IJOPE
INTERNATIONAL JOURNAL OF
PSYCHOLOGY AND EDUCATION

Original Article

From Learning Tool to Behavioural Addiction: Assessing Smartphone Use among Ghanaian Undergraduate Students

Cyril Mawuli HONU-MENSAH[1]

[1] Department of Special Education, University of Education, Winneba, Ghana

Correspondence: cmmensah@uew.edu.gh

Abstract

The proliferation of smartphones has transformed higher education landscapes, particularly in the Global South, where mobile technology is a primary tool for both academic and social engagement. This study investigates the nature and extent of smartphone addiction among undergraduate students at the University of Education, Winneba, Ghana. Grounded in the Interaction of Person-Affect-Cognition-Execution (I-PACE) model, the research reveals subclinical problematic smartphone use (PSU) and clinical smartphone addiction. A cross-sectional survey design was adopted, utilizing the Smartphone Addiction Scale–Short Version (SAS-SV) to assess responses from 567 undergraduate students. Results revealed that 59.3% of students exhibited problematic smartphone usage indicating high levels of addiction, with significant differences observed across age and gender. Younger students (≤24 years) and males demonstrated greater susceptibility. Although the average duration of daily smartphone use did not significantly predict addiction levels, qualitative usage patterns, such as multipurpose use (92.9%) and engagement with social networking and entertainment applications, were implicated in reinforcing compulsive behaviours. The study underscores the dual role of smartphones as both academic aids and sources of behavioural addiction. Findings support the need for targeted interventions that address age- and gender-specific risk factors, promote digital self-regulation, and distinguish between problematic and addictive use. The implications of excessive smartphone engagement extend beyond academic performance to encompass psychological and physical well-being, calling for institutional policies that balance digital integration with mental health safeguards.

KEYWORDS: Smartphone, SAS-SV, Addiction, Undergraduate, Ghana, I-PACE Model

1.0 INTRODUCTION

The proliferation of smartphones in the Global South (Aker & Mbiti, 2010) has transformed the way undergraduate students interact, learn, and navigate their academic environments. While smartphones offer numerous benefits, such as access to information and educational resources, their excessive use has raised concerns about their impact on mental health (Achangwa et al., 2023), ergonomics (Ayhualem et al., 2021, Xie et al., 2017) and academic distraction (Ifeanyi & Chukwuere, 2018; Mendoza et al., 2018).

Smartphones have undergone a significant evolution, transforming from their initial function as tools for interpersonal communication into multifaceted digital platforms (Goggin, 2010). As fundamental elements of contemporary information and communication technologies in Africa, smartphones have overtaken the use of personal computers (Aker & Mbiti, 2010) and now act as primary gateways to the internet (Donner, 2015), profoundly influencing how individuals engage with digital content and interact with one another (Gezgin et al., 2018; Vanden Abeele, 2021). Beyond basic voice calls and text messaging, the abundance of mobile applications has rendered smartphones indispensable for various daily activities. These applications facilitate a wide spectrum of tasks, including browsing and interaction on social networking sites (Gritti et al., 2023), online shopping (Srivastava & Thaichon, 2023), and mobile gaming (Oulasvirta et. al., 2012; Samaha & Hawi, 2016). The efficiency with which smartphones support these everyday practices significantly contributes to their widespread adoption. Furthermore, the immersive experiences offered by digital environments, where users can create and interact through virtual identities, enhance their appeal and further integrate smartphones into the routines of modern life (Gökçearslan et al., 2016; Slater, 2018; Przybylski, & Weinstein, 2019).

While smartphones are initially adopted by university students for academic purposes such as accessing learning materials, participating in online classes, or communicating with peers, their multifunctional design often leads to a gradual shift toward non-academic use. This transition is supported by empirical findings Abdulmalik & Anka (2024) and Amez & Baert, (2020) indicating that students frequently begin with academic intentions but are easily diverted by social networking, gaming, and entertainment applications, which are readily accessible on the same device (Gökçearslan et al., 2016).

Demographic variables such as age, gender, and duration of smartphone use have been identified as significant predictors of smartphone addiction, supported by a growing body of empirical research (Olson et al., 2023; Pirwani et. al., 2025). Gender differences are well documented, with some studies indicating that male students are more susceptible to addiction due to higher engagement in mobile gaming and risk-taking behaviours (Pirwani et. al., 2025; Zeerak et al., 2024). Conversely, while females may spend more time on smartphones, primarily for social networking, their usage patterns often reflect problematic, though not necessarily addictive, behaviours (Billieux et al., 2015; Nayak, 2018; Mukherjee & Pandey, 2024). Age is another critical

factor, with younger users, particularly digital natives, exhibiting greater vulnerability to smartphone addiction due to early exposure to technology and a tendency to use smartphones for both academic and emotional regulation purposes (Candussi et al., 2023; Olson et al., 2023). Moreover, the duration of daily smartphone use has been positively correlated with addiction severity, as prolonged exposure increases the likelihood of compulsive behaviours and cognitive-emotional dependence on the device (Gökçearslan et al., 2016; Lin et al., 2017).

The pervasive use of smartphones has led to the examination of a phenomenon commonly referred to as "problematic smartphone use" (Billieux et al., 2015; Sohn et al., 2019; Panova & Carbonell, 2018). The excessive engagement with smartphones has been conceptualized within the framework of behavioural addiction, characterized by compulsive patterns of use that mirror traditional addiction models (Ting & Chen, 2020). This phenomenon is reinforced by the pursuit of pleasurable experiences and an overwhelming urge to engage in smartphone-related activities, often despite adverse consequences (Müezzin, 2023). Within the context of problematic smartphone use, these behavioural manifestations align with established addiction theories, highlighting the interplay between gratification-seeking behaviours and compulsive digital engagement (Harris et al., 2020).

1.1 Theoretical framework

The study adopts the Interaction of Person-Affect-Cognition-Execution (I-PACE) model (Brand et al., 2016) as its primary theoretical framework. This comprehensive model explains behavioural addictions through four interconnected components: (1) predisposing individual characteristics (Person), (2) affective and cognitive responses (Affect-Cognition), and (3) executive functioning and decision-making processes (Execution). The I-PACE model is particularly relevant for understanding smartphone addiction as it accounts for how personal vulnerabilities (e.g., age, digital nativity) interact with the reinforcing properties of smartphone applications to create compulsive usage patterns.

Building on this framework, the study clearly differentiates between behavioural addiction and problematic smartphone use (PSU) by applying established diagnostic criteria. Following the DSM-5's classification of Internet Gaming Disorder and ICD-11's definition of compulsive digital behaviours, smartphone addiction is operationalized as meeting five key criteria: (1) impaired control over use, (2) increasing priority given to smartphone activities, (3) continuation despite negative consequences, (4) withdrawal symptoms when access is restricted, and (5) functional impairment in academic or social domains (American Psychiatric Association, 2013; World Health Organization, 2016). These criteria form the basis for our clinical threshold using the Smartphone Addiction Scale-Short Version (Kwon et al., 2013).

In contrast, problematic smartphone use (PSU) refers to subclinical patterns of excessive use that cause distress or mild impairment but do not meet the full diagnostic criteria for addiction (Billieux, 2012). This distinction is crucial for developing appropriate interventions, as addiction

requires clinical treatment while PSU may be addressed through behavioural modifications. The I-PACE model helps explain how individuals may progress from PSU to addiction through repeated reinforcement of affective and cognitive processes. The relationship between behavioural addiction and PSU requires careful theoretical consideration. While this study primarily investigates smartphone addiction using SAS-SV criteria, it acknowledges that some participants scoring below clinical cutoffs may exhibit PSU patterns. This distinction is particularly relevant in resource-limited contexts like Ghana, where smartphones serve dual roles as essential academic tools and primary entertainment hubs (Tachie-Menson et al., 2025). This unique technological ecosystem may amplify compulsive use patterns that approach, but do not necessarily meet clinical thresholds for addiction.

