The intervention lasted 14 days, with participants in the VR and ASMR groups completing 20-minute daily sessions. These durations (14 days) and formats were informed by prior short-term intervention studies demonstrating measurable psychological benefits within comparable timeframes.^{31–33}

Adherence was monitored via daily check-ins and automated session logs; participants completing at least 80% of scheduled sessions were classified as adherent ([Supplementary Table 1](#)). Weekly check-in messages through a secure platform offered reminders, technical guidance, and motivational support to maintain engagement. Post-intervention, all participants repeated the same assessments to evaluate changes in anxiety, stress, and self-esteem.

Development of the MDI-STUDENT Model

In the course of the study, we developed the MDI-STUDENT model ([Table 1](#)), designed to establish stable practices of mindful digital behavior, reduce anxiety and stress, and enhance students' self-esteem and resilience through targeted work on digital habits, informational noise, and psycho-emotional overload.

The model integrates six components, Digital Detox, VR/ASMR Sessions, Educational Module, Daily Digital Reflection, Media Filter, and Group Support, implemented via a three-level approach: (1) reducing external pressure from informational noise and toxic content, (2) introducing positive digital practices such as VR meditation, ASMR, and self-reflection, and (3) fostering awareness through educational and supportive tools.

The “Group Support” element is a key pillar of the psychosocial intervention, comprising small-group, weekly online sessions facilitated by trained mental health professionals to provide a psychologically safe environment, normalize experiences, and build self-regulation skills. Detailed structural elements, facilitation methods, and participation guidelines are provided in [Supplementary Table 1](#).

Table 1 MDI-Student Model Components

Component	Description	Implementation Format
1. Digital Detox	Limiting social media usage to 2 hours per day, with screen time tracking	Mobile app or checklist
2. VR/ASMR Sessions	Introducing 20-minute relaxation practices five times a week	User's choice: VR meditation or ASMR
3. Educational Module	Five short video lectures on anxiety, stress, self-esteem, and digital addiction	Online format with quizzes
4. Daily Digital Reflection	Keeping a digital journal for mood and media consumption tracking	Google Forms, Telegram bot
5. Media Filter	Personalized content settings: unsubscribing from anxiety-provoking sources, subscribing to positive content	Digital hygiene guide
6. Group Support	Weekly Zoom sessions for students to share experiences and receive emotional support	Moderated by a psychologist or mentor

To maintain participant engagement, a structured adherence monitoring system tracked completion of each component using self-reports, automated logs, and moderator feedback. Adherence thresholds were defined as high ($\geq 80\%$), moderate (50–79%), or low ($< 50\%$). The full monitoring framework and scoring procedures are outlined in [Supplementary Table 2](#).

Development of the Information Noise Assessment System

Alongside the main intervention, we developed a quantitative Information Noise Assessment System to measure informational overload in students' digital environments. The tool scores six indicators, including daily notifications, task switching, and content consumption, on a 1–5 scale, with summed scores categorized as low (6–15), medium (16–20), or high (21–30) noise. Recommended digital offloading strategies for high-noise cases, as well as the complete indicator set and scoring criteria, are presented in [Supplementary Table 3](#).

Digital Mindfulness Methodology

To promote sustained conscious digital behavior, we implemented a six-stage Digital Mindfulness Methodology encompassing awareness, media reset, content filtering, screen-free intervals, mindful screen use, and reflection. Stage objectives, tools, and practical examples are summarized in [Supplementary Table 4](#).

Expected outcomes include reduced perceived stress and anxiety, improved concentration, and enhanced emotional self-regulation, contributing to the formation of stable digital mindfulness skills.

Statistical Analysis

The statistical analysis was conducted using GraphPad Prism 11.0.0. Descriptive statistics (mean $\pm$ SD) were calculated for all continuous variables. Pearson's correlation coefficient (r) was used to assess the relationship between the frequency of social media use and levels of anxiety and stress. Linear regression analysis was performed to determine the extent to which time spent on social media predicted anxiety levels, providing an estimate of the strength and direction of this relationship.

For the experimental component, paired-sample Student's t -tests were applied to compare pre- and post-intervention scores within each group. One-way analysis of variance (ANOVA) with post-hoc Tukey's tests was used to assess between-group differences (VR meditation, ASMR content, and control). Statistical significance was set at $p < 0.05$.

