

Smartphone and Social Media Engagement, Stress and Sleep Patterns among Teenagers in California.

Abstract

Smartphones have become an integral part of teenagers' daily lives, providing ways to communicate, learn, access entertainment, and stay connected through social media. However, the ways teenagers use these features may also be related to their stress levels and sleep habits. This study examines the relationship between smartphone and social media engagement, self-reported stress and mood, and usual bedtime among teenagers in California. Primary survey data were collected from 117 teenagers using a structured questionnaire. Responses to seven Likert-scale items were combined to calculate an overall Engagement Score. Pearson's correlation and multiple linear regression analyses were then used to examine the relationships between engagement, stress and mood, and bedtime. The results showed a moderate positive correlation between Engagement Score and the stress/mood measure ($r = 0.556$) and a moderate negative correlation between Engagement Score and bedtime ($r = -0.307$). The relationship between stress/mood and bedtime was weak and not statistically significant ($r = -0.148$). The regression analysis also showed that the stress/mood measure was positively associated with Engagement Score, while bedtime had a significant negative association. Together, the predictors explained 32.6% of the variation in Engagement Score ($R^2 = 0.326$). These findings suggest that teenagers' engagement with smartphone and social media features is associated with both their self-reported stress and mood and their bedtime patterns. The study provides insight into adolescent digital habits and may help inform discussions among parents, educators, and healthcare professionals about encouraging healthier technology use.

Keywords: Smartphone addiction, Mental stress, Sleep quality, Teenagers, California, Behavioural addiction, Primary survey

Introduction

Smartphones have become a regular part of everyday life, especially for teenagers, who use them to communicate, access educational resources, watch entertainment, and interact on social media. Although these devices offer many benefits, the amount of time and attention teenagers devote to them has raised concerns about how smartphone use may relate to their mental well-being and sleep habits.

Adolescence is an important stage of development, marked by changes in emotional, psychological, and social functioning. During this period, habits involving technology may become closely tied to daily routines and emotional experiences. Frequent or difficult-to-control smartphone use may be associated with increased stress, reduced concentration, and changes in sleep patterns. Researchers have also examined problematic smartphone use as a behavioural concern, particularly when individuals struggle to control their usage or when it begins to interfere with everyday activities (Billieux, 2012; Kwon et al., 2013).

Previous research has found associations between problematic smartphone use and mental health concerns, including stress, anxiety, depressive symptoms, and lower emotional well-being (Elhai et al.,

2017). Sleep is another important area of concern. Using smartphones late at night, responding to notifications, and spending extended periods on social media may delay bedtime and interfere with sleep. Exposure to screen light can also affect the body's natural sleep-wake cycle (Demirci et al., 2015). Inadequate sleep may then contribute to difficulties with emotional regulation, concentration, and academic performance. These relationships make it important to examine smartphone habits alongside teenagers' emotional experiences and sleep routines.

California offers a relevant setting for studying these relationships among adolescents. Smartphones and online platforms are part of everyday life for many teenagers, yet their experiences with digital technology may differ depending on their habits and circumstances. Examining data collected directly from teenagers can provide a closer look at how smartphone engagement relates to their reported stress and bedtime patterns within this population.

The present study explores the relationship between engagement with smartphone and social media features, self-reported stress and mood, and usual bedtime among teenagers in California. Using primary survey data, the study examines whether stronger engagement is associated with differences in reported stress and mood or bedtime. Rather than assuming that smartphone use directly causes these outcomes, the study focuses on identifying patterns and relationships within the collected responses. The findings may contribute to a better understanding of adolescent digital habits and inform conversations about healthier technology use.

Review of Literature

The growing use of smartphones has received considerable attention from researchers over the past decade. Problematic smartphone use involves more than simply spending a lot of time on a device; it can also include difficulty controlling usage, continuing to use a phone despite negative consequences, and feeling uncomfortable when unable to access it (Kwon et al., 2013). Kwon et al. (2013) developed the Smartphone Addiction Scale (SAS), a widely used tool for assessing problematic smartphone use. Their research helped identify behaviours associated with smartphone addiction, including reduced self-control and interference with daily activities.