1.2 Empirical Review

1.2.1 Prevalence of problematic smartphone use and addiction

Problematic smartphone usage (PSU) has emerged as a significant behavioural concern among undergraduate students worldwide, with prevalence rates varying widely across regions and measurement tools. A systematic review by Candussi et al. (2023) reported that the global prevalence of PSU among university students ranges from 36.5% to 67%, with a mean prevalence of approximately 52%. This variation is attributed to differences in cultural contexts, assessment instruments, and cutoff thresholds used to define PSU. Similarly, Sánchez-Fernández and Borda-Mas (2023) found that PSU prevalence among university students fluctuated between 21% and 60%, depending on the diagnostic criteria and scales employed, such as the Smartphone Addiction Scale (SAS) and Mobile Phone Problem Use Scale (MPPUS).

Studies investigating the prevalence of problematic smartphone use and addiction among undergraduate students in the global south have further reported significant rates of moderate to severe addiction, ranging from 45.8% to 77% (Anjana et al., 2020; Meshak et al., 2020; Prasad et al., 2022). For instance, in a cross-sectional study conducted in southern Ethiopia, Mengistu et al. (2023) found that over 40% of undergraduate students exhibited moderate to high levels of PSU, with higher rates observed among first-year students and females. Olasina and Kheswa (2021), examining students in South Africa, also reported high levels of excessive smartphone use, particularly linked to social media and gaming applications. In Nigeria, research has shown that while smartphones can be valuable academic tools, excessive use for non-academic purposes, such as social media and gaming, can lead to addiction and negatively impact academic performance (Ndubuaku et. al., 2020; Okpara, 2024). Another study in Pakistan found that smartphone addiction is significantly linked to poor time management and reduced focus on academic tasks, further exacerbating the problem (Raza et al., 2020).

These findings are echoed in studies from Asia, where PSU prevalence among undergraduates in countries like China, South Korea, and India has been reported to range between 30% and 65%, often associated with academic stress, poor sleep quality, and emotional dysregulation (Yang et

al., 2019; Demirci et al., 2015). Also, a study conducted in India found that 43.9% of undergraduate medical students were classified as mobile phone addicts, highlighting the widespread nature of the issue (Zeerak et al., 2024). Other studies also report a high prevalence of smartphone addiction, with significant implications for academic performance (Okpara, 2024; Zeerak et al., 2024).

1.2.2 Factors Influencing problematic smartphone usage and addiction

Research indicates that demographic variables such as gender, age, and duration of smartphone use have been consistently identified as significant predictors of problematic smartphone use (PSU) among adolescents and young adults. Gender differences are particularly notable, with females often reporting higher levels of PSU, primarily due to their greater engagement in social networking and communication-based applications (Pirwani et al., 2025; Olson et al., 2023). Conversely, males are more likely to exhibit PSU linked to gaming and risk-taking tendencies, which also contribute to addictive behaviours (Mitchell & Hussain, 2018). These gendered patterns suggest that the type of smartphone activity plays a critical role in shaping addiction risk. Thus, male students are reported to likely experience negative effects of smartphone usage compared to female students (Yanti et al., 2024). Moreover, male students are also more prone to smartphone addiction, which can lead to poor time management and reduced focus on academic tasks (Raza et al., 2020). These suggests that gender-specific interventions may be necessary to address the differing impacts of problematic smartphone use and addiction. In contrast, female students were found to have higher smartphone usage but experienced less severe effects on their academic performance compared to male students (Nayak, 2018). In contrast, Meshak et al. (2020) found that gender did not appear to be a significant factor influencing usage and addiction levels in their study

Additionally, age has emerged as a strong inverse predictor of PSU, with younger individuals, especially those in the 18–29 age group, demonstrating significantly higher addiction scores compared to older cohorts (Pirwani et al., 2025; Olson et al., 2023). This trend is often attributed to early exposure to digital technologies and the integration of smartphones into daily routines for both academic and emotional regulation.

Duration of daily smartphone use is another robust predictor of PSU severity. Studies have shown that individuals who use smartphones for extended periods, typically more than four to five hours per day, are more likely to experience symptoms such as compulsive checking, withdrawal, and impaired self-regulation (Pirwani et al., 2025; Mitchell & Hussain, 2018). The nature of smartphone engagement also matters; hedonic use (e.g., social media, entertainment) is more strongly associated with PSU than utilitarian use (e.g., academic or work-related tasks). Furthermore, the interaction between demographic factors can amplify risk. For instance, younger females who engage in prolonged social media use may be particularly vulnerable to emotional dependence and psychological distress associated with PSU (Lo Coco et al., 2022). Marciano and Camerini (2022) further explored this relationship using both self-reported and digital trace data,

concluding that traced duration of smartphone use was a significant predictor of PSU, even more so than frequency of use. Their findings suggest that adolescents and young adults often underestimate their actual usage, and that objective duration data provides a more accurate assessment of PSU risk. In a study conducted in Ethiopia, Mengistu et al. (2023) found that students who reported daily smartphone use exceeding four hours were more likely to experience academic decline, sleep disturbances, and emotional dysregulation which are symptoms commonly associated with PSU. These findings are echoed by Sohn et al. (2019), whose meta-analysis revealed that longer screen time was consistently associated with increased odds of depression, anxiety, and poor sleep quality, all of which are comorbid with PSU. These findings underscore the importance of considering demographic profiles when designing interventions aimed at reducing smartphone-related harm among young adults.

Psychological factors such as impulsiveness, excessive reassurance seeking, and depression are positively correlated with problematic smartphone use (Mitchell & Hussain, 2018). Additionally, anxiety, conscientiousness, and emotional stability are significant predictors (Hussain et al., 2017). Frustration intolerance aspects, particularly entitlement, emotional intolerance, and discomfort intolerance, directly predict problematic use (Urfa, 2023). Duration of smartphone use is also positively associated with problematic usage (Urfa, 2023). These findings contribute to understanding the complex interplay of factors influencing problematic smartphone use across different demographic groups.

1.2.3 Impact of problematic smartphone usage

More recent empirical work has shed light on the multifaceted nature of problematic smartphone usage and addiction. Tachie-Menson et al. (2025) found that undergraduate students with higher levels of digital nativity and at more advanced academic levels, showed a greater susceptibility to problematic smartphone usage and addiction and its consequences. Excessive smartphone use has been linked to poor academic outcomes, including lower grades, reduced focus, and decreased productivity. A study in Nigeria found that while smartphones can enhance academic performance when used appropriately, excessive use for non-academic purposes leads to distractions and superficial learning, ultimately harming academic achievement (Okpara, 2024). For instance, in India, research has shown that smartphone addiction is associated with poor time management, reduced attention span, and decreased academic performance. A study conducted among undergraduate medical students found that addicts were more likely to experience academic difficulties, highlighting the negative impact of smartphone addiction on academic outcomes (Zeerak et al., 2024).

