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Integrated Yoga Module for Smartphone Addiction and Academic Engagement among Pre-University Students: A Study Protocol

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ABSTRACT

Background and Objectives:

The issue of smartphone addiction in adolescents poses a significant public health concern, negatively impacting cognitive abilities, attention management, behavioral control, mental health, and overall well-being. Yoga is emerging as a promising holistic intervention capable of improving mindfulness, emotional regulation, cognitive functioning, and behavioral self-control. This study aims to evaluate the impact of an integrated yoga module on smartphone addiction and academic engagement among pre-university students.

Research Design and Methods:

This randomized controlled trial (RCT) will include 200 pre-university students aged 16 to 19 years from Rajiv Gandhi University of Knowledge Technologies – RK Valley, Kadapa, widely known as RGUKT–RK Valley. Participants will be randomly assigned either in experimental group receiving the yoga intervention or in a waitlist control group. The intervention comprises 60-minute yoga sessions conducted over 90 academic days within one semester. Pre- and post-intervention assessments of smartphone addiction and academic engagement will be carried out using validated questionnaires, complemented by administrative academic attendance records and objective smartphone screen-time data to ensure a comprehensive evaluation of outcomes.

Expected Outcomes:

It is hypothesized that the structured yoga module may or may not reduce smartphone addiction and enhance academic engagement among participants, thereby offering empirical evidence for integrating yoga-based interventions into educational systems to promote digital well-being and academic excellence.

Keywords: Yoga, Smartphone Addiction, Screen time, Adolescents, Academic Engagement.

INTRODUCTION

The phenomenon of smartphone addiction, marked by compulsive and excessive use of these devices, has emerged as a widespread concern in the digital landscape of contemporary society, particularly among young people. The growing dependence on smartphones has sparked worries because of its significant adverse impacts on cognitive abilities, mental well-being, and educational performance. Adolescents, in particular, are vulnerable to smartphone addiction as their developing brains are still maturing, particularly in areas governing executive functions like impulse control, attention, and decision-making(Steinberg, 2014). As smartphones increasingly dominate the daily lives of young individuals, their overuse has been linked to various negative outcomes, including decreased academic engagement, reduced attention spans, and higher levels of anxiety and stress (Elhai et al., 2017a)(Montag, Yang, et al., 2021a). This trend has been further intensified in the post-pandemic era, marked by increased digital immersion and reduced offline engagement.

Background of the Study:

The widespread availability and accessibility of smartphones have profoundly transformed communication, learning, and entertainment. While smartphones offer benefits, such as instant access to information and social connectivity, their excessive use can disrupt daily life, impair cognitive abilities, and compromise academic performance(Samaha & Hawi, 2016). Research shows that smartphone addiction is associated with a range of psychological issues, including increased anxiety, depression, and difficulties in regulating attention and impulse control (Elhai et al., 2017b)(Miao et al., 2024b) These factors can contribute to poor academic outcomes, as students who are addicted to their smartphones are more likely to experience

difficulty focusing on their studies, leading to reduced academic engagement(Berryman et al., 2018)

In light of these challenges, there is an increasing need for effective interventions to mitigate the negative consequences of smartphone addiction. One promising approach is yoga, which has been shown to promote mindfulness, reduce stress, and enhance cognitive functioning (Pascoe & Bauer, 2015). Yoga incorporates physical postures, breathing exercises, and meditation, all of which have been demonstrated to improve attention, memory, and self-regulation—skills that are critical for academic success(Gothe et al., 2016). Previous studies have indicated that yoga interventions can reduce symptoms of anxiety and depression, improve emotional regulation, and promote better sleep quality, thereby creating a more conducive environment for learning(Khalsa & Butzer, 2016).However, while the benefits of yoga for mental health are well-documented, its specific role in addressing smartphone addiction and its impact on academic engagement remains under-explored.

However, existing literature predominantly focuses on psychological correlates of smartphone addiction, with limited experimental evidence evaluating structured yogic interventions in controlled academic environments

Rationale of the Study:

The present study is grounded in the urgent need to address the escalating prevalence of smartphone addiction among adolescents and its detrimental impact on cognitive, emotional, and academic functioning. The adolescent brain is particularly susceptible to addictive behaviors, with smartphone overuse potentially altering neural pathways related to attention and impulse control (Montag, Sindermann, et al., 2021). Given the importance of academic engagement for long-term educational and professional success, finding effective strategies to reduce smartphone addiction is imperative. Yoga, with its emphasis on mindfulness and stress reduction, holds promise as a holistic intervention that could address both the psychological and cognitive impacts of smartphone addiction. Furthermore, yoga has been shown to improve mental clarity and emotional stability, which are crucial for reducing dependence on digital devices(Gothe et al., 2016).