Results

Survey Findings

Descriptive statistics for the BAI, PSS-10, and RSES are summarized in [Table 2](#). On average, anxiety scores were in the moderate range (18.4 ± 7.2), perceived stress levels were relatively high (21.7 ± 6.5), and self-esteem scores were moderate (17.1 ± 4.3). The

Table 2 Descriptive Statistics of Anxiety, Stress, and Self-Esteem Scores Among Students (N=250)

Scale	Mean $\pm$ Standard Deviation (M $\pm$ SD)	Minimum	Maximum
BAI	18.4 $\pm$ 7.2	4	36
PSS-10	21.7 $\pm$ 6.5	8	34
RSES	17.1 $\pm$ 4.3	7	28

majority of students reported moderate anxiety ($n = 97$, 38.8%) or high anxiety ($n = 71$, 28.4%), while 41 (16.4%) experienced very high anxiety, and an equal proportion had low anxiety (Figure 1A). Stress levels were predominantly moderate ($n = 131$, 52.4%), followed by high ($n = 68$, 27.2%) and low ($n = 51$, 20.4%) (Figure 1B). Most students had moderate self-esteem ($n = 137$, 54.8%), with 72 (28.8%) reporting high and 41 (16.4%) reporting low self-esteem (Figure 1C). Daily social media use was most frequently 3–4 hours ($n = 77$, 30.8%), followed by 1–2 hours ($n = 64$, 25.6%) and more than 6 hours ($n = 44$, 17.6%) (Figure 1D).

There was a moderate positive correlation between anxiety (BAI) and frequency of social media use ($r = 0.51$, $p < 0.05$), indicating that students who spend more time on digital platforms tend to experience higher anxiety (Table 3). A similar relationship was observed between stress (PSS-10) and social media use ($r = 0.47$, $p < 0.05$). In contrast, self-esteem (RSES) demonstrated a moderate negative correlation with social media use ($r = -0.43$, $p < 0.05$), suggesting that increased time spent online is associated with lower personal confidence. These findings confirm Hypotheses H₁ and H₂, emphasizing the psychological risks of excessive digital engagement.

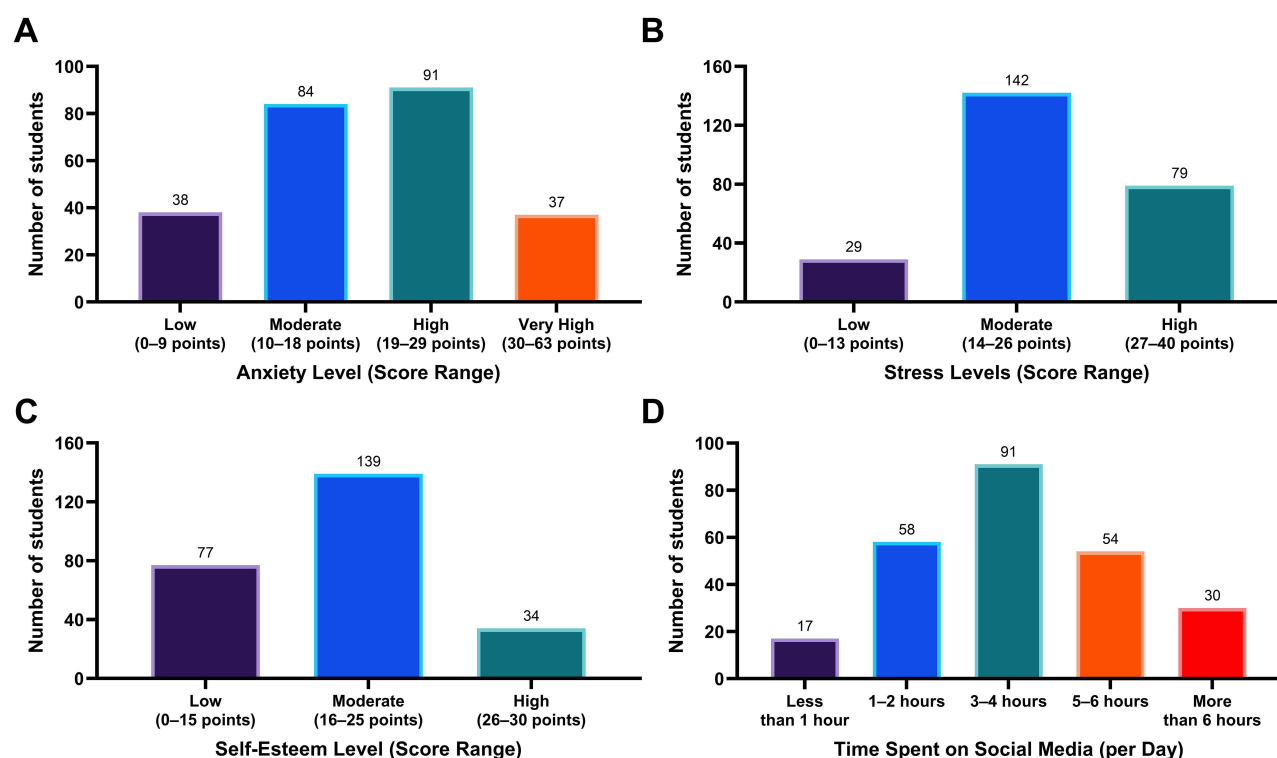


Figure 1 Distribution of anxiety levels (A), stress levels (B), self-esteem levels (C), and daily time spent on social media (D) among surveyed students (N = 250). Each bar represents the number of students in the corresponding category. (A) Anxiety levels were classified as Low (0–9), Moderate (10–18), High (19–29), and Very High (30–63), based on the BAI. (B) Stress levels were classified as Low (0–13), Moderate (14–26), and High (27–40), based on the PSS-10. (C) Self-esteem levels were classified as Low (0–15), Moderate (16–25), and High (26–30), based on the RSES. (D) Daily time spent on social media was grouped into: less than 1 hour, 1–2 hours, 3–4 hours, 5–6 hours, and more than 6 hours.

