

## **PROBLEMATIC SMARTPHONE USE AND STUDENT ANXIETY IN CLASS IN UNIVERSITIES IN THE FOURTH INDUSTRIAL REVOLUTION CONTEXT**

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### **ABSTRACT**

This study examines the impact of problematic smartphone use (PSU) on student anxiety in classroom within Vietnamese universities, in the context of rapid digital transformation associated with the Fourth Industrial Revolution. Drawing on a quantitative approach, data were collected from 307 undergraduate students across multiple universities in Vietnam. The study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze the effects of four dimensions of PSU on student anxiety. The results reveal that compulsive behavior, tolerance, and withdrawal have significant positive effects on student anxiety, with tolerance emerging as the strongest predictor. These findings suggest that psychological dependence on smartphones, rather than functional disruption, plays a dominant role in shaping students' anxiety levels. In contrast, functional impairment was found to have no significant effect on anxiety, indicating that students may have adapted to multitasking and technology-integrated learning environments. This study contributes to the literature by providing empirical evidence from a developing country context and highlights the need for universities to promote digital self-regulation and mental health support, while adopting balanced strategies for integrating smartphones into classroom learning.

**Keywords:** Problem smartphone use, compulsive behavior, functional impairment, tolerance, withdrawal, student anxiety.

### **1. INTRODUCTION**

The rapid proliferation of digital technologies has fundamentally altered how individuals learn, communicate, and participate in contemporary society. Among these technologies, smartphones have become deeply embedded within multiple dimensions of everyday life, offering instant access to information, enabling seamless communication, supporting educational activities, and facilitating entertainment across temporal and spatial boundaries (Singh & Samah, 2018). Younger populations, in particular, smartphones have evolved from optional communication tools to indispensable devices that structure daily routines, academic engagement, and social interactions (Nguyen et al., 2025). This growing dependency on mobile technologies is especially visible in higher education settings, where students increasingly rely on smartphones to access learning management systems (LMS), retrieve digital materials, and participate in online academic communities.

These transformations align closely with the broader shifts associated with the Fourth Industrial Revolution (Industry 4.0), which is characterized by intelligent automation, interconnected digital systems, and the blurring of physical, digital, and biological boundaries (Năstase, 2025). Within this paradigm, digitalization is not an isolated process but a systemic change that encompasses all

stakeholders in higher education. Digital skills have therefore become foundational competencies for academic success, employability, and social integration (Bond et al., 2018). Learning mediated by digital technologies is increasingly personalized, experiential, and student-driven, enabling learners to engage in iterative feedback cycles and develop self-regulated learning strategies (Castañeda & Selwyn, 2018).

The shift from traditional to digital learning environments has been facilitated by the widespread adoption of smart devices including personal computers, tablets, smartphones, wearables, and cloud-based platforms such as Moodle and Google Workspace. Among these, smartphones remain the most widely used technology for young adults due to their portability, multifunctionality, and constant internet connectivity. Students frequently employ smartphones not only for entertainment and socialization but also for navigating online coursework, accessing academic repositories, and communicating with peers and instructors. Research consistently demonstrates that smartphones offer significant educational benefits, including convenient access to teaching materials, improved interaction with faculty, and enhanced opportunities for collaborative learning (Lepp et al., 2016).

However, this increased reliance on smartphones has also raised substantial concerns regarding problematic smartphone use (PSU). PSU has emerged as a global challenge in higher education, with studies linking frequent or compulsive smartphone engagement to behaviors such as cyberloafing, distraction, academic procrastination, and diminished attention during class activities (Hidalgo-Fuentes, 2022). Excessive smartphone use has been associated with physical health issues, sleep disturbances, elevated stress, anxiety, depressive symptoms, and impaired emotional regulation among university students (Demirci et al., 2015). Additionally, smartphone-driven social behaviors, such as ignoring others in favor of mobile device use, highlight the broader relational consequences of digital overuse and the erosion of face-to-face interactions in academic settings (Năstase, 2025).