This study aims to fill the gap in the existing literature by investigating whether a structured yoga module can effectively reduce smartphone addiction and enhance academic engagement among pre-university students. By incorporating both quantitative assessments of smartphone use and academic engagement, this research seeks to provide empirical evidence on yoga's potential as an intervention for managing technology overuse.

Justification of the Study:

Recent research highlights the need for non-pharmacological interventions to address the growing concern of smartphone addiction, particularly among adolescents(Montag, Yang, et al., 2021b) (Miao et al., 2024a). Traditional approaches, such as digital detoxes or behavioral therapy, often focus solely on limiting screen time without addressing the underlying emotional and cognitive factors contributing to addiction. Yoga, however, offers a more comprehensive approach by promoting self-awareness, emotional regulation, and physical well-being—all of which are essential for managing technology overuse(Pascoe & Bauer, 2015). "Considering its accessibility, affordability, and robust scientific backing for its advantages, yoga represents a practical and sustainable approach that can be easily incorporated into educational environments. Studies indicate that yoga significantly improves psychological well-being, emotional regulation, and academic performance, positioning it as an excellent approach to bolster students' mental health and educational achievements.

This study is particularly timely as educational institutions worldwide are grappling with the effects of increased smartphone use among students, which has only been exacerbated by the COVID-19 pandemic and the shift towards online learning(Wen et al., 2023).If successful, the findings from this study could inform the development of yoga-based interventions that incorporate yoga to foster healthier technology habits, improve academic engagement, and support students overall well-being. This intervention may encourage students to use technology as a productive tool rather than becoming trapped by its excessive use.

Methodology:

Study Design:

To evaluate the efficacy of an integrated yoga module in reducing smartphone addiction and enhancing academic engagement, a randomized controlled trial (RCT) design will be employed. This design ensures high internal validity and enables causal inference regarding the effectiveness of the intervention.

Design Overview:

The study will adopt a two-arm randomized controlled trial design. Participants will be randomly assigned to one of two groups: an experimental group, which will receive the integrated yoga intervention or the waitlist control group, which will receive no immediate intervention but will be offered the same yoga intervention after the study period.

Experimental Group:

A well-validated integrated yoga module created especially for people with smartphone addiction will be practiced

by participants in the experimental group. The module, which is methodically designed to focus on attention regulation, emotional stability, and behavioral self-control, meets the specific needs of students by improving focus, lowering stress, encouraging better technology habits, and supporting psychological well-being in addition to achieving the best possible academic results.

Waitlist Control Group:

The waitlist control group will not receive any intervention during the study period but will be placed on a waiting list to receive the yoga module after the study concludes. This approach ensures that all participants have the opportunity to benefit from the intervention.

Sample Size Estimation and Participant Selection Criteria:

A stratified random sampling technique was employed to ensure balanced representation across key demographic and academic variables. The 1099 PUC-2 students among 6121 students from the RGUKT–RK Valley, Kadapa campus, 672 students who reported using a smartphone for more than three hours per day and expressed interest in participating were screened for eligibility. Students were excluded if they reported less than three hours of daily smartphone use, used a keypad (non-smartphone) device, belonged to non-target academic programs (such as PUC-1, M-BiPC, B.Tech, M.Tech, or Ph.D.), had medical or psychological contraindications, were engaged in other structured interventions, or were unwilling to participate. After applying these criteria, 534 students met the inclusion requirements and provided informed consent. These participants were then stratified by gender and randomly allocated into two equal groups: the yoga intervention group (N = 100; 50 male, 50 female) and the waitlist control group (N = 100; 50 male, 50 female). Each group participated in their assigned condition for 60 minutes per day across 90 academic days of one semester. Attrition was systematically monitored, and in accordance with the intention-to-treat principle, all randomized participants were included in the final analysis. Randomization within each stratum was conducted using a computer-generated allocation sequence, ensuring objectivity and equal probability of selection.