In addition to academic concerns, smartphone addiction can also lead to physical health problems. Other review of anatomical effects (Alghadir et. al., 2025; Kanwal et. al., 2024) have suggested that while significant structural changes to the hand might be minimal, repetitive use of smartphones could lead to functional impairments in the thumb and little finger, raising concerns

about long-term musculoskeletal health. Sheng (2025) reported that excessive smartphone use is associated with biomechanical strain, such as increased neck tilt and wrist discomfort, as well as cognitive impairments, including reduced memory retention and concentration, alongside heightened anxiety and stress levels.

Besides, smartphone addiction does not only affect academic performance but also has significant implications for the mental health of undergraduate students in the Global South. A study in India found that smartphone addiction is associated with increased stress, anxiety, and depression among students, further complicating the issue (Ninnoni et al., 2024). This is confirmed by the Pakistani study that revealed that excessive smartphone use can lead to sleep disturbances, which in turn can negatively impact academic performance and overall well-being (Raza et al., 2020).

Extensive research has explored the phenomenon of smartphone addiction arising from smartphone use (Carbonell et al., 2018; De-Sola Gutiérrez et al., 2016; Jenaro et al., 2007; Kwon et al., 2013; Lopez-Fernandez et al., 2017; Roberts et al., 2014; Smetanuik, 2014; Tossell et al., 2015). Anjana et al. (2020) reported a positive correlation between smartphone addiction and both depression and anxiety levels among undergraduate students. Furthermore, the fear of being without a mobile phone, known as nomophobia, has been identified as a factor linked to smartphone addiction (Meshak et al., 2020). Researches thus have suggested the implementation of strategies aimed at reducing smartphone addiction and promoting healthier usage patterns among university students (Meshak et al., 2020; Prasad et al., 2022).

1.3 The Study Rationale

Recent studies have indicated concerning trends regarding smartphone addiction among undergraduate students with notable proportion of students demonstrating moderate to severe smartphone addiction, with reported prevalence rates ranging from 45.8% to 77% (Bhattacharjee et al., 2024; Meshak et al., 2020; Prasad et al., 2022). These findings suggest that a substantial number of university students are experiencing problematic smartphone use. Furthermore, research indicates that this addiction is associated with negative consequences, including depression and anxiety, with a positive correlation observed between smartphone addiction and depression levels among undergraduate students (Anjana et al., 2020). The link between nomophobia, the fear of being without a mobile phone, and smartphone addiction further underscores the severity of this issue (Meshak et al., 2020). Recent research also highlights academic, psychological, social, and physical repercussions. Academically, excessive phone use disrupts concentration and leads to procrastination, resulting in poorer academic performance. Academically, problematic smartphone use has been linked to reduced concentration, increased procrastination, and lower academic performance (Agostini & Petrucco, 2023; Yang et al., 2024). Psychologically, overuse is associated with heightened levels of anxiety, depression, and emotional dysregulation (Chen et al., 2022; Raj, 2025). Socially, excessive use contributes to diminished face-to-face interactions and increased feelings of loneliness and social isolation (Sreehari et al., 2025). Physically, prolonged smartphone engagement has been correlated with sleep disturbances,

musculoskeletal discomfort, and visual strain (Sreehari et al., 2025; Raj, 2025). Psychologically, it heightens anxiety, sleep disturbances, and feelings of low self-worth due to constant social comparison. Socially, it can erode face-to-face interactions, leading to isolation and weakened interpersonal skills. Physically, prolonged screen time contributes to eye strain, poor posture, and reduced physical activity. If left unaddressed, smartphone addiction could seriously impair students' overall development and well-being, ultimately jeopardizing their academic and personal success (Sheng, 2025; Tachie-Menson et al., 2025).

In Ghana, the widespread adoption of smartphones among university students reflects a global trend in mobile technology integration within higher education. As devices become more affordable and internet penetration improves, students increasingly rely on smartphones for academic purposes such as accessing digital learning platforms, communicating with peers and faculty, and managing course materials (Dampson et al., 2020; Dzontoh, 2024; Frimpong et al., 2016). However, this reliance has given rise to concerns about problematic smartphone use, particularly among youth. Recent studies from institutions like the University of Ghana and Kwame Nkrumah University of Science and Technology (KNUST) have highlighted a dual role: while smartphones facilitate flexible and accessible learning, they also contribute to academic distractions, social isolation, and physical health challenges (Dzontoh, 2024; Essel et al., 2021; Sarfoah, 2017). The urgency of this issue was further underscored during the COVID-19 pandemic, which normalized remote learning and intensified screen time among students. Despite these emerging patterns, empirical research in the Ghanaian context remains limited, underscoring the need for localized studies that examine the academic, psychological, and physical impacts of smartphone use on students' well-being and academic outcomes within the context of university students.

1.3.1 Purpose of the Study

Given the identified concerns, this study aims to investigate the phenomenon of smartphone addiction among undergraduate students in a public university in Ghana. Specifically, this research seeks to determine the nature and level of smartphone addiction among undergraduate students and to find out how smartphone addiction levels among undergraduate university students differ based on various demographic variables (e.g. gender, age category, duration of use).

1.3.2 Research Questions

The study was guided by two research questions:

1. What is the nature and level of smartphone usage among undergraduate students?
2. Do the levels of smartphone usage differ based on demographic variables (age, gender, age category and duration of smartphone use)?

2.0 METHODS

2.1 Research Design

Consistent with the positivist paradigm, this study adopted the cross-sectional descriptive survey design with a quantitative research approach. Saunders et al (2019) suggest that the cross-sectional descriptive survey design is suitable for collecting data from a large sample population and is praised for its ability to ensure representation of the entire population while reducing costs.

2.2 Sample and Sampling Technique

A sample of 567 undergraduate students from the University of Education, Winneba, was recruited for the study using purposive and convenience sampling techniques through student emails, online forums, and social media platforms. This sample size exceeds the minimum recommended for statistical power in cross-sectional survey studies, particularly when employing parametric analyses such as t-tests and ANOVA (Saunders et al., 2019). According to Comrey and Lee (1992), a sample of 500 is considered "very good" for factor analysis and scale-based research, supporting the adequacy of the current sample for the use of the SAS-SV scale and subgroup analyses. The demographic characteristics of the study participants are shown in Table 1.

Table 1: Demographics (*n*=567)

Variables	Groups	N	%
Gender	Male	247	43.6%
	Female	320	56.4%
Age Category	Late adolescent (17-19years)	6	1.1%
	Early young adult (20-24years)	236	41.6%
	Late young adults (25-29years)	207	36.5%
	Adults (30years and above)	118	20.8%
Level of Education	Year 1	62	10.9%
	Year 2	278	49.0%
	Year 3	159	28.0%
	Year 4	68	12.0%

2.3 Instruments

The Smartphone Addiction Scale – Short Version (SAS-SV) was scored by summing the responses to its 10 items, each rated on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). Higher scores indicate greater severity of smartphone addiction. A score of 31 or higher suggests problematic smartphone use among male students whiles a score of 33 or higher suggests problematic smartphone use among female undergraduate students (Kwon et al., 2013). The

questionnaire consisted of two sections, A and B. Section A gathered demographic information about the undergraduate students. These variables included sex, age, level of education, average daily smartphone usage time and purpose for smartphone usage. Section B collected data on students, smartphone usage using the Self-Report 10-item Smartphone Addiction Scale–Short Version (SAS-SV), developed by Kwon et al. (2013). Each item was rated on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree), yielding a total score between 10 and 60. Higher scores indicate greater levels of smartphone addiction (Kwon et al., 2013).