Table 3 Pearson Correlation Coefficients Among Psychological Indicators and Social Media Use. Pearson's Correlation Coefficients (r) Indicate the Strength and Direction of Linear Relationships Between Variables, Where Positive Values Denote Direct Associations and Negative Values Indicate Inverse Associations

Indicators	BAI (Anxiety)	PSS-10 (Stress)	RSES (Self-Esteem)	Frequency of Social Media Use
BAI (Anxiety)		0.68*	-0.59	0.51*
PSS-10 (Stress)			-0.54	0.47*
RSES (Self-Esteem)				-0.43*

Note: $p < 0.05$.*

Social Media Content Analysis

A total of 500 mental health–related posts were analyzed across Instagram, TikTok, and Twitter to identify dominant themes, content formats, delivery styles, and audience engagement patterns. The most frequent topics addressed were anxiety, stress, and self-help, followed by personal experiences and motivational messages.

The most prevalent category among the analyzed posts was Anxiety and Stress, accounting for 182 posts (36.4%). This theme also showed above-average audience engagement, with a mean of 2850 interactions per post. Mindfulness and Meditation ranked second, comprising 96 posts (19.2%) with an average of 2120 interactions. Although ASMR and Relaxation represented only 74 posts (14.8%), they achieved the highest engagement level at 3110 interactions per post, highlighting strong audience interest in this digital self-regulation format (Figure 2).

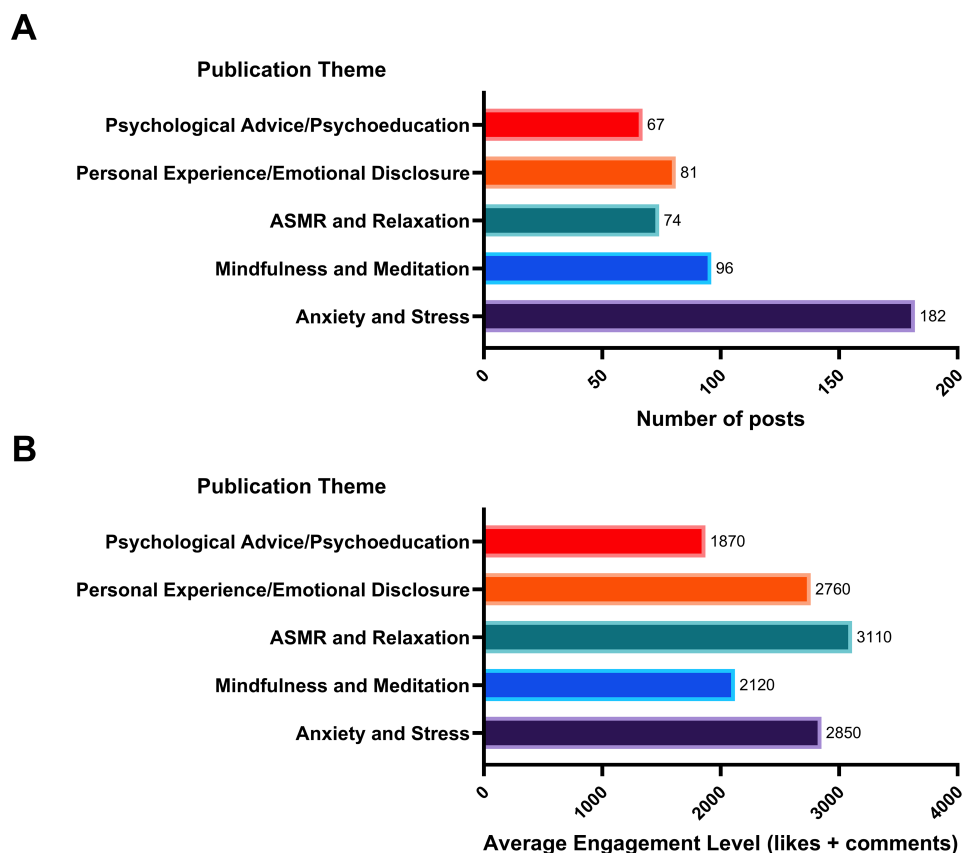


Figure 2 Distribution of Posts by Theme and Corresponding Engagement Levels ($n = 500$). (A) Number of posts for each publication theme. (B) Average engagement level (likes + comments) for each theme.