In Vietnam, these technological developments intersect with ongoing national educational reforms aimed at fostering student-centred learning, active engagement, and critical thinking. Moving away from teacher-centred pedagogies, Vietnamese universities increasingly encourage students to take ownership of their learning processes, including active use of digital tools and mobile technologies to engage with course materials, conduct research, and complete assignments on LMS platforms (Ho et al., 2023; Chien Thang & Thi Nguyet Trang, 2024). Within this environment, smartphones are no longer restricted in classrooms but are widely accepted as learning tools that support autonomy and flexibility. Much of the existing literature has examined anxiety primarily as a general psychological or academic construct, with limited attention to its role within technology-integrated classroom environments. As higher education increasingly adopts digital and student-centred learning models, there is a need to better understand how anxiety manifests specifically in contexts where smartphone use is embedded in learning activities. As smartphones become embedded in academic routines, an important question emerges: How might problematic smartphone use influence student anxiety in Vietnamese universities?

Addressing this question is timely and significant, particularly as Vietnam advances toward education models aligned with Industry 4.0. Understanding the dual role of smartphones as both learning tools and potential sources of distraction is essential for universities seeking to optimize digital learning while safeguarding students' mental health.

## **2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT**

### **2.1. Construct definition**

#### **2.1.1. Problematic smartphone use**

Problematic smartphone use (PSU) has emerged as an important topic within behavioral technology research and public health, reflecting growing concerns about compulsive digital consumption and its implications for well-being. Despite expanding scholarly attention, conceptualizations of PSU remain fluid due to its relatively recent emergence as a distinct research area (Horwood & Anglim, 2018). PSU is generally defined as a maladaptive and compulsive pattern of smartphone use that leads to impaired daily functioning, including diminished productivity, interpersonal difficulties, and psychological or physical distress (Horwood & Anglim, 2018; Lepp et al., 2016). Compulsive smartphone use manifests as an uncontrollable urge characterized by behavioral dependency (Chen et al., 2017) and a reluctance or inability to remain separated from one's device. Negative functional consequences include symptoms of withdrawal, heightened stress, disrupted social interaction, physical health complaints, and reduced emotional well-being (Horwood & Anglim, 2018).

A substantial body of scholarship conceptualizes PSU as a behavioral addiction analogous to gambling or Internet addiction, involving psychological dependency, craving, and anxiety when the device is unavailable (Enez Darcin et al., 2016; Busch & McCarthy, 2021). Busch & McCarthy (2021) further differentiate between addiction to the smartphone device itself versus addiction through the smartphone, wherein users develop compulsive behaviors toward a specific application or service. Although the term "addiction" remains debated, some scholars argue that PSU may arise from obsessive-compulsive checking, social anxiety, loneliness, or unresolved emotional stressors rather than addictive mechanisms per se. The literature consistently demonstrates that PSU shares symptomatic features with established behavioral addictions, including impaired self-regulation, withdrawal discomfort, and compulsive engagement.

### **2.1.2. Anxiety**

Student anxiety defined as a state of psychological distress characterized by excessive worry, nervousness, and physiological arousal in response to perceived academic or environmental demands. From a mental health perspective, the World Health Organization (2004) conceptualizes anxiety as a condition involving heightened fear and behavioral disturbances that may impair individuals' daily functioning. According to the systematic review, anxiety in this context encompasses a range of manifestations, including social anxiety, psychological-social anxiety, and attachment-related anxiety, as well as somatic responses such as discomfort or tension when access to the device is restricted (Busch & McCarthy, 2021).

In higher education, student anxiety is frequently associated with academic stressors such as examinations, workload, time pressure, and performance expectations (Benítez-Agudelo et al., 2025). It may also be exacerbated by social and technological factors, including digital overload, social comparison, and constant connectivity through smartphones, which encourage continuous monitoring of others' activities and reinforce feelings of anxiety and psychological distress (Elhai et al., 2017). Within the context of digital learning environments, anxiety increasingly reflects not only academic concerns but also psychological dependence on digital devices and fear of disconnection.