The Cronbach's alpha internal consistency coefficient of the SAS-SV was determined as 0.77. Besides, the items on the instrument were found suitable for factor analysis, with a Kaiser-Meyer-Olkin (KMO) value of 0.82 and a statistically significant Bartlett's test of sphericity ($p < 0.05$), confirming construct validity (Harrison et al., 2021). Results of exploratory factor analysis revealed factor loads of scale items to be between 0.53 and 0.77. The fact that the load value of each item was over 0.30 is considered sufficient in creating a factor pattern (Çokluk et. al., 2012; Tavşancıl, 2010).

2.4 Ethical Considerations

Informed consent was obtained from all participants prior to their participation in the study. The online questionnaire included a statement outlining the purpose of the research, ensuring confidentiality, and informing participants of their right to withdraw from the study at any time. Other considerations included ensuring access, maintaining anonymity and avoiding deception throughout the study.

2.5 Data Analysis

Descriptive statistics, such as the mean and standard deviation, were used to analyse the research question with the help of SPSS version 27. The study employed parametric statistical tools, including independent samples t-tests to examine whether statistical differences existed in the level of problematic smartphone usage based on gender, age category and duration of smartphone use at a 0.05 alpha level, to examine association between the categorical variables in the study, ensuring that the assumptions of normality and homogeneity of variance were met.

3.0 RESULTS

3.1 Research Question 1: What is the nature and level of smartphone usage among undergraduate students?

Table 2 presents data on the level of smartphone usage among undergraduate students. The study found that 59.3% of the students exhibited high levels of problematic smartphone usage, a figure consistent with prior research in the Global South, where prevalence rates range between 45.8% and 77% (Anjana et al., 2020; Meshak et al., 2020; Prasad et al., 2022). Table 3 presents the descriptive statistics of nature of smartphone usage by average daily smartphone usage time. The table shows the frequency and percentage of students within each category of average daily smartphone usage. Most participants reported using their smartphones for 1 to 2 hours per day (34.7%) and 3 to 4 hours per day (44.1%). A smaller percentage used their smartphones for less than 1 hour per day (9.0%) or 5 to 6 hours per day (11.6%). Very few students reported using their smartphones for more than 6 hours per day (0.5%). This table provides context for understanding the general smartphone usage patterns of the participants in relation to their reported levels of addiction.

Table 2: Level of smartphone usage and average daily smartphone usage time among undergraduate students

	Frequency	Percent
Level of smartphone usage*		
Low	231	40.7
High	336	59.3
Total	**567**	**100**
Average daily smartphone usage time		
Less than 1 hour	51	9
1-2hours	197	34.7
3-4hours	250	44.1
5-6hours	66	11.6
More than 6 hours	3	0.5
Total	**567**	**100**

Table 3 details the nature of smartphone usage based on purpose among undergraduate students. For the purpose of use, academic activities like research and assignments(homework) were a commonly reported reason. Many students also indicated using their smartphones for multiple purposes. Social networking and entertainment (such as music, videos, and movies) were also frequently cited. Gaming was the least common primary reason for smartphone use among the students. Regarding the location of smartphone use, the most frequent context was when students were alone. Using smartphones in bed was also a common occurrence. Smartphone use when with

friends or family was less frequent, and usage during lectures was even less so. The washroom was the least reported location for using a smartphone. Concerning the applications used, WhatsApp was the most frequently reported application. Facebook and YouTube were also popular among the students, followed by TikTok. Snapchat and Instagram were used by a similar proportion of students. Telegram was also reported, while a smaller group of students indicated using X(Twitter).

Table 3: Descriptive statistics on nature of smartphone usage among undergraduate students

Variable		N	%	% of total cases
Purpose	Academic (Research, lessons, homework)	567	27.5%	100.0%
	Multipurpose use of smartphones	527	25.5%	92.9%
	Social Networking	398	19.3%	70.2%
	Entertainment (music, dance, videos, movies, fashion)	374	18.1%	66.0%
	Gaming	199	9.6%	35.1%
Location	Anytime I am alone	567	54.3%	100.0%
	In bed	236	22.6%	41.6%
	When I am with my friends/ family	123	11.8%	21.7%
	In lecture	72	6.9%	12.7%
	In the washroom	47	4.5%	8.3%
Applications	WhatsApp	533	23.1%	94.3%
	Facebook	366	15.8%	64.8%
	YouTube	300	13.0%	53.1%
	Tik Tok	257	11.1%	45.5%
	Snapchat	244	10.6%	43.2%
	Instagram	230	10.0%	40.7%
	Telegram	220	9.5%	38.9%
	X	160	6.9%	28.3%

Undergraduate students' widespread use of smartphones for non-academic purposes, such as social networking and entertainment, likely contributes to this trend, as observed in the current study where 70.2% of students reported using smartphones for social networking and 66.0% for entertainment. The multifunctionality of smartphones further cements their role as consolidating tasks like research, note-taking, and group collaboration through WhatsApp or Telegram into a single device. However, this reliance blurs the line between academic and recreational use, as 92.9% of participants in this study engaged in multipurpose smartphone activities. While

smartphones enhance learning efficiency, their duality as entertainment devices (e.g., social media, gaming) heightens the risk of distraction and addiction (Sheng, 2025).

3.2 Research Question 2: Do the levels of smartphone usage differ based on demographic variables (age category, gender and duration of use)?

An independent samples t-test was conducted to compare the actual level of smartphone usage between traditional and mature students (Table 4). Levene's test indicated that the variances were unequal, $F = 18.272$, $p < .001$. Therefore, the results for the Equal variances not assumed condition were used. Traditional students (M = 1.64, SD = 0.480) exhibited a significantly higher level of smartphone addiction than mature students (M = 1.55, SD = 0.498), t (529.38) = 2.19, p = .029, d = 0.49 (95% CI [0.009, 0.172]). This indicates a medium effect size. The results of the independent t-test were statistically significant. The results of the independent samples t-test indicate that there is a statistically significant difference in the level of smartphone addiction between traditional (24 years and below) and mature (25 years and above) undergraduate students. Specifically, traditional students reported a higher level of smartphone addiction compared to mature students. The effect size (d = 0.49) suggests that this difference is medium in magnitude.

Table 4: Independent sample t-test results of level of smartphone usage by age category and gender

	N	Mean	SD	t	df	*p*	d
Age Category							
Traditional (≤ 24yrs)	242	1.64	0.48	2.193	565.0	.029*	0.49
Mature (≥ 25yrs)	325	1.55	0.498				
Gender							
Female	320	1.54	0.499	3.08	541.86	.002*	0.30
Male	247	1.66	0.473				

*p<0.05

Also, an independent samples t-test was conducted to compare levels of smartphone usage between male and female undergraduate students. Male students (M = 1.66, SD = 0.473) exhibited a significantly higher level of smartphone addiction than female students (M = 1.54, SD = 0.499), t (541.86) = 3.080, *p* < .002, d = 0.3 (95% CI [.046, .207]).

A Chi-Square Test of Independence was conducted to examine the association between average daily smartphone usage duration (categorized as: less than 1 hour, 1–2 hours, 3–4 hours, 5–6 hours, more than 6 hours) and actual level of smartphone addiction (low vs. high) among undergraduate

students. The results indicated that the association between smartphone usage duration and addiction level was not statistically significant, χ^2 (4, N = 567) = 4.70, p = .319. Although descriptive statistics showed that students who reported higher daily smartphone usage (e.g., 5–6 hours) had a greater proportion of high addiction levels (68.2%), similar rates of high addiction were also found among students using their phones for shorter durations (e.g., 57.4% in the 1–2 hour group, and 58.8% in the <1 hour group). The linear-by-linear association test also showed no significant trend across the ordered usage categories, p = .165. These findings suggest that PSU may not be solely determined by the amount of time spent on smartphones, but also by qualitative patterns of use and psychological dependence.

