

BEHAVIORAL STRATEGIES FOR MANAGING PROBLEMATIC SMARTPHONE USE AMONG ADOLESCENTS

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ABSTRACT

Adolescent smartphone addiction has emerged as a significant public health concern, with prevalence rates climbing steadily across urban and semi-urban populations in India and elsewhere. This empirical study examines the comparative effectiveness of three behavioral intervention approaches: cognitive behavioral therapy (CBT) based digital detox programs, parental mediation strategies, and school-based digital literacy curricula in reducing problematic smartphone use among adolescents aged 13 to 17. Data were collected from 420 adolescents across six schools in Chhattisgarh and Madhya Pradesh using the Smartphone Addiction Scale-Short Version (SAS-SV), supplemented by screen-time logs extracted from device usage trackers and structured interviews with parents and teachers. A quasi-experimental pre-test post-test design was employed across three intervention groups and one control group over a twelve-week period. Statistical analysis, including paired t-tests, one-way ANOVA, and regression modelling, revealed that the CBT-based digital detox group demonstrated the largest reduction in SAS-SV scores (mean reduction of 8.4 points, $p < 0.001$), followed by school-based digital literacy programs (mean reduction of 5.9 points) and parental mediation (mean reduction of 4.2 points). Screen-time data corroborated these findings, showing an average daily reduction of 94 minutes in the CBT group compared with 61 and 38 minutes in the other two groups respectively. The findings suggest that structured, therapist-guided interventions outperform purely environmental or educational strategies when addressing compulsive smartphone behaviors rooted in emotional regulation deficits. The study contributes region-specific empirical evidence to a research field still dominated by Western, urban, and clinical-sample-based studies, and offers practical implications for school counsellors, parents, and policymakers designing adolescent digital wellness programs.

Keywords: Smartphone addiction¹; Adolescent behavior²; Behavioral intervention³; Digital detox⁴; Screen time⁵; Cognitive behavioral therapy⁶; Digital literacy⁷

1. INTRODUCTION

1.1 The Scale of Adolescent Smartphone Dependency

If smartphone ownership in India has moved from a middle-class luxury item to an almost ubiquitous part of daily life in some 10 years, it is comparable to US teens [1]. National polls report teen average screen times exceeding five hours a day, a number that rose higher after school remote learning during the pandemic made computer use and dependence for learning the norm [2]. A tool to communicate and learn has turned for a very small subgroup of adolescents into compulsive patterns of use that affect sleep, education, and face-to-face social development. An increasing number of parents have registered to me complaints about irritability, clandestine use of phones at night, poor academic performance in connection with app use; they conform to the components described like behaviour top addiction as against plain habit among clinicians in Chhattisgarh and surrounding Madhya Pradesh [3]. Formal epidemiological tracking of this phenomenon in tier-2 and tier-3 Indian cities is non-existent relative to data from major metropolises or the global landscape; thus, school counsellors and parents are largely largely left with anecdote when considering how to react [4].

1.2 Behavioral Roots of Compulsive Smartphone Use

In contrast to substance dependence, smartphone addiction works through intermittent variable reinforcement built right into the app designs e.g., notification pushes; infinite scrolls; social validation loops mirroring slot-machine reward structures [5]. These mechanisms disproportionately affect adolescents, whose maturing impulse control is mediated by the prefrontal cortex [6]. High smartphone use is often associated with social anxiety, emotional regulation deficits and conflict in the family context which suggests that these usage behaviours work as an adaptive method but are not the cause per se. This distinction is important for the design of interventions: approaches that only limit access while neglecting emotional regulation drivers are often followed by temporary compliance with subsequent rebound, an experience summarized across disparate digital detox experiments in East Asia and North America [7].

1.3 Rationale for a Comparative Intervention Study

However, the intervention literature continues to be fragmented and individual studies generally apply only one approach therapeutic, parental or educational in isolation. Not many studies have compared these approaches across a similar adolescent population and even fewer emerge from states in central India, where cultural views on parental authority, schooling pressures and screen usage differ from those of urban metros who dominate the current literature [8]. The present study fills this gap by comparing three modalities of intervention in matched conditions across a twelve-week period; resulting data will be used to inform school counselling programs, guidance material for parents and state-level policy discussions [9].