Billieux (2012) suggested that problematic smartphone use may be related to impulsive behaviour and difficulties managing emotions. Some individuals may turn to their phones to distract themselves from stress or other uncomfortable feelings, potentially reinforcing their reliance on digital devices. Similarly, Elhai et al. (2017) found associations between problematic smartphone use and anxiety, depression, and stress. However, this relationship may work in both directions: psychological distress may encourage greater smartphone use, while problematic use may also be associated with increased distress.

Although many studies examine the amount of time people spend on their phones, the features of digital platforms may also influence how users interact with them. Many apps include features such as infinite scrolling, autoplay, notifications, and algorithmically recommended content that make it easy to continue browsing. A 2023 Common Sense Media report highlighted platform features that may encourage prolonged social media engagement. By removing natural stopping points, features such as infinite scrolling and autoplay can make it easier for users to continue viewing content longer than they originally intended.

Recent research on adolescents has also examined repeated and automatic engagement with digital content, sometimes described as “mindless usage” (Ali et al., 2026). Features such as autoplay, endless feeds, and recommended content may encourage users to continue browsing without consciously deciding to do so. Wilmer, Sherman, and Chein (2017) examined the relationship between smartphone use and cognitive functioning, including the effects of phone-related interruptions on attention. These findings suggest that smartphone engagement may be influenced by both individual behaviour and the design of digital platforms.

Teenagers may be particularly responsive to these features because adolescence involves ongoing development in areas such as self-regulation, reward sensitivity, and social motivation (Odgers & Jensen, 2020). Although smartphones provide valuable opportunities for learning and social connection, digital engagement can also be associated with behavioural and mental health concerns. Features such as notifications, social feedback, and algorithm-based feeds may influence teenagers' usage habits, making it important to understand how these features relate to their everyday experiences.

Previous studies have also explored the relationship between smartphone use and psychological well-being. Elhai et al. (2017) found associations between problematic smartphone use and anxiety, depression, and psychological distress. Thomée, Härenstam, and Hagberg (2011) followed young adults over time and found that certain patterns of mobile phone use were associated with stress, sleep disturbances, and depressive symptoms. Their findings suggest that mobile phone use and psychological well-being may be related over time. Similarly, Twenge and Campbell (2018) reported an association between greater screen time and lower psychological well-being among adolescents. Together, these studies highlight the importance of examining how digital habits relate to mental health, while recognizing that these associations do not necessarily establish cause and effect.

Sleep is another area frequently examined in research on smartphone use. Demirci, Akgönül, and Akpınar (2015) found that problematic smartphone use was associated with poorer sleep quality and lower quality of life among university students. Levenson et al. (2017) also found an association between greater social media use and sleep disturbances among young adults. One possible explanation is that activities such as watching videos, scrolling through social media, and responding to late-night notifications can keep users engaged with their devices beyond their intended bedtime. Screen exposure and continued mental engagement may also interfere with regular sleep routines. These findings highlight the importance of examining smartphone habits alongside sleep-related behaviours, although bedtime alone does not necessarily indicate sleep quality or duration.

Overall, previous research has established associations between problematic smartphone use, psychological distress, and sleep-related difficulties. However, many studies focus on total screen time or general smartphone addiction rather than the specific features that encourage continued engagement. Fewer studies examine engagement with these features alongside stress and bedtime patterns within the same teenage population. To address this gap, the present study examines teenagers' engagement with smartphone and social media features, self-reported stress and mood, and usual bedtime using primary survey data collected from 117 teenagers in California. Responses to seven questionnaire items were combined into an overall Engagement Score to examine how engagement relates to the other measures. By focusing on specific features rather than screen time alone, this study aims to provide a clearer understanding of how digital engagement relates to teenagers' reported emotional experiences and bedtime patterns.

121 **Research gap**

122 Most existing research focuses on "screen time" as the main measure of smartphone use, mainly looking
123 at how many hours teenagers spend on their phones. However, fewer studies examine why this use can
124 be difficult to control. In particular, less research looks at specific platform features, such as autoplay,
125 notifications, and algorithm-based recommendations, and how these features may be connected to stress
126 and sleep within the same group of teenagers.