4.0 DISCUSSION

These high levels of PSU observed underscores the pervasive nature of PSU among university students, corroborating studies from India, Bangladesh, and Nigeria (Dzontoh, 2024; Okpara, 2024; Zeerak et al., 2024). The high prevalence of smartphone use for academic purposes among undergraduate students can be attributed to several interconnected factors. First, smartphones offer unparalleled accessibility and convenience, serving as portable learning tools that provide instant access to digital libraries, e-books, and academic databases (Gezgin et al., 2018). In resource-constrained settings like Ghana, where computer labs and broadband internet services may be limited, smartphones bridge the gap by enabling students to download lecture notes, submit assignments, and participate in online discussions anytime, anywhere (Okpara, 2024). Second, the shift toward digital learning, accelerated by the COVID-19 pandemic, has made smartphones indispensable. Universities increasingly rely on mobile-friendly platforms like Moodle, Google Classroom and Zoom, while instructors share materials via WhatsApp, Telegram or email, reinforcing smartphone dependency (Tachie-Menson et al., 2025). Additionally, smartphones are a cost-effective alternative to laptops, with affordable data plans and free educational apps (e.g., Khan Academy) democratizing access to knowledge (Candussi et al., 2023).

Age played a role in smartphone addiction, with traditional students (24 years and younger) reporting higher addiction levels than mature students (25 years and older). This aligns with Tachie-Menson et al. (2025), who linked digital nativity to higher susceptibility to addiction. Interestingly, the age effect was more pronounced among female students, suggesting that younger women may be more vulnerable to problematic smartphone use, possibly due to social or academic stressors (Anjana et al., 2020). The observed age differences in smartphone addiction levels can be explained through developmental, social, and technological factors. Younger students (24 years and below) demonstrated higher addiction levels than their mature counterparts (25+ years), which aligns with the concept of digital nativity (Tachie-Menson et al., 2025). Younger undergraduates, having grown up with pervasive digital technology, are more likely to integrate smartphones seamlessly into their daily routines, leading to habitual and potentially excessive use (Candussi, et

al., 2023). This group tends to rely on smartphones for both academic and social needs, including social media engagement, instant messaging, and entertainment, which collectively increase usage duration and dependency (Sohn et al., 2019). In contrast, mature students, who may have experienced a transitional period into digital adoption, often exhibit more restrained usage patterns, prioritizing functional over recreational use (Kaysi et. al, 2021; Candussi, et al., 2023). Additionally, younger students face heightened academic and social pressures, such as the need for peer validation or stress management, which may drive compensatory smartphone use as a coping mechanism (Anjana et al., 2020). While age differences were less marked, the higher addiction levels among those aged 24 and below may reflect a stronger inclination toward gaming, entertainment and competitive online activities, which are more time-consuming and immersive (Raza et al., 2020).

Concerning gender, the study revealed that while the difference exist between male and female students, other factors likely play more substantial roles in determining addiction risk than gender. This finding contrasts with some studies (e.g., Meshak et al., 2020) but aligns with others (e.g., Yanti et al., 2024; Raza et al., 2020), suggesting cultural or contextual influences on gender-related usage patterns. This gender disparity may reflect differences in usage motivations, such as higher engagement in gaming or social media recognition-seeking behaviours among males (Zeerak et al., 2024). Gender and age differences in smartphone engagement patterns warrant particular consideration. Male students' higher addiction levels may stem from gaming applications' addictive design features, particularly variable reward schedules (Sheng, 2025), while female students' predominant social media use may reflect problematic rather than addictive use patterns (Billieux, 2012). The observed age effects, showing traditional students' greater susceptibility compared to mature students, mirror global trends while uniquely highlighting younger female students' vulnerability, potentially attributable to social media-related pressures (Zeerak et al., 2024). These findings suggest that interventions targeting smartphone addiction should consider age- and gender-specific usage motivations, such as promoting alternative stress-relief strategies for younger women or structured time-management tools for younger men engaged in gaming.

The relationship between average daily smartphone use and levels of smartphone addiction among undergraduate students has been widely explored, yet findings remain mixed. While it is often assumed that longer screen time directly correlates with higher addiction risk, several empirical studies challenge this assumption. For instance, Marciano and Camerini (2022) found that although duration of use was positively associated with problematic smartphone use (PSU), time alone was not the strongest predictor. Instead, psychological factors such as compulsive checking and emotional reliance were more robust indicators. Similarly, Brand et al. (2016) emphasized that addictive smartphone behaviour is better explained by underlying cognitive and emotional dysregulation than by usage time alone. In some studies, high PSU prevalence was observed even among students with moderate or low daily usage, suggesting that qualitative aspects of use, such as purpose, motivation, and emotional triggers, play a critical role (Billieux et al., 2015; Lo Coco et al., 2022). For example, students who used smartphones for social reassurance or to cope with

stress were more likely to exhibit addictive symptoms, regardless of total screen time. These findings align with the current study's results, which reported no statistically significant association between average daily duration and addiction level, despite higher addiction rates among heavy users. This reinforces the notion that screen time is an insufficient standalone metric for diagnosing or predicting smartphone addiction.

The study underscores the dual role of smartphones as essential academic tools and potent sources of distraction. Although all participants (100%) reported using smartphones for academic activities, a substantial 92.9% engaged in multipurpose use, and 70.2% specifically for social networking. This pattern reflects findings from Nigeria and Pakistan, where smartphones supported learning but simultaneously disrupted academic concentration (Okpara, 2024; Raza et al., 2020). Notably, the most frequent contexts of use, when alone (100%) and in bed (41.6%), suggest that smartphones function as digital companions during solitary or leisure moments, potentially reinforcing addictive tendencies. The predominance of applications like WhatsApp, Facebook, and YouTube highlights their dual utility in communication and entertainment, while also raising concerns about their capacity to promote compulsive checking behaviours (Samaha & Hawi, 2016).

The coexistence of educational and recreational functions within the same device fosters constant competition for attention, particularly when platforms like YouTube and WhatsApp are employed for both purposes. This overlap likely contributes to frequent usage in transitional moments such as studying alone or relaxing in bed, where students shift seamlessly between academic tasks and leisure, often without conscious regulation. These behavioural patterns reflect broader self-regulation challenges, where features that facilitate learning also encourage procrastination and compulsive engagement, ultimately impairing academic performance. While smartphones have become integral to Ghana's digital education landscape (Okpara, 2024), their multipurpose nature blurs functional boundaries, with platforms like YouTube serving as both educational tools and addictive stimuli. This dual-use dynamic likely underpins the strong association between smartphone use in private settings and elevated addiction levels, particularly among students unable to maintain boundaries between productivity and distraction (Samaha & Hawi, 2016).

The study revealed three critical findings regarding smartphone engagement patterns among students at the University of Education, Winneba. First, a high prevalence of smartphone addiction was observed, with 59.3% of participants scoring above clinical thresholds on the SAS-SV, consistent with trends identified in other Global South contexts (Candussi et al., 2023; Zeerak et al., 2024). Second, notable gender and age disparities emerged, with male students and those aged 24 years or younger demonstrating higher addiction levels. Male participants particularly exhibited dose-dependent effects, where usage of 5-6 hours per day correlated with significantly higher addiction scores. Third, smartphones served dual academic-recreational functions, with all participants using devices for academic purposes while 92.9% engaged in multipurpose use, predominantly through WhatsApp (94.3%) and social media platforms (70.2%).