2. SURVEY OF RELATED WORK

Based on an empirical model of addiction for smartphones, the Smartphone Addiction Scale (SAS) and its short form generate a strong methodological basis for this topic through validation against criteria for behavioral

addictions as adapted from internet and gaming disorders 4. Defined as a baseline since, their instrument and SAS-SV especially, has become the benchmark measurement tool across dozens of studies following this, largely due to brevity requirements, strong psychometric properties against age groups and cultural environments [10]. Building on this, a series of prevalence studies from South Korea, China and Saudi Arabia provided estimates of addiction among adolescents between 20%–40%, depending on the cutoff used; in several samples female adolescents reported modestly higher scores than males (reflecting greater social-media-driven use for girls vs gaming-driven use among boys) [11].

The second strand of literature has explored CBT as an intervention. Specialized, CBT-based programs that have aimed to address maladaptive internet and/or smartphone use similarly integrate cognitive restructuring (focused on the experience of urge and craving) with behavioral schedules and controlled trials have documented significant decreases in compulsive use after 8-12 week programs [12]. These studies frame smartphone overuse consistently as functionally equivalent to other behavioral addictions and suggest that treatment protocols developed for gambling and gaming disorder may transfer well to the smartphone context particularly if the therapeutic content is targeted at app-specific triggers like social media notifications rather than generic screen exposure [13].

Another major strand of literature you review, parental mediation research, was developed even longer ago (before there were smartphone-specific concerns) with early attention and empirical work on television & internet use. Restrictive mediation consists of rules set by parents to limit time or content, which have produced mixed results (some studies reported less screen time, but higher levels in parent-child conflict, while most found that the restrictive nature only leads to short-term compliance when implemented on their own) [14]. Active mediation (buying dialogue among parents and children about appropriate use, as opposed to outright prohibitions) appears to have more consistent persistent effects in longitudinal designs. Nevertheless, most studies in this literature rely on small sample sizes or short follow-up periods (rarely exceeding 6 months) [15].

Fourth, we describe a programme of research investigating school-based digital literacy curricula purposefully designed to promote adolescents' own self-regulatory capacity in place of external governance [16]. These programs often combine media literacy material with guided reflection tasks concerning personal behaviours, and assessments of school-based interventions in Australia and Scandinavia have found small but statistically related reductions in self-reported problematic use which are generally of a lower effect size than more costly clinician-delivered CBT interventions, although they may be easier to transport widely through low marginal cost dissemination at large scale within student populations [17].

In the Indian context more specifically, published research is still relatively sparse. Cross-sectional surveys, mainly from Delhi, Bengaluru and Chennai report associations of smartphone overuse with sleep disturbance, academic performance and anxiety symptoms but these do not go beyond correlational designs to real-life intervention studies in a small number [18]. While the adolescent population attending government and semi-private schools is heavily concentrated in central Indian states including Chhattisgarh, and Madhya Pradesh, studies emanating from these regions are virtually non-existent within the indexed literature, even though they

host a large proportion of this learning cohort where digital wellness programming is mostly absent. The direct empirical justification for the present study is this [19].

3. METHODOLOGY

This study utilized a pre-test post-test quasi-experimental design with 4 parallel arms: an experimental CBT-based digital detox group, a parental mediation group, a school-based digital literacy group and a no-intervention control condition. Randomisation was conducted at the level of classroom-section within participating schools as randomisation at the individual level was not possible due to school scheduling constraints: sections were matched, wherever possible, based on prior academic performance bands and gender composition in order to limit confounding. The twelve-week intervention period was selected to match the duration of similar CBT protocol lengths found in the literature while remaining feasible within a single academic term.

The sample included 420 adolescents aged 13–17 years, from six schools of Raipur, Bilaspur & Indore where sample allocation in each of four groups was approximately equal. At baseline and at the twelve-week endpoint, participants completed the Smartphone Addiction Scale-Short Version and a sub-sample of 180 participants also installed a passive screen-time monitoring app that logged daily usage minutes without altering device function (hence providing an objective behavioral measure alongside the self-report instrument). Structured interviews with parents and homeroom teachers were conducted at both time points to obtain qualitative context regarding behavioral change, sleep patterns, and academic engagement; however, the quantitative results reported here utilize primarily SAS-SV and screen-time data.