127 This study addresses this gap by looking beyond the amount of time teenagers spend on their phones. It
128 also measures how strongly they respond to specific features that encourage continued use, along with
129 measures of stress and mood and sleep patterns from the same participants. This approach provides a
130 more detailed view of how smartphone design and usage may be related to teenagers' well-being.

131 **Objectives of the Study**

132 The study has the following objectives:

- 133 1. To assess the level of smartphone addiction among teenagers in California.
- 134 2. To examine the relationship between smartphone addiction and mental stress.
- 135 3. To investigate the relationship between smartphone addiction and sleep quality.
- 136 4. To analyse the relationship between mental stress and sleep quality.
- 137 5. To determine the combined influence of mental stress and sleep quality on smartphone addiction.
- 138 6. To suggest policy measures for promoting healthier smartphone usage among adolescents.
- 139

140 **Research methodology**

141 This study used a quantitative survey to examine the relationship between smartphone and social media
142 use, stress, and sleep among teenagers. The survey was created using Google Forms and shared with
143 teenagers, resulting in 117 responses.

144 The survey consisted of four sections:

- 145 1. Basic information - Participants reported their gender, age, and education level.
- 146 2. Smartphone use - Participants reported the number of hours they typically spend on their phones
147 each day and the number of social media platforms they regularly use.
- 148 3. Engagement with app features - Participants answered seven questions about specific
149 smartphone and social media features and habits. These questions asked whether they spend
150 more time on their phones than they originally planned, whether autoplay or short-form videos
151 keep them watching, whether they have missed schoolwork because of their phone, whether
152 notifications encourage them to return to their phone, whether content becomes more interesting
153 the longer they scroll, whether they lose track of time while using their phone, and whether they
154 use their phone in bed before going to sleep. Each question was answered using a 5-point scale
155 ranging from "Strongly Disagree" to "Strongly Agree." The seven responses were added together
156 to create an overall Engagement Score, ranging from 7 to 35. A higher score indicates a stronger
157 tendency to be drawn into smartphone and social media use.
- 158 4. Mood, stress, and sleep - Participants answered one question about their mood or stress after
159 using social media and one question about their usual bedtime on a school night.

160 To analyze the data, Pearson's correlation was used to examine the strength and direction of the
161 relationships between Engagement Score, the mood/stress measure, and bedtime. A multiple linear
162 regression was then conducted to determine whether the mood/stress measure and bedtime could
163 together predict Engagement Score. This allowed the study to examine not only whether these variables
164 were related, but also how much they contributed to differences in participants' Engagement Scores.

165 Prior to statistical analysis, the data were examined for completeness and consistency. Descriptive
166 statistics were used to summarize respondent characteristics and construct scores. Pearson's correlation
167 analysis was employed to examine the direction and strength of the relationships among smartphone
168 addiction, mental stress, and sleep quality. Subsequently, multiple linear regression analysis was
169 performed to estimate the combined influence of mental stress and sleep quality on smartphone
170 addiction. The empirical model estimated in the study is expressed as:

171
$$\text{Smartphone Addiction} = \beta_0 + \beta_1 \text{Sleep_Quality} + \beta_2 \text{Mental_Stress} + \varepsilon$$

172 where β_0 is the intercept, β_1 and β_2 are the regression coefficients, and ε is the stochastic error term.
173 Statistical significance was evaluated at the 5% level. The analytical procedures follow standard
174 quantitative methods widely used in behavioural and psychological research (Cohen et al., 2018; Field,
175 2018).

176 Results and discussion

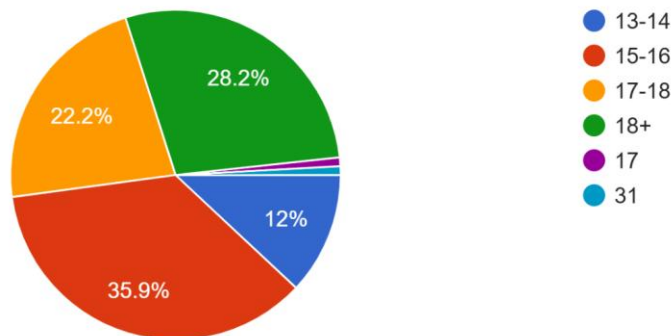
177 Discussion for objective 1- Assessing the level of smartphone addiction among teenagers in 178 California.