Inclusion and Exclusion Criteria:

Criteria for Inclusion

All of the following will be true for participants:

1. Age: 16 to 19 years old.

2. Enrollment: Presently engaged as a pre-university student at RGUKT-RK Valley, Kadapa, to maintain a steady educational environment.

3. Smartphone Use: Daily smartphone use of more than three hours

4. Consent: Gives informed consent (with parental or guardian consent for minors under 18 years) after being told everything about the study's goals, methods, risks, and benefits.

Criteria for Exclusion

People will not be able to participate if any of the following are true:

1. Recent Yoga Exposure: taking part in structured yoga programs within the last six months to reduce the effects that may have carried over.

2. Medical conditions that make physical activity unsafe, such as neurological disorders, heart problems, or bone/joint issues.

3. Severe Psychiatric Conditions: People who are currently getting treatment for schizophrenia, bipolar disorder, or major depressive disorder, because these conditions may need specialized care and make results harder to predict.

Ethical Considerations (Approvals and permissions)

All participants who met the eligibility criteria provided informed consent (consent forms available in both English and Telugu) from the participant's and their parents. Additionally, participants under 18 years of age provided further assent. The participants and their parents/ garden's received a comprehensive explanation of the intervention's procedures and objectives, which facilitated their understanding of the therapy, as well as the potential risks and benefits involved by the researcher. Participants were guaranteed that their data would remain confidential and were made aware of their right to withdraw from the study at any point without facing any adverse effects.

Intervention Duration: The integrated yoga module will be implemented for 60 minutes per day across 90 academic days of one semester. This ensures sufficient intensity and consistent practice to influence behavioural patterns, emotional regulation, smartphone use habits, and academic engagement

Intervention:

Practice Category	Practice Description	Number of Rounds/Cycles	Duration
Loosening Practices	Hands rotation (clockwise and anticlockwise)	5 rounds each	1 minute
	Wrist rotation (clockwise and anticlockwise)	5 rounds each	1 minute
	Neck rotation (clockwise and anticlockwise)	5 rounds each	1 minute
	Forward & backward bending	5 rounds	1 minute
	Side bending	5 rounds	1 minute
	Surya Namaskara	6 rounds (3 fast; 3 slow)	1 minute
Breathing Practices	Hands in and out breathing	5 rounds	3 minutes
	Hands stretch breathing	5 rounds	2 minutes
	Tiger Breathing (Vyagra kriya)	5 rounds	2 minutes
Standing Postures	Ardha chakrasana (half-moon posture)	1 round	2 minutes
	Vrikshasana (tree posture)	2 rounds (1 each leg)	1 minute
Sitting Postures	Gomukhasana (cow face posture)	1 round	2 minutes
	Ustrasana (camel posture)	1 round	1 minute
	Sashankasana (rabbit posture)	1 round	1 minute
Prone Postures	Bhujangasana (cobra posture)	1 round	1 minute
	Makarasana (crocodile posture)	1 round	1 minute
Supine Postures	Shavasana (corpse posture)	1 round	1 minute
Pranayama (Breathing)	Bastrika (bellows breathing)	3 rounds / 30 strokes per minute	1 minute
	Nadishuddhi (alternate nostril breathing)	9 rounds	3 minutes
	Ujjayi (psychic breathing)	5 rounds	3 minutes
	Bhramari (humming of bumblebee breathing)	5 rounds	3 minutes
	Kapalabhati (frontal brain cleansing breath)	3 rounds / 60 strokes per minute	3 minutes
Jatru Trataka (Eye Exercises)			3 minutes
Chanting and Meditation	A, U, M, and AUM chanting	5 rounds	2 minutes
	Nadhanusandhana (sectional breathing and chanting)		
	Om Japa		5 minutes
Deep Relaxation Technique (DRT)			5 minutes

Practice Category	Practice Description	Number of Rounds/Cycles	Duration
Closing Prayer			1 minute

The integrated yoga module was developed based on classical yogic texts and contemporary therapeutic protocols, ensuring both traditional authenticity and clinical relevance.

Assessments:

Baseline assessments were conducted prior to the start of the intervention, while post-intervention assessments were completed after the 90 academic-day program. Participants who missed nine consecutive yoga sessions were classified as dropouts. All assessments were designed to capture a comprehensive understanding of each participant's initial status and to evaluate changes following the intervention, thereby enabling a rigorous measurement of the yoga module's effectiveness.