In terms of content format, short-form video dominated, making up 54.2% of all analyzed posts, with photos (22.6%), text-based content (17.8%), and ephemeral stories (5.4%) comprising smaller shares (Table 4). Video-based formats, especially those incorporating emotional storytelling or ASMR effects, consistently produced the most rapid and sustained audience engagement. Nearly half of all posts (49.2%) were personal narratives or motivational content, often serving to foster emotional identification and social connection. Practical, skill-based content, such as breathing exercises, self-regulation techniques, or stress-reduction tips, accounted for roughly one-fifth of posts, indicating a significant niche for actionable guidance.

Overall, the analysis underscores that visually rich, emotionally resonant formats, particularly ASMR and personal storytelling, are highly effective in driving engagement around mental health topics. These findings support the strategic inclusion of such formats in digital wellness programs targeting student audiences.

Experimental Study

A comparative analysis evaluated the effects of VR meditation (n=33) and ASMR content (n=33) versus a control group (n=34) with no change in digital behavior, with pre- and post-intervention measurements taken over two weeks using the BAI, PSS-10, and RSES (Table 5). Both intervention groups showed marked improvements from baseline, with VR

Table 4 Overview of Digital Content Formats, Topics, Engagement, and Content Types (n = 500)

Aspect	Category/Topic	Count/ Average	% of Total Posts	Engagement (Avg. Likes)	Engagement (Avg. Comments)	Engagement (Avg. Shares)
Formats of Digital Content	Video (Reels, TikTok, short clips)	271	54.2%	—	—	—
	Photo/Image with caption	113	22.6%	—	—	—
	Text post (Twitter, long captions)	89	17.8%	—	—	—
	Stories/Temporary content	27	5.4%	—	—	—
Publication Topics (mentions)	Anxiety	161	32.2%	—	—	—
	Stress	143	28.6%	—	—	—
	Emotional burnout	88	17.6%	—	—	—
	Mental health support	74	14.8%	—	—	—
	Sleep disturbances/fatigue	34	6.8%	—	—	—
Average Engagement by Topic	ASMR and Relaxation Content	—	—	2,350	530	230
	Personal Experience/Open Posts	—	—	1,970	490	300
	Motivational Content	—	—	1,580	310	120
	Tips and Recommendations	—	—	1,250	280	150
	Informational Posts (Articles)	—	—	980	150	90
Content Types	Motivational Messages/Quotes	134	26.8%	—	—	—
	Personal Experiences and Stories	112	22.4%	—	—	—
	Practical Tips and Instructions	96	19.2%	—	—	—
	Relaxing Media Content (ASMR, Meditation)	74	14.8%	—	—	—
	Psychoeducational Posts (Facts, Research)	59	11.8%	—	—	—
	Memes and Humorous Content Related to Anxiety	25	5.0%	—	—	—

Table 5 Combined Intra- and Inter-Group Results for BAI, PSS-10, and RSES

Indicator	Group	Δ Change (Points)	t-value	p-value	ANOVA F	ANOVA p
BAI	VR (n=33)	-7.3	-6.32	<0.001	12.41	<0.001
	ASMR (n=33)	-5.2	-4.89	<0.001		
	Control (n=34)	-0.5	-0.91	0.368		
PSS-10	VR (n=33)	-6.3	-5.77	<0.001	10.86	<0.001
	ASMR (n=33)	-4.8	-4.24	<0.001		
	Control (n=34)	-0.5	-0.82	0.416		
RSES	VR (n=33)	+3.7	+5.01	<0.001	9.77	<0.001
	ASMR (n=33)	+2.5	+3.89	<0.001		
	Control (n=34)	+0.2	+0.37	0.712		

meditation yielding the largest reductions in anxiety (-7.3 points) and stress (-6.3 points) and the greatest increase in self-esteem (+3.7 points). ASMR also produced significant benefits (anxiety: -5.2; stress: -4.8; self-esteem: +2.5). The control group changes were minimal and statistically non-significant. Paired-samples t-tests confirmed these within-group improvements in VR and ASMR groups ($p < 0.001$ for all measures). One-way ANOVA indicated significant post-intervention differences between groups for all three outcomes ($p < 0.001$), confirming the robustness of the effects.

Regression analysis showed that each additional hour of daily social media use predicted a 2.33-point increase in anxiety, explaining 26% of the variance ($\beta = 2.33$, $SE = 0.42$, $t = 5.55$, $p < 0.001$, 95% CI [1.51; 3.14]). Mediation analysis (PROCESS Model 4) indicated that stress partially mediated this relationship: social media time was positively associated with stress ($\beta = 1.85$, $p < 0.001$), which in turn predicted higher anxiety ($\beta = 0.56$, $p < 0.001$). The indirect effect via stress was significant ($\beta = 1.04$, $p < 0.001$), and the direct effect of social media on anxiety remained after accounting for stress ($\beta = 1.29$, $p < 0.01$). Effect size calculations confirmed the strongest impact for VR meditation, with very large reductions in anxiety ($d = 1.40$) and stress ($d = 1.31$), and a large increase in self-esteem ($d = 1.09$). ASMR showed moderate-to-large effects (anxiety: $d = 0.97$; stress: $d = 0.89$; self-esteem: $d = 0.76$). ANOVA-based effect sizes further supported the practical significance, with η^2 values of 0.231 for anxiety, 0.198 for stress, and 0.186 for self-esteem.