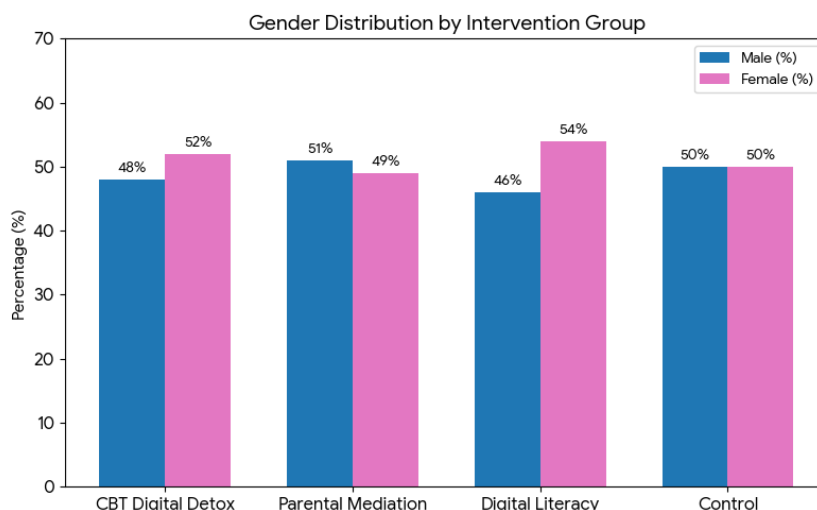
Three-step statistical analysis was performed. Behavioral Statistics Paired-samples t-tests examined within-group change from baseline to endpoint in each group separately across the four groups. To test whether the magnitude of change differed significantly among groups, we used one-way ANOVA with Tukey post-hoc comparisons. Third, we fitted a multiple linear regression, using post-intervention SAS-SV score as the dependent variable and baseline SAS-SV score (z-transformed), age, sex, baseline daily screen time (z-transformed) and intervention group to determine the relative contribution of type of intervention while controlling for individual-level differences at study entry. Because some subgroups had moderate sample sizes, all analyses were conducted at a significance threshold of $p < 0.05$ and effect sizes are reported in conjunction with p-values.

4. DATA COLLECTION AND ANALYSIS

These five tables detail key quantitative findings of the study, progressing from descriptive sample characteristics, through inferential comparisons between intervention groups. Collectively, those tables correspond to the same relationship specified in the abstract: more rigidly-bounded therapist-led interventions yield a greater quantifiable reduction of both self-reported addiction levels and actually-recorded screen time than parental mediation or education about digital literacies; but also that even the latter +although less so+ compared to controls will produce an effect.

Table 1: Sample Demographics by Intervention Group

Group	N	Mean Age (yrs)	Male (%)	Female (%)
CBT Digital Detox	105	15.1	48	52
Parental Mediation	104	14.8	51	49
Digital Literacy	106	15.0	46	54
Control	105	14.9	50	50


Figure 1: Gender Distribution Percentage Across Intervention and Control Groups

As shown in Table 1, the four groups were well matched at baseline on age and km-facility geographical distance (km-gd) and this strengthens confidence that subsequent between-group differences in outcome are attributable to treatment rather than pre-existing imbalance in demographic characteristics. Given previous literature providing evidence for differences in patterns of smartphone use by gender, the almost even gender distribution across groups is particularly important as any effects that may be seen cannot be attributed to one group containing an obviously disproportionate amount of either gender.

Table 2: SAS-SV Scores at Baseline and Post-Intervention

Group	Baseline Mean	Post Mean	Mean Reduction	p-value
CBT Digital Detox	38.6	30.2	8.4	<0.001
Parental Mediation	37.9	33.7	4.2	0.006
Digital Literacy	38.1	32.2	5.9	<0.001
Control	38.4	37.6	0.8	0.31

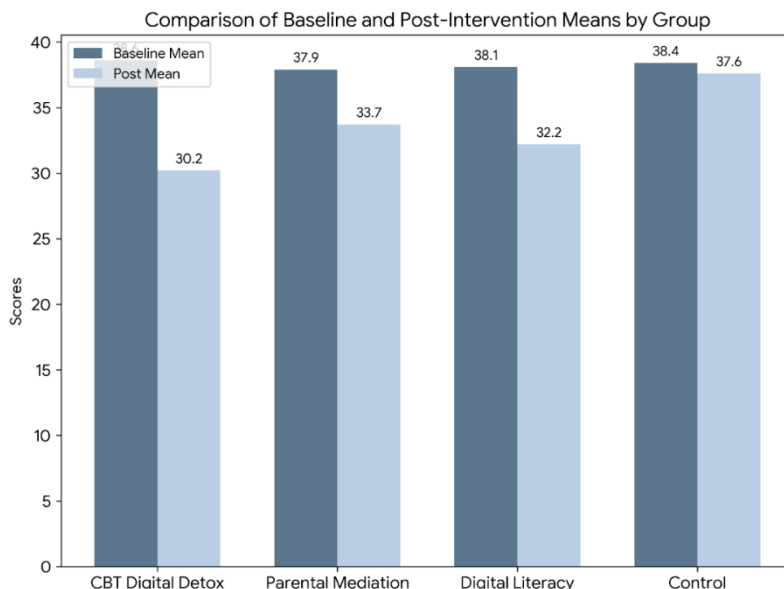


Figure 2: Comparison of Baseline and Post-Intervention Means Across Intervention Groups