179 A total of 117 teenagers responded to the survey. The largest age groups were 15–16 years old, with 42
180 participants, and 18 years or older, with 34 participants. There were also 27 participants who were 17–
181 18 years old and 14 who were 13–14 years old.

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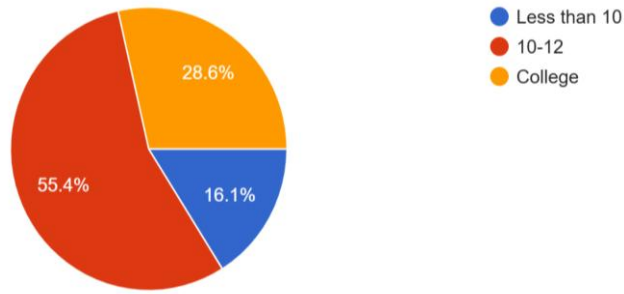
How old are you?

117 responses



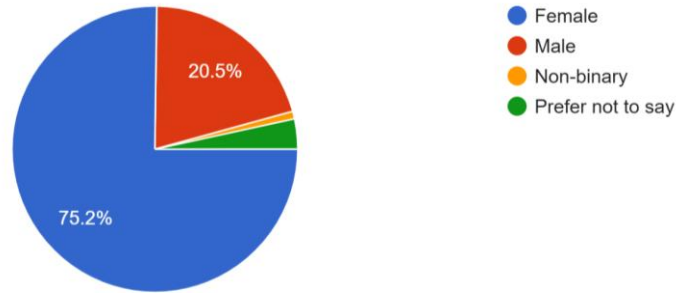
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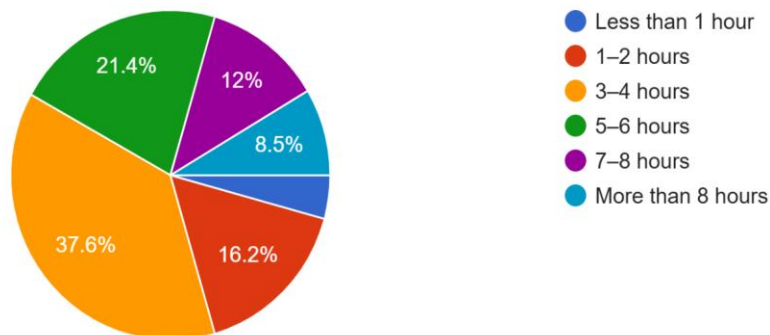
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186 The sample was mostly female, with 88 female participants, 24 male participants, 4 participants who
 187 preferred not to report their gender, and 1 non-binary participant. Because females made up the majority
 188 of the sample, the findings may reflect the experiences of female teenagers more strongly than those of
 189 other gender groups.



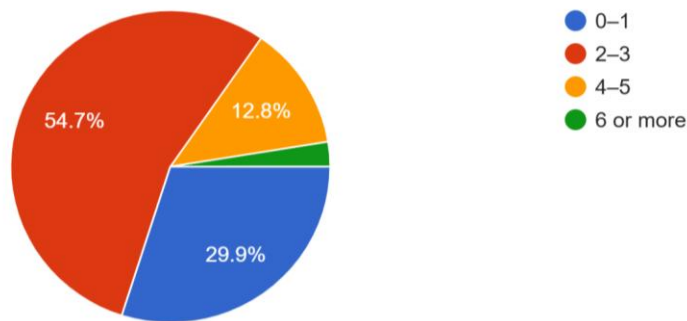
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191 In terms of smartphone use, 44 participants reported using their phones for 3–4 hours per day, making
 192 this the most common usage range. Another 25 participants reported 5–6 hours of daily phone use. Most
 193 participants also reported regularly using 2–3 social media platforms, with 64 participants falling into
 194 this group.