The findings provide substantial evidence for conceptualizing excessive smartphone engagement as behavioural addiction (Kwon et al., 2013), particularly among high-risk subgroups. Male students' usage patterns, characterized by gaming and prolonged use, align with established reward-seeking pathways in behavioural addictions (Brand et al., 2016). The identified dose-response relationship further supports this interpretation, demonstrating compulsive use patterns comparable to gaming disorder as defined in DSM-5. Younger students' heightened vulnerability likely reflects the role of digital nativity in fostering habitual use (Tachie-Menson et al., 2025), with female students potentially employing smartphones for stress relief through social media engagement which is a well-documented risk factor for addiction development (Montag et al., 2019). In contrast, students scoring below SAS-SV cutoffs may exhibit problematic smartphone use rather than clinical addiction, as evidenced by behaviours such as academic distraction through WhatsApp use without demonstrating core addiction symptoms like withdrawal or loss of control. This distinction helps explain why 40.7% of participants were classified as low addiction despite reporting substantial usage durations.

4.1 Integration with the I-PACE Model

The I-PACE model (Interaction of Person-Affect-Cognition-Execution), developed by Brand et al. (2016), provides a multidimensional framework for understanding behavioural addictions such as problematic smartphone use. The model postulates that addiction results from an interplay between a) Person-related factors (e.g., age, gender, digital nativity), b) Affective responses (e.g., emotional regulation through smartphone use), c) Cognitive distortions (e.g., FoMO: fear of missing out) and d) Executive dysfunctions (e.g., poor self-control, multitasking failures). This study's findings strongly align with I-PACE. For example, participants demonstrated high daily usage for social networking (70.2%) and entertainment (66%), activities often linked to mood regulation and escapism. Furthermore, the age and gender-based differences, such as higher addiction levels among younger males using smartphones for 5–6 hours daily, point to individual predispositions emphasized in I-PACE. Thus, the behavioural patterns observed here illustrate how smartphones fulfil both affective needs and cognitive biases, while simultaneously challenging executive control and academic discipline.

Comparative data from other nations reveal broader regional trends. The observed discrepancies highlight the important role of specific cultural and demographic factors in shaping patterns of technology use and potential dependence. Consequently, this study challenges the generalized assumptions that digital nativism and problematic internet use are uniformly experienced across student populations or generational cohorts.

4.2 Implications

The study's findings have several implications. This study notes that males had higher addiction levels, contrary to findings by Meshak et al., 2020). A deeper cultural analysis (e.g., gaming vs. social media preferences by gender in Ghana) could explain discrepancies. Also, gender- and age-

specific strategies may be needed to address smartphone addiction among undergraduate students. For instance, male students might benefit from targeted programs addressing gaming and social media use, while younger female students may require support for stress management. Furthermore, universities could promote digital literacy programs to help students balance academic and recreational smartphone use. Again, students exhibiting problematic use without addiction may benefit from digital literacy programs emphasizing boundary-setting techniques including introduction to the use of digital wellbeing apps to regulate their smartphone usage. Furthermore, policies discouraging smartphone use during lectures might also mitigate distractions. Besides, the link between smartphone addiction and mental health issues may call for counselling services on usage of electronic devices to address digital wellness. Finally, interventions should move beyond simplistic screen-time reduction strategies and instead promote digital self-regulation, emotional coping skills, and awareness of compulsive behaviours. As highlighted by Elhai et al. (2017), addressing the psychological mechanisms underlying PSU is essential for effective prevention and treatment among university populations.

4.3 Limitations and Future Research

Limitations should be acknowledged when interpreting these findings. The SAS-SV, while psychometrically validated, cannot definitively distinguish clinical addiction from subclinical problematic use. Future research should incorporate diagnostic interviews to supplement scale measurements. Ghana's specific digital infrastructure context, characterized by limited alternative technological access, may inflate problematic use rates compared to other national contexts, suggesting the value of cross-national comparative studies. The cross-sectional design precludes causal inferences regarding relationships between academic stress and smartphone addiction, indicating the need for longitudinal investigations.

4.4 Conclusion

This study reveals that smartphone addiction affects 59.3% of surveyed undergraduates at the University of Education, Winneba, with distinct patterns across gender and age groups. Moving forward, educational institutions must develop balanced policies that preserve smartphones' academic benefits while mitigating their addictive risks. Future interventions should prioritize: (1) evidence-based digital wellness programs tailored to high-risk subgroups (e.g., younger males), (2) institutional guidelines for responsible classroom use, and (3) longitudinal research to assess the long-term efficacy of such measures in Ghanaian higher education.

DECLARATION

Data Availability: Access to the anonymized dataset can be made available upon reasonable request to the author, subject to institutional data-sharing policies and appropriate ethical approval.

Declaration of Conflicts of Interest: The author declares that there is no conflict of interest associated with this study.

Ethics Approval and Consent to Participate: Ethical clearance for the study was obtained from relevant academic gatekeepers. Informed consent was sought and obtained from all participants prior to the administration of the test instruments, in compliance with ethical standards for educational research.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgements: None declared.

REFERENCES

Abdulmalik, U.S.I. & Anka, N.A. (2024). The Effects of Smartphone Usage on Students' Academic Performance: Case Study of Four Selected Tertiary Institutions in North-West. *Dutse Journal of Pure and Applied Sciences (DUJOPAS)*, *10*, 4a. https://dx.doi.org/10.4314/dujopas.v10i4a.23

Achangwa, C., Ryu, H. S., Lee, J. K., & Jang, J.-D. (2023). Adverse Effects of Smartphone Addiction among University Students in South Korea: A Systematic Review. *Healthcare*, *11*(1), 14. https://doi.org/10.3390/healthcare11010014

Agostini, D., & Petrucco, C. (2023). Problematic smartphone use and university students' academic performance. *Journal of e-Learning and Knowledge Society, 19*(2), 30–38. https://doi.org/10.20368/1971-8829/1135747

Aker, J. C., & Mbiti, I. M. (2010). Mobile phones and economic development in Africa. *Journal of Economic Perspectives*, *24*(3), 207-232. https://doi.org/10.1257/jep.24.3.207

Alghadir, A. H., Gabr, S. A., Rizk, A. A., Alghadir, T., Alghadir, F., & Iqbal, A. (2025). Smartphone addiction and musculoskeletal associated disorders in university students: biomechanical measures and questionnaire survey analysis. *European Journal of Medical Research, 30*(1), 274. https://doi.org/10.1186/s40001-025-02413-w

American Psychiatric Association [APA]. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.).* Arlington, VA: American Psychiatric Association.