Follow-Up Pilot Test

After the central experimental period, the MDI-STUDENT model was applied in a follow-up pilot study involving students from the original control group. Although these participants had not received any intervention during the main trial, they subsequently underwent a two-week implementation of the full MDI-STUDENT model. This allowed assessment of the model's efficacy outside the original experimental allocation and confirmed its scalability to new participant groups.

Results showed statistically significant improvements across all indicators: reductions in anxiety and stress, and an increase in self-esteem (Table 6). These outcomes support the model's adaptability and practical relevance, indicating

Table 6 Indicator Changes in the Control Group After Implementation of the Model

Indicator	Before Implementation	After Implementation (2 Weeks)	Δ Change	Statistical Significance (t, p)
BAI (Anxiety)	21.3 $\pm$ 5.7	15.2 $\pm$ 4.6	-6.1	$t = -5.44$, $p < 0.001$
PSS-10 (Stress)	24.0 $\pm$ 5.2	17.5 $\pm$ 4.8	-6.5	$t = -5.61$, $p < 0.001$
RSES (Self-Esteem)	17.6 $\pm$ 4.0	20.7 $\pm$ 3.9	+3.1	$t = +4.87$, $p < 0.001$

that MDI-STUDENT can be effectively integrated into individual psychological support or group-based prevention programs to mitigate student burnout in educational settings.

Discussion

This study reinforces the growing body of evidence linking frequent social media use with elevated levels of anxiety and stress among students, as well as reduced self-esteem.^{34–36} These findings align with psychological models suggesting that continuous exposure to curated and idealized online content fosters social comparison, information overload, and heightened emotional reactivity.³⁷ Consistent with earlier work, our results indicate that these dynamics can undermine emotional stability and self-worth.^{38–41} The results correlate with the findings of Anto et al (2022),⁴² who also established a direct link between prolonged exposure to social media and increased anxiety levels among students. The work of Iwamoto & Chun (2020)⁴³ confirmed the negative impact of social platforms on emotional regulation, while studies by Zhen et al (2021)⁴⁴ and Anand et al (2021)⁴⁵ focused on students' stress tolerance in the digital age.

In the experimental phase, both VR meditation and ASMR content emerged as promising tools for stress and anxiety reduction, with VR showing the most pronounced effects. These results are consistent with earlier evidence that immersive VR environments can shield users from external distractions, fostering deep relaxation and psychological recovery.^{46,47} One plausible explanation for VR's stronger impact is its high level of sensory immersion, which minimizes exposure to environmental triggers that can sustain stress responses. By occupying the full visual and auditory fields, VR may facilitate attentional disengagement from ruminative thoughts more effectively than ASMR, which primarily engages the auditory channel.^{48,49} This aligns with immersive presence theory, which posits that multi-sensory environments enhance absorption and emotional regulation compared to single-modality stimuli.⁵⁰ ASMR, while slightly less potent, demonstrated benefits likely linked to sensory relaxation and soothing audio stimuli, echoing previous findings on its calming influence.^{51–53} The differential effectiveness of these modalities may reflect individual variations in sensory responsiveness and engagement style.

The content analysis adds an important contextual layer, showing that social media functions as a dual-edged space: it can both amplify anxiety triggers and serve as a platform for emotional support. High engagement with emotionally soothing content such as ASMR, motivational posts, and personal narratives suggests that students are actively seeking digital coping resources.^{54–56} This dual role of the digital environment may explain why targeted interventions delivered through the same medium can be particularly effective.

Unlike many earlier studies, which primarily document negative digital effects without exploring solutions, our work tested an integrated intervention model, MDI-STUDENT, that combines sensory relaxation, behavioral feedback, and structured social support. This comprehensive approach positions digital tools not only as potential sources of stress but also as vehicles for long-term emotional resilience and conscious technology use.⁵⁷ Such integration reflects an emerging paradigm in digital mental health, where immersive and interactive modalities are embedded within behavior change frameworks rather than deployed in isolation.

From a practical standpoint, the findings support the inclusion of VR and ASMR sessions in university mental health programs, whether as individual supports or group-based workshops [56].⁵⁸ Coupled with digital hygiene education, media filtering strategies, and reflection practices, these tools could form the backbone of scalable, accessible psychoeducational interventions. Embedding them within existing university infrastructure, such as learning management systems and mobile platforms, could further enhance reach and personalization.

Nonetheless, several limitations should be acknowledged. The study's sample was limited to a few urban universities, and reliance on self-reported measures introduces potential biases. The short intervention duration captures only immediate effects; long-term outcomes remain unknown. Future research should extend intervention periods, expand the sample to include diverse cultural and educational contexts, and examine additional modalities such as mobile mindfulness apps or AI-driven digital assistants. Moreover, deeper content analyses could clarify how specific types of online material, whether motivational, neutral, or negative, differentially affect cognitive and emotional states.