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198 The seven engagement items combined into an overall Engagement Score, with an average of 24.8 out
 199 of 35 a relatively high level of engagement with the features measured. When grouped, 39 participants
 200 (33%) fell into Low Engagement, 50 (43%) into Moderate, and 28 (24%) into High Engagement.

201 The individual questions that made up the Engagement Score show why these scores were relatively
 202 high. When asked whether they often spend more time on their phones than they originally intended,
 203 47.0% of participants selected "Agree" and 22.2% selected "Strongly Agree." Together, 69.2% reported
 204 that they often use their phones for longer than planned. In comparison, approximately 7.7% disagreed
 205 or strongly disagreed, while 23.1% remained neutral. This shows that spending more time on a phone
 206 than originally planned was a common experience among participants.

207 A similar pattern appeared when participants were asked whether features such as autoplay, short-form
 208 videos, and recommended content encourage them to spend more time on apps than they planned. 46.2%
 209 agreed and 19.7% strongly agreed, resulting in a combined 65.9% who reported being encouraged to
 210 spend longer on apps because of these features. Only 12.7% disagreed or strongly disagreed, while the
 211 remaining participants were neutral. These responses suggest that many teenagers in the sample
 212 perceived specific platform features as contributing to longer periods of smartphone use.

213 The results were more mixed when the questions focused on the consequences of smartphone use. When
 214 asked whether they had missed or delayed schoolwork, homework, or other responsibilities because of
 215 their phone or social media use, 33.3% agreed and 14.5% strongly agreed. This means that 47.8% of
 216 participants reported some level of interference with their academic or personal responsibilities.
 217 However, 28.2% disagreed, 7.7% strongly disagreed, and 16.2% remained neutral. Compared with the
 218 first two questions, these results suggest that while extended phone use was common, its effect on
 219 responsibilities varied more between participants.

220 Notifications showed a somewhat weaker but still notable pattern. 40.2% of participants agreed and
 221 11.1% strongly agreed that notifications about new content, trends, or updates encourage them to return
 222 to their phones, for a combined 51.3%. Meanwhile, 21.4% disagreed, 8.5% strongly disagreed, and
 223 18.8% remained neutral. This suggests that notifications may not affect participants as consistently as
 224 features such as autoplay, short-form videos, and recommended content, although they still appeared to
 225 influence phone use for more than half of the sample.

226 Overall, the individual responses support the distribution of the Engagement Score. A clear majority of
 227 participants reported using their phones for longer than intended and experiencing longer use in

connection with specific engagement features. However, fewer participants reported that this use interfered with their academic or personal responsibilities. This suggests that strong engagement with smartphone features was common in the sample, while the extent to which that engagement affected daily responsibilities differed between individuals.

Discussion for objectives 2, 3, 4- How engagement connects to stress and sleep

What we compared	Correlation (r)	Significant?
Engagement Score & Stress/mood question	0.556	Yes
Engagement Score & Bedtime	-0.307	Yes
Stress/mood question & Bedtime	-0.148	No

These results suggest that teenagers with higher Engagement Scores were more likely to report feeling stressed or experiencing a worse mood after using social media. Higher Engagement Scores were also associated with later bedtimes, suggesting that stronger engagement with these features may be related to later sleep schedules. In this study, the strongest relationship was between Engagement Score and the stress/mood measure ($r = 0.556$). This suggests that teenagers who were more strongly affected by these engagement features were also more likely to report feeling stressed or experiencing a worse mood after using social media. However, because this study used a cross-sectional design, it cannot determine which factor comes first. It is possible that greater engagement contributes to stress, that stressed teenagers are more likely to engage with these features, or that both patterns influence each other.

Interestingly, the stress/mood measure and bedtime were not significantly correlated with each other ($r = -0.148$). This suggests that, within this sample, the two outcomes did not have a strong direct relationship. Instead, both may be related to participants' engagement with smartphone and social media features, although the study cannot determine whether one causes the other.

Late-night smartphone use was one of the most commonly reported behaviors in the survey. When asked whether they use their phones in bed to scroll, watch videos, or check notifications before falling asleep, 47.0% of participants agreed and 21.4% strongly agreed. Together, 68.4% reported using their phones in bed before sleeping. In comparison, approximately 22.3% disagreed or strongly disagreed, while 9.4% remained neutral. This was one of the highest agreement rates among the seven engagement items, suggesting that smartphone use is a common part of bedtime routines for many participants.