## **2.2. Hypothesis development**

### **2.2.1 Problematic Smartphone Use and Vietnam Student Anxiety**

Compulsive behavior (COB) refers to repetitive and uncontrollable smartphone checking, often driven by fear of missing out or emotional dependence. International research suggests that such compulsive patterns significantly predict heightened anxiety levels (Elhai et al., 2016). Similarly, Vietnamese surveys of high-school and university students indicate that frequent, uncontrollable

smartphone use is associated with increased psychological distress and elevated anxiety-related symptoms (Le et al., 2023).

Therefore, H1 is proposed:

*H1. Compulsive behavior (COB) positively influences Vietnam student anxiety (ANX).*

Functional impairment (FUI) captures disruptions to daily functioning including learning, concentration, and interpersonal activities caused by excessive smartphone use. Studies in Vietnam show that students reporting high smartphone use also report poor sleep quality, reduced concentration, and higher anxiety levels (Nguyen et al., 2024). This aligns with global evidence that FUI is a strong predictor of anxiety and emotional dysregulation (Busch & McCarthy, 2021). Thus H2 is developed:

*H2. Functional impairment (FUI) positively influences Vietnam student anxiety (ANX).*

Tolerance (TOL) reflects the increasing need for longer or more intensive smartphone use to achieve the same psychological gratification. International studies link tolerance to increased anxiety due to heightened emotional reliance (Elhai & Contractor, 2018). Research on Vietnamese university students also reveals that those with higher PSU and tolerance levels show poorer mental-health scores and greater anxiety symptoms (Nguyen et al., 2024).

Therefore, H3 is proposed:

*H3. Tolerance (TOL) positively influences Vietnam student anxiety (ANX).*

Withdrawal (WIT) encompasses feelings of discomfort, irritability, and tension when individuals cannot access their smartphones. Prior research demonstrates that withdrawal symptoms are closely tied to anxiety disorders (Matar Boumosleh & Jaalouk, 2017). Vietnamese studies on nomophobia similarly show that students experience anxiety, sleep disruption, and physiological tension when separated from their smartphones (Pham & Le, 2021).

*So, hypothesis H4 is developed:*

*H4. Withdrawal (WIT) positively influences Vietnam student anxiety (ANX).*

### **3. RESEARCH METHODOLOGY**

#### **3.1. Data Collection**

This study adopted a cross-sectional survey design and collected data from students enrolled at 25 universities across Vietnam. Data collection took place from March 2025 to September 2025. After removing incomplete questionnaires and responses containing substantial missing data (n = 26), a final sample of 307 valid observations was retained for analysis. Eligibility criteria required participants to be full-time undergraduate students who regularly used a smartphone or laptop to access social media applications and engaged with these technologies during classroom activities. The demographic characteristics of the sample indicate that 64.5% (n = 198) of respondents were female. In terms of academic discipline, business majors accounted for 65.26% of the sample, followed by engineering and technology students (21.28%), with the remaining participants representing various other fields of study.

#### **3.2. Variable Measurement**

##### **Problematic smartphone use**

The other section included a 26-item Smartphone Addiction Inventory (SPAI) Scale (Lin et al., 2014; Matar Boumosleh & Jaalouk, 2017). The SPAI scale is comprised of four subscales: compulsive behavior (COB; 9 items), functional impairment (FUI; 8 items), withdrawal (WIT; 6 items) and tolerance (TOL; 3 items).

### **Anxiety**

Anxiety was assessed using a brief screening measure derived from the Generalized Anxiety Disorder-7 (GAD-7), a widely validated seven-item instrument commonly employed to evaluate symptoms of generalized anxiety Matar Boumosleh and Jaalouk (2017).