In sum, this study contributes to a more nuanced understanding of the interplay between digital engagement and student mental health. By simultaneously identifying risk pathways and testing targeted interventions, it lays the

groundwork for tailored, technology-based strategies that move beyond harm reduction toward proactive resilience building.

Conclusions

This study examined the relationship between social media use and students' mental health, and evaluated the potential of VR meditation and ASMR as digital interventions. Findings indicate that excessive online engagement is associated with higher anxiety and stress and lower self-esteem, while targeted immersive tools can mitigate these effects.

The proposed MDI-STUDENT model integrates relaxation techniques, digital hygiene practices, and reflective activities into a coherent framework for promoting resilience in academic settings. These results support the inclusion of structured, technology-based interventions in university mental health strategies, while underscoring the need for broader, longer-term research to validate and refine these approaches.

Abbreviations

BAI, Beck Anxiety Inventory; PSS-10, Perceived Stress Scale – 10 Items; RSES, Rosenberg Self-Esteem Scale; VR, Virtual Reality; ASMR, Autonomous Sensory Meridian Response; MDI-STUDENT, Model of Digital Intervention for Student Emotional and Neuro-Traumatic Tone; ANOVA, Analysis of Variance.

Data Sharing Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to the sensitive nature of psychological data, datasets are not publicly archived to ensure participant confidentiality.

Ethical Approval Statement

This study was reviewed and approved by the Ethical Review Board of Q University (Approval No. QU20257) and was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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References