Participants showed more varied responses when asked about their emotional experiences after using social media. 24.8% agreed and 14.5% strongly agreed that they often feel more stressed, tired, or in a worse mood after spending time on social media, resulting in a combined 39.3%. Meanwhile, 22.2% disagreed and approximately 4.3% strongly disagreed, while 31.6% remained neutral. Compared with the other engagement items, these responses were more evenly distributed. This suggests that although many participants reported being strongly drawn to their phones, fewer consistently reported negative emotional effects after using social media.

260 The survey also showed relatively late bedtimes among participants on school nights. The largest group,
261 35.0%, reported going to bed between 11:00 PM and 12:00 AM, followed by 32.5% who reported a
262 bedtime between 10:00 PM and 11:00 PM. Another 16.2% reported going to bed after midnight. In
263 comparison, approximately 13.7% reported going to bed between 9:00 PM and 10:00 PM, with fewer
264 participants reporting bedtimes earlier than 9:00 PM.

265 Sleep duration was also concentrated in the lower ranges. Nearly half of the participants (49.6%)
266 reported getting 6-7 hours of sleep on a typical school night, while 21.4% reported 5-6 hours.
267 Approximately 23.9% reported getting 7-8 hours, while relatively few participants reported more than 8
268 hours or less than 5 hours.

269 Taken together, these results show that late-night smartphone use and later bedtimes were common
270 among the teenagers surveyed. The fact that 68.4% reported using their phones in bed before sleeping is
271 particularly notable because it suggests that smartphone engagement extends into participants' nighttime
272 routines. However, these findings describe patterns within the sample and do not establish that
273 smartphone use directly caused later bedtimes or shorter sleep duration.

274 Discussion for objective 5-

275 To examine the combined influence of mental stress and sleep quality on smartphone addiction, a
276 multiple linear regression model was estimated.

277 Model Summary

Statistic	Value
Multiple R	0.571
R ²	0.326
Adjusted R ²	0.314
Standard Error	4.569
Observations	117
F-statistic	27.554
Significance F	<0.001

278 Regression Coefficients

Variable	Coefficient	Standard Error	t-value	p-value
Intercept	29.364	2.446	12.007	<0.001
Sleep Quality	-0.826	0.207	-3.999	<0.001

Mental Stress	1.890	0.387	4.884	<0.001
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The overall regression model is statistically significant ($F = 27.554$, $p < 0.001$), indicating that mental stress and sleep quality jointly explain a significant proportion of the variation in smartphone addiction. The coefficient of determination ($R^2 = 0.326$) suggests that approximately 32.6% of the variation in smartphone addiction is explained by the two explanatory variables.

Stress was positively associated with Engagement Score ($B = 1.890$, $p < .001$), while the sleep quality variable was negatively associated with Engagement Score ($B = -0.826$, $p < .001$). suggesting that better sleep quality is associated with lower levels of smartphone addiction. The empirical findings support the hypothesis that smartphone addiction is positively associated with mental stress and negatively associated with sleep quality. The regression results further demonstrate that mental stress is a stronger predictor of smartphone addiction than sleep quality, suggesting that psychological interventions aimed at stress reduction may also contribute to healthier smartphone usage among adolescents. The results are consistent with the behavioural addiction framework proposed by Billieux (2012), which argues that individuals often use smartphones as coping mechanisms during periods of emotional distress. The positive relationship between stress and smartphone addiction also supports the findings of Elhai et al. (2017), who reported that adolescents experiencing psychological distress tend to engage in compulsive smartphone use. Similarly, the negative relationship between smartphone addiction and sleep quality corroborates the work of Demirci et al. (2015) and Levenson et al. (2017), who concluded that prolonged smartphone use before bedtime significantly disrupts sleep.

The regression findings reinforce the correlation analysis and indicate that psychological well-being and healthy sleep habits play an important role in explaining smartphone addiction among teenagers. These findings also support the main idea presented in the Introduction: looking at why smartphone use is difficult to stop may provide more useful information than looking at screen time alone. Total screen time does not show whether someone is using their phone passively or repeatedly engaging with features that encourage continued use. The Engagement Score used in this study attempts to capture this difference by focusing on specific behaviors and design features.