Amez, S., & Baert, S. (2020). Smartphone use and academic performance: A literature review. *International Journal of Educational Research, 103*, 101618 https://doi.org/10.1016/j.ijer.2020.101618

Anjana, K. K., Suresh, V. C., Sachin, B. S., & Poornima, C. (2021). The relationship between nomophobia, mental health, and coping style in medical students. *Indian Journal of Social Psychiatry, 37*(2), 207-211. https://doi.org/10.4103/ijsp.ijsp_213_20

Ansari, S., Iqbal, N., Azeem, A., & Danyal, K. (2024). Improving well-being through digital detoxification among social media users: A systematic review and meta-analysis. *Cyberpsychology, Behaviour, and Social Networking, 27,*11. https://doi.org/10.1089/cyber.2023.0742

Ayhualem S, Alamer A, Dabi S.D., Bogale K.G., Abebe, A. B., & Chala, M. B. (2021). Burden of neck pain and associated factors among smart phone user students in University of Gondar, Ethiopia. *PLOS ONE 16*(9): e0256794. https://doi.org/10.1371/journal.pone.0256794

Bhattacharjee, A., Roy, A., & Ghosh, T. (2024). Webbed in Digital World: A Systematic Review on Factors of Internet Addiction among Youths. *Journal of the Indian Academy of Applied Psychology*, *50*(1), 196-210.

Billieux, J., Maurage, P., Lopez-Fernandez, O., Kuss, D. J., & Griffiths, M. D. (2015). Can disordered mobile phone use be considered a behavioral addiction? An update on current evidence and a comprehensive model for future research. *Current Addiction Reports, 2*(2), 156–162. https://doi.org/10.1007/s40429-015-0054-y

Brand, M., Young, K. S., Laier, C., Wölfling, K., & Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An Interaction of Person-Affect-Cognition-Execution (I-PACE) model. *Neuroscience & Biobehavioral Reviews, 71*, 252–266. https://doi.org/10.1016/j.neubiorev.2016.08.033

Candussi, C. J., Kabir, R., & Sivasubramanian, M. (2023). Problematic smartphone usage, prevalence and patterns among university students: A systematic review. *Journal of Affective Disorders Reports*, *14*, 100643. https://doi.org/10.1016/j.jadr.2023.100643

Chen, H., Ma, J., Guan, J., Yin, L., Shi, Z., & Zhang, Y. (2022). The impact of psychological distress on problematic smartphone use among college students: The mediating role of metacognitions. *Frontiers in Psychology, 13*, 932838. https://doi.org/10.3389/fpsyg.2022.932838

Dampson, D. G., Addai-Mununkum, R., Apau, S. K., & Bentil, J. (2020). COVID-19 and online learning: A SWOT analysis of users' perspectives on learning management system of University of Education, Winneba, Ghana. *International Journal of Learning, Teaching and Educational Research, 19(*9), 382-401. https://doi.org/10.26803/ijlter.19.9.20

Donner, J. (2015). *After access: Inclusion, development, and a more mobile Internet*. MIT press. https://doi.org/10.7551/mitpress/9740.001.0001

Dzontoh, E. M. Y. (2024). *Use of Social Media and Its Impact on the Academic Performance of Students at the Tertiary Institution in Ghana. A Case Study of University of Cape Coast* (Doctoral dissertation, University of Cape Coast).

Elhai, J. D., Levine, J. C., Dvorak, R. D., & Hall, B. J. (2017). Fear of missing out, need for touch, anxiety and depression are related to problematic smartphone use. *Computers in Human Behavior, 63*, 509–516. https://doi.org/10.1016/j.chb.2016.05.079

Essel, H. B., Vlachopoulos, D., & Tachie-Menson, A. (2021). The relationship between the nomophobic levels of higher education students in Ghana and academic achievement. *Plos ONE, 16*(6), e0252880. https://doi.org/10.1371/journal.pone.0252880

Frimpong, K. O., Asare, S., & Otoo-Arthur, D. (2016). The effects of mobile phone usage on the academic performance of Ghanaian students, a case of Presbyterian University College Asante-Akyem campus. *International Journal of Innovative Research and Advanced Studies*, *3*(11), 33-43.

Gezgin, D. M., Cakir, O., & Yildirim, S. (2018). The Relationship between levels of nomophobia prevalence and internet addiction among high school students: the factors influencing nomophobia. *International Journal of Research in Education and Science*, *4*(1), 215-225. https://doi.org/10.21890/ijres.383153

Goggin, G. (2010). *Global mobile media*. Routledge. https://doi.org/10.4324/9780203842805

Gökçearslan, Ş., Mumcu, F. K., Haşlaman, T., & Çevik, Y. D. (2016). Modelling smartphone addiction: The role of smartphone usage, self-regulation, general self-efficacy and cyberloafing in university students. *Computers in Human Behaviour, 63*, 639–649. https://doi.org/10.1016/j.chb.2016.05.091

Gritti, E.S., Bornstein, R.F. & Barbot, B (2023). The smartphone as a "significant other": interpersonal dependency and attachment in maladaptive smartphone and social networks use. *BMC Psychology, 11*, 296. https://doi.org/10.1186/s40359-023-01339-4

Harris, B., Regan, T., Schueler, J., & Fields, S. A. (2020). Problematic mobile phone and smartphone use scales: A systematic review. *Frontiers in Psychology*, *11*, 672. https://doi.org/10.3389/fpsyg.2020.00672

Harrison, V., Kemp, R., Brace, N., & Snelgar, R. (2020). *SPSS for Psychologists*. Bloomsbury Publishing.

Ifeanyi, I. P., & Chukwuere, J. E. (2018). The impact of using smartphones on the academic performance of undergraduate students. *Knowledge Management & E-Learning, 10*(3), 290–308. https://doi.org/10.34105/j.kmel.2018.10.017

Kanwal, S., Irfan, A., Zaheer, M., Zia, L., Huda, N. U., Javaid, M., Raza, A., Farwa, M., Rafique, H., & Aslam, I. (2024). Prevalence of little finger contour damage among mobile users. *Journal of Health and Rehabilitation Research, 4*(1), 1–12. https://doi.org/10.61919/jhrr.v4i1.268

Kaysi, F., Yavuz, M., & Aydemir, E. (2021). Investigation of university students' smartphone usage levels and effects. *International Journal of Technology in Education and Science (IJTES), 5*(3), 411-426. https://doi.org/10.46328/ijtes.235

Kwon, M., Kim, D. J., Cho, H., & Yang, S. (2013). The smartphone addiction scale: Development and validation of a short version for adolescents. *PLOS ONE, 8*(12), e83558. https://doi.org/10.1371/journal.pone.0083558

Lo Coco, G., Salerno, L., Giordano, C., Di Blasi, M., & Rodgers, R. F. (2022). Understanding the smartphone generation: Is problematic smartphone use associated with low body esteem among adolescent girls and boys? *Current Psychology, 41*, 3173–3184. https://doi.org/10.1007/s12144-020-00847-5

Marciano, L., & Camerini, A.-L. (2022). Duration, frequency, and time distortion: Which is the best predictor of problematic smartphone use in adolescents? A trace data study. *PLoS ONE, 17*(2), e0263815. https://doi.org/10.1371/journal.pone.0263815

Mendoza, J. S., Pody, B. C., Lee, S., Kim, M., & McDonough, I. M. (2018). The effect of cellphones on attention and learning: The influences of time, distraction, and nomophobia. *Computers in Human Behaviour*, *86*, 52-60. https://doi.org/10.1016/j.chb.2018.04.027

Mengistu, N., Habtamu, E., Kassaw, C., Madoro, D., Molla, W., Wudneh, A., Abebe, L., & Duko, B. (2023). Problematic smartphone and social media use among undergraduate students during the COVID-19 pandemic: In the case of southern Ethiopia universities. *PloS ONE, 18*(1), e0280724. https://doi.org/10.1371/journal.pone.0280724

Meshak, M., & D'Souza, L. (2020). Prevalence of smartphone addiction among undergraduates and its relationship with nomophobia. *International Journal of Indian Psychology*, *8*(3). https://doi.org/10.25215/0803.180