1. Chavez LJ, Kelleher K, Slesnick N, et al. Virtual reality meditation among youth experiencing homelessness: pilot randomized controlled trial of feasibility. *JMIR Mental Health*. 2020;7(9):e18244. doi:10.2196/preprints.18244
2. Bin S, Alrashdi DH, Whitehead T, Riches S, Drini E. Mental health professionals' attitudes towards virtual reality therapies: a systematic review. *J Technol Behav Sci*. 2025. doi:10.1007/s41347-025-00499-x
3. Bridge P, Mehta J, Keane P, et al. A virtual reality environment for supporting mental wellbeing of students on remote clinical placement: a multi-methods evaluation. *Nurse Educ Today*. 2024;138:106184. doi:10.1016/j.nedt.2024.106184
4. Ladakis I, Filos D, Chouvarda I. Virtual reality environments for stress reduction and management: a scoping review. *Virtual Real*. 2024;28(1):50. doi:10.1007/s10055-024-00943-y
5. Wies B, Landers C, Ienca M. Digital mental health for young people: a scoping review of ethical promises and challenges. *Front Digit Health*. 2021;3:697072. doi:10.3389/fdgh.2021.697072
6. Yang M. Exploration of virtual reality technology supported mindfulness training models and effects. *Appl Educ Psychol*. 2025;6.
7. Adaeva A. A, Slazheva T. I, Abdrakhmanova SH. Z, Kausova G. K, Kalmakova ZH. A. A problematic social media use and mental being of urban and rural adolescents In Kazakhstan. *Sci Healthc*. 2023;140–151. doi:10.34689/SH.2023.25.6.017
8. Khadzhimuradova BK. The role of emotional intelligence in interpersonal relationships and personal effectiveness. *Tendencias Dev Sci Educ*. 2023;97:139–141.
9. Reyaz S, - AT, - TA, et al. Impact of social media and anxiety among college students. *Int J Multidiscip Res*. 2024;6(6):31894. doi:10.36948/ijfmr.2024.v06i06.31894
10. Kurniasari D, Soekardi R, Kurniasih DE, Krisdiyanto J. The correlation between intensity of social media use and the level of Social anxiety students. *J Formil Forum Ilm Kemas Respati*. 2023;8:174.
11. Lai F, Wang L, Zhang J, et al. Relationship between social media use and social anxiety in college students: mediation effect of communication capacity. *Int J Environ Res Public Health*. 2023;20(4):3657. doi:10.3390/ijerph20043657
12. Li Pira G, Ruini C. Effectiveness of home_positivity: a vr program for promoting positive mental health. A pilot feasibility study. *Int J Appl Posit Psychol*. 2025;10(23). doi:10.1007/s41042-025-00216-2
13. Alwuqaysi B. A systematic review and meta-analysis of social media's influence on mental health, family functioning, and visual content. *Soc Sci Humanit Open*. 2025;12:101793.
14. Schwaiger M, Krajncan M, Vuković M, Jenko M, Doz D. Educators' opinions about VR/AR/XR: an exploratory study. *Educ Inf Technol*. 2024;29(18):24861–24880. doi:10.1007/s10639-024-12808-7
15. Qiu R, Li Y, Gong Y, et al. Anxiety mediates the effect of social media addiction on negative attentional bias: the moderating role of impulsivity. *Front Psychiatry*. 2025;16:1592132. doi:10.3389/fpsy.2025.1592132
16. Verma A, Islam S, Moghaddam V, Anwar A. Digital emotion regulation on social media. *Computer*. 2024;57(6):82–89. doi:10.1109/MC.2023.3332331
17. Blumberg FC, Rice JL, Dickmeis A. Social media as a venue for emotion regulation among adolescents. *Emotions, Technology, and Social Media*. Elsevier; 2016:105–116. doi:10.1016/B978-0-12-801857-6.00006-3
18. Çiçek I, Emin Şanlı M, Arslan G, Yıldırım M. Problematic social media use, satisfaction with life, and levels of depressive symptoms in university students during the COVID-19 pandemic: mediation role of social support. *Psihologija*. 2024;57(2):177–197. doi:10.2298/PSI220613009C
19. Iovu M-B, Runcan R, Runcan P-L, Androni F. Association between facebook use, depression and family satisfaction: a cross-sectional study of Romanian youth. *Iran J Public Health*. 2020. doi:10.18502/ijph.v49i11.4728
20. Peng L, Wang J, Zheng N, Guo X. Traversing emotional spaces: social media affordances and emotion regulation in times of physical isolation. *Soc Media Soc*. 2024;10(1):20563051241237273. doi:10.1177/20563051241237273
21. Foroughi B, Iranmanesh M, Nikbin D, Hyun SS. Are depression and social anxiety the missing link between facebook addiction and life satisfaction? The interactive effect of needs and self-regulation. *Telemat Inform*. 2019;43:101247. doi:10.1016/j.tele.2019.101247
22. Ulutas Deniz E, Eren R. Social media addiction, depression and life satisfaction in Turkish pharmacy students: a correlational study. *Pharm Educ*. 2024;24(1):311–321. doi:10.46542/pe.2024.241.311321
23. Rosenberg BM, Kodish T, Cohen ZD, Gong-Guy E, Craske MG. A novel peer-to-peer coaching program to support digital mental health: design and implementation. *JMIR Ment Health*. 2022;9(1):e32430. doi:10.2196/32430
24. Venkatesan A, Rahimi L, Kaur M, Mosunic C. Digital cognitive behavior therapy intervention for depression and anxiety: retrospective study. *JMIR Ment Health*. 2020;7(8):e21304. doi:10.2196/21304
25. Wolitzky-Taylor K, LeBeau R, Arnaudova I, et al. A novel and integrated digitally supported system of care for depression and anxiety: findings from an open trial. *JMIR Ment Health*. 2023;10:e46200. doi:10.2196/46200
26. Anser MK, Nabi AA, Ahmad I, Abro MMQ, Zaman K. Advancing mental health care: a comprehensive review of digital tools and technologies for enhancing diagnosis, treatment, and wellness. *Health Care Sci*. 2025;4(3):163–178. doi:10.1002/hcs2.70018
27. Lee J, Kim J, Ory MG. The impact of immersive virtual reality meditation for depression and anxiety among inpatients with major depressive and generalized anxiety disorders. *Front Psychol*. 2024;15:1471269. doi:10.3389/fpsyg.2024.1471269
28. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol*. 1988;56(6):893–897. doi:10.1037/0022-006X.56.6.893
29. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24(4):385–396. doi:10.2307/2136404
30. Rosenberg M. *Society and the Adolescent Self-Image*. Princeton University Press, Princeton; 2016.
31. Zhou H, Chen C, Liu J, Fan C. Acute augmented effect of virtual reality (VR)-Integrated relaxation and mindfulness exercising on anxiety and insomnia symptoms: a retrospective analysis of 103 anxiety disorder patients with prominent insomnia. *Brain Behav*. 2024;14(10):e70060. doi:10.1002/brb3.70060
32. Lewis J, Rorstad B. Immersive VR as a tool to enhance relaxation for undergraduate students with the aim of reducing anxiety - a pilot study. 2019. doi:10.48550/ARXIV.1903.01210
33. Zheng L, Li W, Song S, et al. Effectiveness of mindfulness-based virtual reality training on stress, anxiety, and depression among Chinese university students. *Mindfulness*. 2024;15(4):899–913. doi:10.1007/s12671-024-02335-4