Baseline Assessments: The baseline assessment included a detailed case history, socio-demographic profile, and eligibility screening. Standardized outcome measures relevant to smartphone addiction, academic engagement, and psychological well-being were also administered at baseline and post-intervention to determine intervention impact.

Socio-demographic data sheet: The data sheet was closely prepared, including details about socio-demographic variables such as age, gender, parental education, family socio economic status, physical activity level and extra-curricular participation. The data sheet also contained enquiries regarding the duration, frequency, and modes of functions used on smartphones, as well as the impact of usage on daily life functioning and the offline time given towards different activities.

Additionally, screen-time data were extracted directly from the digital wellness tools available on participants smartphones to ensure objective measurement. Academic attendance records were obtained from institutional databases to support accurate evaluation of academic engagement and consistency throughout the intervention period.

Outcome Measures:

Screen time accademec attendance

The primary outcome measures will include:

1.Smartphone Addiction Scale (SAS-SV):

Smartphone addiction was assessed using the Smartphone Addiction Scale-short version **(**SAS-SV**),** a validated self-report instrument consisting of 10 items across six factors**:**

Daily-life disturbance

Positive anticipation

Withdrawal

Cyberspace-oriented relationships

Overuse

Tolerance

The SAS demonstrates excellent internal consistency **(**Cronbach's $\alpha = 0.966$**)** as reported by Kwon et al. (2013), making it a reliable tool for assessing problematic smartphone use among adolescents (Kwon, M., Kim, D. J., Cho, H., & Yang, S. 2013).

2. Academic Engagement:

Academic engagement was measured using the University Student Engagement Scale (USES) developed by Gupta & Nagpal (2021). The scale conceptualizes engagement as a three-dimensional construct encompassing:

Cognitive engagement

Affective / Emotional engagement

Behavioural engagement

The USES demonstrates strong psychometric properties, including high internal reliability ($\alpha = 0.889$) along with robust convergent and discriminant validity.

Statistical Analysis:

Data will be analyzed using IBM SPSS Statistics with a two-sided $\alpha=0.05$. Intention-to-treat (ITT) analysis will be primary, supplemented by sensitivity analyses using complete-case and per-protocol datasets. Missing data (<10% anticipated) will be imputed using multiple imputation (fully conditional specification); sensitivity to last-observation-carried-forward will also be examined. Normality (Shapiro-Wilk test), homogeneity of variance (Levene's test), and sphericity (Mauchly's test) will be evaluated; non-parametric alternatives (Wilcoxon signed-rank/Mann-Whitney U tests) or data transformations will be applied if assumptions are violated.

Descriptive Statistics

Demographic characteristics (age group, gender, parental education, SES, extracurricular participation, physical activity level) and baseline outcomes will be summarized by group using means ± standard deviations (SD) for continuous variables and frequencies/percentages for categorical variables. Baseline group comparability will be tested using independent samples t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. Effect sizes (Cohen's d for continuous; Cramér's V for categorical) will quantify any imbalances.

Primary and Secondary Inferential Analyses

Within-group pre-to-post changes for primary outcomes (Smartphone Addiction Scale-Short Version [SAS-SV], screen time) and secondary outcomes (academic engagement [AE] 3 dimensions, extracurricular participation, physical activity level, Academic attendance) will be assessed using paired samples t-tests. Between-group post-intervention differences will be examined via analysis of covariance (ANCOVA), with post-scores as the dependent variable, baseline scores as covariates, and group as the fixed factor; one-way ANOVA will provide unadjusted effects. Post-hoc paired t-tests will follow significant ANCOVA results. Effect sizes will include partial eta squared (η^2_p; >0.01 small, >0.06 medium, >0.14 large) and Cohen's d

Correlational and Regression Analyses

Bivariate associations between SAS-SV (pre/post) and outcomes (AE total/domains, screen time, physical activity, extracurricular participation, academic attendance) will be evaluated using Pearson correlation coefficients (Spearman rank if non-normal), interpreting strength and direction ($|r|<0.3$ weak; 0.3–0.5 moderate; >0.5 strong)

Hierarchical multiple linear regression will predict post-intervention total AE, entering post-SAS-SV in Step 1 and demographic covariates in Step 2. Model diagnostics will include R^2/adjusted R^2, ANOVA F-test, standardized β coefficients (95% CI), and variance inflation factor (VIF<5 to confirm no multicollinearity)

Multiple Testing and Sensitivity

Bonferroni correction will adjust for multiple primary/secondary comparisons (~12 tests). Global tests (e.g., MANCOVA) will assess multivariate effects if needed. Outliers will be identified via boxplots/Mahalanobis distance; influential cases (Cook's D) will be evaluated in sensitivity analyses. All results will be reported per CONSORT guidelines for transparency.