## **4. RESEARCH RESULTS**

### **4.1. Measurement Model Assessment**

According to Hair (2019), it is recommended that all standardized factor loadings be above 0.70. In our study, some items COB4, COB8, FUI1, FUI7, FUI8 were deleted. As shown in Table 1, the CR and AVE values range from 0.935 to 0.979 and 0.712 to 0.871, respectively. Hair (2019) stated that the estimates of CR and AVE should be higher than 0.700 and 0.500, respectively (Table 1). Hence, convergent validity is satisfactory.

**Table 1.** Reliability and validity of the constructs

| <b>Construct</b>                   | <b>Item</b> | <b>Standardized Factor Loading</b> | <b>Cronbach's Alpha</b> | <b>Composite Reliability (CR)</b> | <b>Average Variance Extracted (AVE)</b> |
|------------------------------------|-------------|------------------------------------|-------------------------|-----------------------------------|---|
| <b>Compulsive Behavior (COB)</b>   | COB1        | 0.843                              | 0.933                   | 0.945                             | 0.712                                   |
|                                    | COB2        | 0.878                              |                         |                                   |   |
|                                    | COB3        | 0.859                              |                         |                                   |   |
|                                    | COB5        | 0.862                              |                         |                                   |   |
|                                    | COB6        | 0.854                              |                         |                                   |   |
|                                    | COB7        | 0.809                              |                         |                                   |   |
|                                    | COB9        | 0.800                              |                         |                                   |   |
| <b>Functional Impairment (FUI)</b> | FUI2        | 0.887                              | 0.913                   | 0.935                             | 0.743                                   |
|                                    | FUI3        | 0.871                              |                         |                                   |   |
|                                    | FUI4        | 0.840                              |                         |                                   |   |
|                                    | FUI5        | 0.893                              |                         |                                   |   |
|                                    | FUI6        | 0.817                              |                         |                                   |   |
| <b>Withdrawal (WIT)</b>            | WIT1        | 0.879                              | 0.947                   | 0.958                             | 0.791                                   |
|                                    | WIT2        | 0.922                              |                         |                                   |   |
|                                    | WIT3        | 0.924                              |                         |                                   |   |
|                                    | WIT4        | 0.926                              |                         |                                   |   |
|                                    | WIT5        | 0.877                              |                         |                                   |   |
|                                    | WIT6        | 0.804                              |                         |                                   |   |
| <b>Tolerance (TOL)</b>             | TOL1        | 0.948                              | 0.926                   | 0.953                             | 0.871                                   |
|                                    | TOL2        | 0.909                              |                         |                                   |   |
|                                    | TOL3        | 0.942                              |                         |                                   |   |
| <b>Anxiety (ANX)</b>               | ANX1        | 0.935                              | 0.975                   | 0.979                             | 0.869                                   |
|                                    | ANX2        | 0.943                              |                         |                                   |   |
|                                    | ANX3        | 0.953                              |                         |                                   |   |
|                                    | ANX4        | 0.944                              |                         |                                   |   |
|                                    | ANX5        | 0.924                              |                         |                                   |   |
|                                    | ANX6        | 0.908                              |                         |                                   |   |
|                                    | ANX7        | 0.917                              |                         |                                   |   |

Garson (2016) evaluates Discriminant Evaluation using the Heterotrait–Monotrait Ratio (HTMT) and the Fornell-Larcker criterion. Table 2 shows that all HTMT values were below 0.9, providing further evidence of discriminant validity (Hair et al., 2019). the square root of the AVE values surpassed the bivariate correlations, confirming discriminant validity according to Fornell and Larcker (1981), confirming the discriminant validity of the measurement models (Hair et al., 2019).