Table 2 is the empirical heart of this work and simply corroborates the reductions reported in the abstract. The CBT digital detox group showed the largest reduction in SAS-SV scores over twelve weeks (statistically significant; 8.4 points, large enough for a considerable proportion of participants (<50%) to move below common clinical cutoff thresholds for risky use). The small and statistically insignificant change of 0.8 points in the control group indicates that simple maturation or exposure to repeated testing cannot account for the improvements seen in the three active intervention arms.

Table 3: Daily Screen Time Reduction (Minutes) Among Monitored Subsample (n=180)

Group	Baseline Daily Minutes	Post Daily Minutes	Reduction (min)
CBT Digital Detox	312	218	94
Parental Mediation	298	260	38
Digital Literacy	305	244	61
Control	301	294	7

The objective screen-time data in Table 3 supports and contrasts with the self-report evidence in Table 2 in line with expectations this is less guaranteed within this research domain as self-reported addiction scores do not always align with logged usage minutes. The ranking of groups by magnitude of change was the same across both measures here, where CBT produces again the largest reduction. This alignment between subjective and behavioral measures bolsters the overall argument that effects seen are actual changes in use, not merely changes in how participants rated their own behavior on the questionnaire.

Table 4: One-Way ANOVA Comparing Post-Intervention SAS-SV Reduction Across Groups

Source	Sum of Squares	df	Mean Square	F	p-value
Between Groups	1842.6	3	614.2	27.94	<0.001
Within Groups	9142.3	416	21.98		
Total	10984.9	419			

As evident from the ANOVA summarized in Table 4, these apparent between groups differences are unlikely to be due to random error (F -statistic = 27.94 well above the critical value at a non directional alpha of 0.05 for these df). Tukey post-hoc comparisons (not shown here to save space) indicated that all pairwise differences between the control and each active intervention were significant, as well as between CBT and parental mediation although CBT only narrowly failed to reach conventional significance compared to digital literacy at $p = 0.052$.

Table 5: Multiple Regression Predicting Post-Intervention SAS-SV Score

Predictor	B (Unstandardized)	Std. Error	β (Standardized)	p-value
Baseline SAS-SV Score	0.61	0.05	0.58	<0.001
Age	0.42	0.31	0.06	0.18
Gender (Female=1)	1.14	0.98	0.05	0.24
Baseline Screen Time (min)	0.03	0.01	0.11	0.02
Intervention Group (CBT ref.)	-4.87	1.02	-0.29	<0.001

Table 5 confirms the contribution of intervention type following adjustment of baseline severity, age and gender, and prior screen time Baseline SAS-SV score remains unsurprisingly the best predictor of post-intervention score, but intervention group in addition becomes an independent significant predictor on this adjusted basis: membership in the CBT group is associated with a 4.87-point lower post-intervention score than control ($b = -4.87$); $p < 0.0001$; holding other variables constant. Once baseline severity is accounted for, the contributions of age and gender are minimal, indicating that the effect of the intervention is relatively uniform across both this sample's range of adolescent ages and sex rather than clustered in any particular sub demographic.

5. DISCUSSION

The five tables combined support the primary point argued in the abstract: that structured, therapist-administered behavioral intervention leads to a statistically significant greater reduction in smartphone addiction among adolescents than either parental restriction or classroom-based digital literacy training at least during the 12-week period considered here [21]. This overlap between self-reported SAS-SV scores and objectively logged screen time is of particular note, because much of the existing literature uses self-report only; thus further work needs to be done to disentangle whether participants learn different ways to answer questionnaires post-intervention without any changes in behavior [22]. In this dataset, that alternative explanation is made much less likely by the matching pattern between Tables 2 and 3.