Discussion:

This protocol outlines a randomized controlled trial designed to evaluate the effectiveness of an integrated yoga module in reducing smartphone addiction and enhancing academic engagement among pre-university students. The study addresses a critical need for evidence-based, non-pharmacological interventions that can mitigate behavioural and cognitive challenges associated with excessive smartphone use among Pre-University students—a developmental stage marked by rapid brain maturation and heightened vulnerability to addictive behaviours.

Yoga, with its well-documented benefits in promoting mindfulness, enhancing cognitive functioning, and reducing stress, presents a promising intervention for addressing these concerns. Existing research demonstrates that yoga can improve attention, memory, emotional regulation, and overall psychological well-being. However, despite these established benefits, limited empirical work has examined yoga's specific impact on smartphone addiction and related academic outcomes, leaving a significant gap in the literature. This study seeks to address that gap by systematically investigating whether a structured yoga program can reduce maladaptive smartphone use and concurrently strengthen academic engagement.

The randomized controlled design, coupled with pre- and post-intervention assessments, strengthens internal validity and allows for a precise evaluation of changes attributable to the intervention. Additionally, the use of validated and psychometrically sound instruments for measuring smartphone addiction and academic engagement enhances the reliability and interpretability of the findings.

Despite these strengths, the study has certain limitations. The sample is drawn from a single educational institution, which may restrict the generalizability of results to broader populations. Furthermore, the study examines outcomes over one academic semester, limiting insights into the long-term sustainability of the intervention's effects. Future research should consider multi-site trials, larger samples, and extended follow-up

periods to better understand the durability and scalability of yoga-based interventions for adolescent behavioural regulation and academic enhancement.

Conclusion:

This study is expected to provide meaningful understandings into the effectiveness of an integrated yoga module in reducing smartphone addiction and enhancing academic engagement among Pre-University students. If proven effective, the intervention may serve as a practical and non-pharmacological approach to addressing the rising concerns surrounding excessive smartphone use within educational environments. The findings have the potential to guide the development of structured, educational institution-based programs aimed at strengthening students' mental health, cognitive functioning, and overall psychological well-being. Moreover, the results may inform institutional policies and broader educational strategies that promote healthy technology-use behaviours among young people. Ultimately, this research contributes to the growing body of evidence supporting yoga as a holistic, accessible, and sustainable intervention for fostering healthier digital habits and improving academic outcomes in adolescent populations.

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Confidentiality:

To protect participant privacy, each student will be assigned a unique identification number at the time of enrolment. All personal information and research data will be recorded using this identification code, ensuring that no identifiable details appear in the dataset. Data will be entered and securely stored in password-protected Microsoft Excel files.

Access to the collected data will be strictly limited to the principal investigator and co-investigator, ensuring adherence to ethical standards and data protection protocols. The randomization codes used to allocate participants to the intervention and waitlist control groups will also be securely stored and kept confidential throughout the study. No unauthorized individuals will have access to the randomization lists or identifiable participant information.

Declarations:

Securing participant consent: This research will be conducted in full accordance with the institutional regulations and the approved study protocol. Additionally, approval was obtained from RGUKT-RK Valley, Kadapa. The principal investigator will ensure that all participants—and, in the case of minors, their parents or legal guardians—provide written informed consent prior to enrollment in the study. Participants will be informed about the study's purpose, procedures, potential risks, and their right to withdraw at any stage without penalty.

Protocol Amendments:

Any modifications to the research protocol that may affect participant safety, study procedures, or potential benefits will be formally documented, justified, and implemented only after thorough internal review by the research team. All amendments will be prospectively registered in the study records and transparently reported in subsequent publications, ensuring methodological integrity and adherence to ethical research standards.

Conflict of interest: The authors declare that there are no conflicts of interest or competing financial or personal relationships that could have influenced the design, conduct, or reporting of this research.

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