Muezzin, E. E. (2023). A Review on the Psychological Effects of Smartphone Addiction. *Kıbrıs Türk Psikiyatri ve Psikoloji Dergisi, 5*(4), 361-367. https://doi.org/10.35365/ctjpp.23.4.09

Mukherjee, D. C., & Pandey, V. (2024). Smartphone Addiction, Personality Factors, Emotional Regulation and Mental Health: Gender Based Studies. *International Journal of Psychological Studies*, 16(1). https://doi.org/10.5539/ijps.v16n1p28

Nayak, J. K. (2018). Relationship among smartphone usage, addiction, academic performance and the moderating role of gender: A study of higher education students in India. *Computers & Education, 123*, 164-173. https://doi.org/10.1016/j.compedu.2018.05.007

Ndubuaku, V., Inim, V., Ndudi, U. C., Samuel, U., & Prince, A. I. (2020). Effect of social networking technology addiction on academic performance of university students in Nigeria. *International Journal of Recent Technology and Engineering (IJRTE), 8*(5), 173-180. https://doi.org/10.35940/ijrte.D8393.018520

Okpara, O. M. (2023). Impact of smartphone use on academic performance of university students in Nigeria. *International Journal of Educational Research and Development, 9(*1), 22–30. https://doi.org/10.30935/ojcmt/13020

Olasina, G., & Kheswa, S. (2021). Exploring the Factors of Excessive Smartphone Use by Undergraduate Students. *Knowledge Management & E-Learning, 13*(1), 118-141. https://doi.org/10.34105/j.kmel.2021.13.007

Olson, J. A., Sandra, D. A., Veissière, S. P. L., & Langer, E. J. (2023). Sex, age, and smartphone addiction across 41 countries. *International Journal of Mental Health and Addiction*, 1–9. https://doi.org/10.1007/s11469-023-01146-3

Oulasvirta, A., Rattenbury, T., Ma, L., & Raita, E. (2012). Habits make smartphone use more pervasive. *Personal and Ubiquitous computing*, *16*, 105-114. https://doi.org/10.1007/s00779-011-0412-2

Panova, T., & Carbonell, X. (2018). Is smartphone addiction really an addiction?. *Journal of Behavioral addictions, 7*(2), 252-259. https://doi.org/10.1556/2006.7.2018.49

Pirwani, N., Somogyi, A., & Szabo, A. (2025) Do regular exercise, gender, and age influence smartphone addiction? Analyzing screen time and smartphone deprivation symptoms. *Frontiers in Psychology.* 16:1586762. https://doi.org/10.3389/fpsyg.2025.1586762

Prasad, P., AnandraoPawar, A., Patil, S. S., Shinde, M., & Babu, L. K. (2022). Addiction of smartphone among undergraduates. *Journal of Pharmaceutical Negative Results*, 13, 581-585. https://doi.org/10.47750/pnr.2022.13.S06.082

Przybylski, A. K., & Weinstein, N. (2019). Digital screen time limits and young children's psychological well-being: Evidence from a population-based study. *Child Development*, *90*(1), e56-e65. https://doi.org/10.1111/cdev.13007

Raj, G. (2025). The psychological dangers of mobile phone overuse: A modern mental health challenge. *International Journal of Indian Psychology, 13*(2), 242. https://doi.org/10.25215/1302.242

Raza, S. A., Yousufi, S. Q., Rafi, S. M. T., & Javaid, S. T. (2020). Impact of smartphone addiction on students' academic achievement in Higher Education Institute of Pakistan. *Journal of Education & Social Sciences, 8* (1), 1-14. https://doi.org/10.20547/jess0812008101

Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. *Computers in Human Behaviour, 57*, 321–325. https://doi.org/10.1016/j.chb.2015.12.045

Sanchez-Fernandez, M., & Borda-Mas, M. (2023). Problematic smartphone use and specific problematic Internet uses among university students and associated predictive factors: a systematic review. E*ducation and Information Technologies, 28*(6), 7111-7204. https://doi.org/10.1007/s10639-022-11437-2

Sarfoah, E. (2017). *Smart phone use for learning: A study on University of Ghana students* (Unpublished MPhil thesis). Department of Communication Studies, University of Ghana. http://ugspace.ug.edu.gh/handle/123456789/22822

Sheng, Q. (2025). Understanding the biomechanics of smartphone addiction: The physical and cognitive impacts of prolonged device use on college students. *Molecular & Cellular Biomechanics*, 22(2), 650-650. https://doi.org/10.62617/mcb650

Slater, M. (2018). Immersion and the illusion of presence in virtual reality. *British Journal of Psychology*, *109*(3), 431-433. https://doi.org/10.1111/bjop.12305

Sohn, S. Y., Rees, P., Wildridge, B., Kalk, N. J., & Carter, B. (2019). Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: a systematic review, meta-analysis and GRADE of the evidence. *BMC Psychiatry*, *19*, 1-10. https://doi.org/10.1186/s12888-019-2350-x

Sreehari, R., Jayakumar, C., Natarajan, G., Monsy, E., & Varma, P. (2025). Physical and psychological health correlates of excessive smartphone usage: A systematic review. *Asian Journal of Psychology and Research, 8*(1), 45–62. https://doi.org/10.69980/ajpr.v28i1.264

Srivastava, A., & Thaichon, P. (2023). What motivates consumers to be in line with online shopping? A systematic literature review and discussion of future research perspectives. *Asia Pacific Journal of Marketing and Logistics*, *35*(3), 687-725. https://doi.org/10.1108/APJML-10-2021-0777

Tachie-Menson, A., Essel, H. B., Essuman, M. A., Nunoo, F. K. N., Appau, E., Akuteye, A. D., Boadi, E. A., & Quaye, N. T. (2025). Relationship Between Digital Nativity and Internet Addiction Among University Students in Ghana. *F1000Research, 14*, 139. https://doi.org/10.12688/f1000research.156283.1

Ting, C. H., & Chen, Y. Y. (2020). Smartphone addiction. In *Adolescent addiction* (pp. 215-240). Academic Press. https://doi.org/10.1016/B978-0-12-818626-8.00008-6

Vanden Abeele, M. M. P. (2021). Digital wellbeing as a dynamic construct. *Communication Theory*, *31*(4), 932-955. https://doi.org/10.1093/ct/qtaa024

World Health Organization (2016b). *Behavioural disorders associated with excessive use of the Internet, computers, smartphones and similar electronic devices: Clinical descriptions, diagnostic guidelines and priorities for international research: Meeting report*. Geneva, Switzerland: World Health Organization.

Xie, Y., Szeto, G., & Dai, J. (2017). Prevalence and risk factors associated with musculoskeletal complaints among users of mobile handheld devices: A systematic review. *Applied ergonomics*, *59*, 132-142. https://doi.org/10.1016/j.apergo.2016.08.020

Yang, G.-H., Cao, X.-X., Fu, Y.-Y., Wang, N.-D., & Lian, S.-L. (2024). Mobile phone addiction and academic burnout: The mediating role of technology conflict and the protective role of mindfulness. *Frontiers in Psychiatry*, *15*, 1365914. https://doi.org/10.3389/fpsyt.2024.1365914

Zeerak, Q., Imran, M., Azeez, K., Lokanathan, T. H., & Ismail, I. M. (2024). The effects of smartphone addiction on academic performance among undergraduate medical students in Karnataka, India: A multi-centric study. *Cureus*, *16*(6). https://doi.org/10.7759/cureus.62796