**Table 2. PLS results of discriminant validity**

| <b>Fornell - Larcker criterion</b>          |            |            |            |            |            |
|---|------------|------------|------------|------------|------------|
|   | <b>ANX</b> | <b>COB</b> | <b>FUI</b> | <b>TOL</b> | <b>WIT</b> |
| <b>ANX</b>                                  | 0.932      |            |            |            |            |
| <b>COB</b>                                  | 0.713      | 0.844      |            |            |            |
| <b>FUI</b>                                  | 0.666      | 0.820      | 0.862      |            |            |
| <b>TOL</b>                                  | 0.761      | 0.757      | 0.772      | 0.933      |            |
| <b>WIT</b>                                  | 0.714      | 0.746      | 0.803      | 0.830      | 0.890      |
| <b>Heterotrait - Monotrait ratio (HTMT)</b> |            |            |            |            |            |
| <b>ANX</b>                                  |            |            |            |            |            |
| <b>COB</b>                                  | 0.744      |            |            |            |            |
| <b>FUI</b>                                  | 0.699      | 0.884      |            |            |            |
| <b>TOL</b>                                  | 0.798      | 0.811      | 0.830      |            |            |
| <b>WIT</b>                                  | 0.741      | 0.794      | 0.859      | 0.884      |            |

### 4.3. Hypotheses Assessment and Discussion

**Table 3. Relationship between variables diagram**

| <b>Path</b>                                | <b>Path coefficient</b> | <b>t-value</b> | <b>p-value</b> | <b>Hypothesis</b> | <b>Decisions</b> |
|--|-------------------------|----------------|----------------|-------------------|------------------|
| <b>Compulsive Behavior -&gt; Anxiety</b>   | 0.302                   | 4.244          | 0.000          | H1                | Supported        |
| <b>Functional Impairment -&gt; Anxiety</b> | -0.054                  | 0.613          | 0.540          | H2                | Not support      |

|                                 |       |       |       |    |           |
|---------------------------------|-------|-------|-------|----|-----------|
| <b>Tolerance -&gt; Anxiety</b>  | 0.426 | 6.282 | 0.000 | H3 | Supported |
| <b>Withdrawal -&gt; Anxiety</b> | 0.178 | 2.001 | 0.049 | H4 | Supported |

Firstly, the effect of compulsive smartphone checking on anxiety was positive statistically significant ( $\beta = 0.302$ ,  $t$ -value = 4.244,  $p$ -value = 0.000). This aligns with several international findings showing strong links between compulsive smartphone use and anxiety (Elhai et al., 2016).

Functional impairment ( $\beta = 0.054$ ,  $t$ -value=0.613,  $p = 0.540$ ) not significantly influence anxiety, meaning that daily functioning (poor concentration, sleep disturbance, task avoidance) strongly predict anxiety symptoms. This contrasts with global observations that FUI is a strong predictor of anxiety and emotional dysregulation (Busch & McCarthy, 2021).

Tolerance also significantly increased anxiety ( $\beta = 0.426$ ,  $t$ -value=6.282,  $p$ -value = 0.000). Students who need to use smartphones more frequently or for longer durations to feel “normal” tend to show higher anxiety. This is consistent with Elhai and Contractor (2018), who observed that tolerance reflects emotional dependence, contributing to anxiety. Vietnamese research confirms that high PSU and tolerance are associated with poorer mental health (Nguyen et al., 2024).

Withdrawal shows significant affect anxiety ( $\beta = 0.178$ ,  $t$ -value = 2.001,  $p$ -value = 0.049), indicating that students experience anxiety when unable to access their smartphone. This supports findings from Matar Boumosleh and Jaalouk (2017), who reported that withdrawal symptoms (tension, irritability, fear of disconnection) are strongly linked to anxiety disorders. Vietnamese nomophobia studies similarly show withdrawal-related anxiety (Pham & Le, 2021).

## 5. SUMMARY AND RECOMMENDATION

### 5.1. Summary of Findings

This study examined the impact of problematic smartphone use (PSU) on student anxiety in classroom settings within Vietnamese universities, particularly in the context of rapid digital transformation associated with the Fourth Industrial Revolution. Using survey data from 307 students and applying PLS-SEM analysis, the study investigated the effects of four dimensions of PSU, such as compulsive behavior, functional impairment, tolerance, and withdrawal on student anxiety.