Policy Implications

The findings of the study have several practical implications:

- Schools should incorporate digital wellness and responsible smartphone usage programmes into their curricula.
- Parents should monitor excessive smartphone use and encourage balanced digital habits.
- Educational institutions should provide counselling services addressing stress management and healthy sleep practices.
- Healthcare professionals should consider problematic smartphone use when assessing adolescent mental health.
- Policymakers should promote awareness campaigns highlighting the psychological consequences of excessive smartphone use.

Limitations

Several limitations should be considered when interpreting the findings of this study:

- Single-question stress measure: Stress was measured using only one question rather than a validated psychological scale. Therefore, this measure should be viewed as an indication of participants' reported mood or stress rather than a complete measure of psychological stress.
- Limited sleep measure: Sleep was measured only through participants' usual bedtime. The study did not measure total sleep duration, sleep quality, or other factors that can affect sleep.
- Uneven gender distribution: The sample included substantially more female participants than male participants. As a result, the findings may not represent the experiences of teenagers across different gender groups equally.
- Convenience sampling: The sample size is limited to 117 respondents and was selected using convenience sampling rather than randomly selected from the broader teenage population, which may restrict the generalisability of the findings. This means the results may not be representative of all teenagers and should be interpreted as findings from this particular sample rather than as estimates for the entire teenage population.

Future studies may employ larger and more representative samples across different states or countries. Longitudinal studies could provide stronger evidence regarding causality. Researchers may also incorporate additional variables such as anxiety, depression, self-esteem, academic performance, family environment, and social media usage. Advanced statistical techniques, including Structural Equation Modelling (SEM) and mediation analysis, may provide deeper insights into the mechanisms linking smartphone addiction with adolescent mental health.

Conclusion

This study examined how teenagers' engagement with smartphone and social media features – such as autoplay, notifications, and algorithmically recommended content – is related to self-reported stress and bedtime patterns. Using survey data from 117 teenagers in California, the study looked beyond total screen time by creating an Engagement Score that measured how strongly participants responded to features that can encourage continued use.

The results showed that engagement with these features was common within the sample. A large majority of participants reported spending more time on their phones than they originally intended, and many also reported that features such as autoplay, short-form content, and recommended content encouraged them to continue using their phones. More than two-thirds reported using their phones in bed before sleeping. Fewer participants reported that their phone use interfered with schoolwork or other responsibilities, suggesting that while extended smartphone use was common, its effects on daily responsibilities varied between individuals.

Higher Engagement Scores were associated with greater self-reported stress or a worse mood after social media use, as well as later bedtimes. The regression analysis showed that the stress/mood measure and bedtime together explained a meaningful portion of the variation in Engagement Score, with both variables making significant contributions to the model. However, stress and bedtime were not significantly related to each other. This suggests that, within this sample, these two outcomes may be related to smartphone engagement in different ways rather than one clearly explaining the other.

These findings support the idea that problematic smartphone use may involve more than simply the amount of time teenagers spend on their phones. The specific features they interact with may also play a

role in keeping them engaged. This may be particularly important during adolescence, when self-regulation and impulse control are still developing. The findings therefore suggest that addressing problematic smartphone use may require attention to individual behavior as well as the ways digital platforms are designed to encourage continued engagement.

Several limitations should be considered when interpreting these findings. The study used a cross-sectional design, meaning it could identify relationships between variables but could not establish cause and effect. It also relied on a convenience sample, single-item measures for stress and bedtime, and an uneven gender distribution. Therefore, the findings should be understood as describing this particular sample rather than representing all teenagers.

Future research could strengthen these findings by using validated psychological and sleep measures, larger and more representative samples, and longitudinal designs that follow participants over time. Even with these limitations, the results suggest that studying why teenagers continue using their phones may provide information that cannot be captured by screen time alone. Understanding the role of engagement-driven features may help parents, educators, researchers, and policymakers develop more informed approaches to supporting healthier digital habits among teenagers.

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