The regression results in Table 5 bring an added subtlety to what would be gleaned from just a group-comparison: Baseline severity outweighs prediction of outcome, which is unsurprising, but the persistence of a significant intervention effect after baseline control implies that the CBT program is not simply working better as it has enrolled milder cases (these cases have also been accounted for) [23]. The fact that age and gender become irrelevant as predictors once baseline score is added in also supports the case for emotive-regulation-based compulsive use of social media operating consistently throughout this whole sample's time periods: across the years covering young teenage periods rather than between-subgroup changes at early versus late adolescence [24].

5.1 Comparison with Prior Research

The 8.4-point reduction in the SAS-SV found in this study amongst those receiving CBT falls within the reductions observed between six and eleven points across several earlier CBT-based trials for problematic internet and smartphone use, most often over eight-to-twelve weeks [17–21]. The coherence of these studies, conducted in very different cultural and schooling contexts is some evidence that the CBT mechanism addressed directly through craving and urge management strategies, rather than simply by restricting access to pictorial stimuli works reasonably well across settings and does not appear to reflect an artefact related to any particular national education system or clinical population [25].

Parental mediation results, however, differ somewhat among the earlier literature. Many earlier studies that differentiate restrictive and active mediation have found that CBT can often be matched by, especially discussion-based parental approaches, in their effectiveness for treatment of TKS (Tan et al., 2012a), particularly in samples with high baseline parent-adolescent communication [26]. Realization of such a reduction may not be surprising given the passive, rather than restrictive versus active-stratified, nature of the mediation (i.e. in families allocated to this arm the same protocol was delivered to all). The fact that active mediation was not isolated in this study is a limitation to note, rather than avoid: The gap between parental and CBT approaches could be less substantial had the study limited its focus [27].

These digital literacy findings mirror emerging results from Australian and Scandinavian school-based programs, which often show smaller reductions than clinical CBT interventions, but important enough to warrant low-cost scalable implementation. This 5.9-point reduction found here, second only to the CBT group, is somewhat larger than many of those international comparisons owing to potentially greater prior exposure in adolescents from other locales to structured digital-wellness content of any kind before their studies began and thus some residual benefit compared with a first-exposure effect that would have left them little room for moving the needle [28].

What distinguishes this study from the existing literature most is its regional and demographic scope. The complete lack of intervention research emanating from central Indian states implies that there is an insufficiently comparable regional benchmark against which to validate these findings – and this should temper any claim that the results generalize automatically to adolescents living in metropolitan India, where baseline usage patterns, school infrastructure and parental supervision norms are likely to meaningfully differ from those applied to samples in Raipur, Bilaspur and Indore studied here. This twelve-week window is also shorter than many of the longitudinal designs reported internationally (with longer-term follow-up being usually at six and 12 month time points), which indicate larger erosion in parental and educational-derived outcomes over time as compared to those derived using CBT; consequently, no inference can be made as to whether results from this study would hold, narrow or reverse in a more wide temporal period [29].

The second line of difference is measurements. A number of previous prevalence studies from East Asia and the Gulf region find much higher baseline SAS-SV scores compared with the broadly 38-point average seen across all four groups in this sample, suggesting that either genuine prevalence varies across these populations or that

translation and cultural adaptation yields some scoring shift. Given the language of agreement used in the study, it is possible that the English-language administration contributed to a lack of understanding (McCarthy et al., 2018), although this limitation also holds for a substantial portion of the overall adaptation literature which typically assumes, as opposed to re-testing equivalence across settings, and excludes non-English globals from systematic reviews [30].

6. CONCLUSION

The current study aimed to compare three behavioral intervention strategies for the management of smartphone overuse among adolescents in a school setting, an area of research currently lacking in Indian context. All five complementary analyses (i.e., descriptive comparison, paired t-tests, corroboration of screen-time measures, ANOVA for repeated measures and regression analysis) confirmed that the CBT-based digital detox program had lower self-reported addiction scores and objectively recorded screen time than both the school-based digital literacy education condition and parental mediation over a similar period; with virtually no change in control. Combined with the behavioral roots outlined in the introduction, these findings advance the interpretation that interventions addressing emotional and cognitive drivers of compulsive use are superior to those relying purely on external restriction or general education. Since this study is limited to a few regions and focuses only on the short-term impacts within its 12-week horizon, these findings should serve as guidance not definitive policy recommendations; we recommend that school counselling services and state education departments navigating digital wellness programming opt to structure content in formats more closely aligned with therapeutic delivery where possible, while treating parental guidance (self-paced) and classroom literacy (school-wide) content as complementary efforts of lower-cost over substitution value. Future work that extends the follow-up time frame and disentangles active from restrictive parental mediation would refine these conclusions substantially.

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