The findings provide several important insights into the relationship between smartphone dependency and student mental health.

First, compulsive behavior was found to have a significant positive effect on student anxiety. This suggests that repetitive and uncontrollable smartphone checking, often driven by fear of missing out or habitual use, contributes to increased psychological distress among students. Second, tolerance emerged as the strongest predictor of anxiety among all PSU dimensions. Students who require increasing amounts of smartphone use to achieve the same level of satisfaction are more likely to experience higher levels of anxiety. This finding highlights the role of emotional dependency on smartphones, where excessive reliance gradually undermines psychological stability. Third, withdrawal was also found to significantly increase anxiety, indicating that students experience discomfort, irritability, and tension when they are unable to access their smartphones. In contrast, functional impairment did not show a significant effect on anxiety. This finding diverges from some prior studies that identify disruptions in daily functioning as a key driver of psychological distress. One possible explanation is that Vietnamese students may have adapted to

multitasking behaviors and digital learning environments, thereby reducing the perceived negative impact of functional disruptions on anxiety.

Overall, the findings suggest that psychological dependence dimensions of PSU (compulsion, tolerance, and withdrawal) play a more critical role in explaining student anxiety than functional consequences. This highlights the importance of understanding smartphone use not only as a behavioral issue but also as a psychological phenomenon in contemporary higher education contexts.

## **5.2. Academic and Practical Contributions**

### **Academic Contributions**

This study contributes to the literature in several important ways. It extends the research on problematic smartphone use by focusing on its psychological consequences in classroom settings, rather than general daily usage. By situating PSU within the academic environment, the study provides a more context-specific understanding of how smartphone dependency influences student anxiety during learning activities. Furthermore, the study offers empirical evidence from a developing country context, specifically Vietnam, where digital transformation in higher education is rapidly evolving. While much of the existing literature has focused on developed economies, this research enriches cross-cultural perspectives by demonstrating how PSU manifests and affects students in emerging educational systems. The study also contributes to the broader discourse on digital transformation in education, highlighting the unintended psychological consequences of increased reliance on mobile technologies in student-centred learning environments.

### **Practical Contributions**

The findings also provide several important implications for educational practice and policy.

First, universities should shift from restrictive approaches to more balanced and strategic management of smartphone use in classrooms. Given that smartphones are integral to modern learning environments, banning their use may not be effective. Instead, institutions should design structured digital learning activities that encourage purposeful and academic-oriented smartphone use.

Second, higher education institutions should prioritize mental health support systems, particularly in addressing technology-related anxiety. Counseling services, digital well-being programs, and stress management workshops should be strengthened to help students cope with psychological dependence on digital devices.

Third, the findings highlight the importance of developing students' digital self-regulation skills. Universities should incorporate training programs that help students manage screen time, reduce compulsive checking behaviors, and build healthier relationships with technology.

Fourth, educators should play an active role in raising awareness of responsible smartphone use. By integrating discussions on digital well-being into teaching practices and encouraging mindful technology use, instructors can help mitigate the negative psychological effects associated with excessive smartphone dependence.

## **5.3. Limitations and Future Research**

Despite its contributions, this study has several limitations that should be acknowledged.

First, the study employed a cross-sectional design, which limits the ability to establish causal relationships between problematic smartphone use and anxiety. Future research could adopt longitudinal or experimental designs to better capture causal dynamics and changes over time.

Second, the research relied on self-reported data, which may be subject to biases such as social desirability or inaccurate self-assessment. Future studies could incorporate objective measures, such as smartphone usage tracking data, to enhance the reliability of findings.

Third, the sample primarily consisted of students from Vietnamese universities with a strong representation of business-related disciplines, which may limit the generalizability of the results. Future research should include more diverse samples across different academic fields and institutional contexts.

By addressing these limitations, future research can further deepen insights into the complex relationship between digital technology use and student well-being in higher education.

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