34. Alzhanova AB, Mukhamadiyeva LI. Crisis communication during emergency (on the example of the Al-Farabi KazNU). *Her Journal*. 2022;66.
35. Vlahovic S, Skopin-Kapov L, Suznjevic M, Pavlin-Bernardic N. Not just cybersickness: short-term effects of popular VR game mechanics on physical discomfort and reaction time. *Virtual Real*. 2024;28(2):108. doi:10.1007/s10055-024-01007-x
36. Zlavinova YT. Practice of social work in social media: ethical issues. *J Psychol Sociol*. 2022;83(4). doi:10.26577/jpcp.2022.v82.i4.07
37. Maksatbekova A, Argan M. Virtual reality's dual edge: navigating mental health benefits and addiction risks across timeframes. *Curr Psychol*. 2025;44(7):6469–6480. doi:10.1007/s12144-025-07623-3
38. Abbasian M, Rajabzadeh T, Moradipari A, et al. Controlling the latent space of GANs through reinforcement learning: a case study on task-based image-to-image translation. 2023. doi:10.48550/arXiv.2307.13978
39. Allshire A, Martin-Martin R, Lin C, et al. LASER: learning a latent action space for efficient reinforcement learning. 2021. doi:10.48550/arXiv.2103.15793
40. Pancini E, Di Natale AF, Villani D. Breathing in virtual reality for promoting mental health: a scoping review. *Virtual Real*. 2025;29(1):29. doi:10.1007/s10055-024-01096-8
41. Saeed S, Khan KB, Hassan MA, Qayyum A, Salahuddin S. Review on the role of virtual reality in reducing mental health diseases specifically stress, anxiety, and depression. 2024. doi:10.48550/arXiv.2407.18918
42. Anto A, Asif RO, Basu A, et al. Exploring the impact of social media on anxiety among university students in the United Kingdom: qualitative study. *JMIR Form Res*. 2023;7:e43037. doi:10.2196/43037
43. Iwamoto D, Chun H. The emotional impact of social media in higher education. *Int J High Educ*. 2020;9(2):239. doi:10.5430/ijhe.v9n2p239
44. Zhen L, Nan Y, Pham B. College students coping with COVID-19: stress-buffering effects of self-disclosure on social media and parental support. *Commun Res Rep*. 2021;38(1):23–31. doi:10.1080/08824096.2020.1870445
45. Anand N, Sharma MK, Marimuthu P. Problematic internet use and its association with psychological stress among adolescents. *Indian J Soc Psychiatry*. 2021;37(3):269–274. doi:10.4103/ijsp.ijsp_225_21
46. Gelada C, Kumar S, Buckman J, Nachum O, Bellemare MG. DeepMDP: learning continuous latent space models for representation learning. 2019. doi:10.48550/arXiv.1906.02736
47. Rybkin O, Zhu C, Nagabandi A, et al. Model-based reinforcement learning via latent-space collocation. 2021. doi:10.48550/arXiv.2106.13229
48. Naef AC, Jeitner M-M, Knobel SEJ, et al. Investigating the role of auditory and visual sensory inputs for inducing relaxation during virtual reality stimulation. *Sci Rep*. 2022;12(1):17073. doi:10.1038/s41598-022-21575-9
49. Ma J, Zhao D, Xu N, Yang J. The effectiveness of immersive virtual reality (VR) based mindfulness training on improvement mental-health in adults: a narrative systematic review. *EXPLORE*. 2023;19(3):310–318. doi:10.1016/j.explore.2022.08.001
50. Triberti S, Sapone C, Riva G. Being there but where? Sense of presence theory for virtual reality applications. *Humanit Soc Sci Commun*. 2025;12(1):79. doi:10.1057/s41599-025-04380-3
51. Jang S, Yoo S, Kang N. Generative design by reinforcement learning: enhancing the diversity of topology optimization designs. *Comput-Aided Des*. 2022;146:103225. doi:10.1016/j.cad.2022.103225
52. Orben A. Teenagers, screens and social media: a narrative review of reviews and key studies. *Soc Psychiatry Psychiatr Epidemiol*. 2020;55(4):407–414. doi:10.1007/s00127-019-01825-4
53. Wang R, Chen F, Chen Z, et al. StudentLife: assessing mental health, academic performance and behavioral trends of college students using smartphones. In *Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing* 3–14 (ACM, Seattle Washington, 2014). doi:10.1145/2632048.2632054.
54. Kaushik A, Kostaki E, Kyriakopoulos M. The stigma of mental illness in children and adolescents: a systematic review. *Psychiatry Res*. 2016;243:469–494. doi:10.1016/j.psychres.2016.04.042
55. Riboldi I, Calabrese A, Piacenti S, et al. Understanding university students' perspectives towards digital tools for mental health support: a cross-country study. *Clin Pract Epidemiol Ment Health*. 2024;20(1):e17450179271467. doi:10.2174/0117450179271467231231060255
56. Taylor KV, Garchitorena L, Scaramutti-Gladfelter C, et al. A digital mental health solution to improve social, emotional, and learning skills for youth: protocol for an efficacy and usability study. *JMIR Res Protoc*. 2024;13:e59372. doi:10.2196/59372
57. Litke SG, Resnikoff A, Anil A, et al. Mobile technologies for supporting mental health in youths: scoping review of effectiveness, limitations, and inclusivity. *JMIR Ment Health*. 2023;10:e46949. doi:10.2196/46949
58. Grist R, Porter J, Stallard P. Mental health mobile apps for preadolescents and adolescents: a systematic review. *J Med Internet Res*. 2017;19(5):e176. doi:10.2196/jmir.7332

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