

# **Revisiting the Causality between Smartphone Usage and Academic Performance: A Large-Scale Survey**

*Research-in-Progress*

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## **Abstract**

*Despite the rapid technological advances, the usage of smartphones among college students has been broadly discouraged, because a number of studies have demonstrated a strong causality between smartphone usage and poor academic performance. Nonetheless, there is a lack of studies that simultaneously test the impacts of the use of multiple smartphone applications on academic performance while considering the possible mediating effect of students' internal status and life habits. Based on a large-scale survey with over 10,000 college students, this study aims to offer robust empirical evidence that appropriate use of certain applications factually motivates a better academic performance. Specifically, our model assumes a direct impact of the use of five types of applications on academic performance, as well as their indirect impacts mediated by cultivation of nomophobia and other habits related to smartphone usage.*

Keywords: Smartphone applications, nomophobia, mobile habits, academic performance

## **Introduction**

Many studies have demonstrated adverse impacts of smartphone usage on students, especially on their physical and psychological wellbeing (Schneider and Wang 2016) as well as on their academic performance (Junco and Cotten 2012). Mobile learning, like other smartphone applications, may also trigger nomophobia - fear of being technologically incommunicable, distant from the mobile phone or internet (Yildirim and Correia 2015). To diminish the negative impacts, forbidding students' use of smartphones at schools has been suggested in various media or in scholarly outlets (Tossell et al. 2015). While a number of earlier studies has evaluated the impact of specific smartphone applications (i.e. apps) on students' academic performance with the help of small survey samples, our study uses a large-scale sample to obtain a more complete understanding by focusing on several different apps and considering their internalization and externalization effects.

Specifically, we aim at better understanding the impacts of the use of different smartphone apps with an integrated model. Past studies have mostly focused on testing the direct effect of overall smartphone usage, or of a specific app, such as social media, video games, and instant messaging. Instead, we believe that our integrated analysis may offer a more complete understanding of the impacts of different smartphone apps on students' academic performance.

Furthermore, even though earlier studies (Junco and Cotten 2011; Nayak 2018) have demonstrated a direct impact of smartphone apps usage on academic performance, possible mediating effects of the psychological traits and life habits have been seldom considered. Smartphone usage may cause different psychological outcomes, such as nomophobia, that can alter users' behaviors or habits and, in turn, alter students' learning activities and performance. Based on activity theory and the principles of internalization and externalization, we expect an indirect impact so that smartphone applications usage is internalized and it shapes users' psychological traits and outcomes (such as, nomophobia), which is later externalized to alter users' behavioral patterns (such as, life habits). The altered life habits are expected to affect students' academic performance directly.

## **Literature Review**

### ***The Impact of Smartphone Usage on Academic Performance***

Recent studies have emphasized that, alongside various advantages that smartphone usage affords the users, it can also cause detrimental impacts (Gokçearslan et al. 2016). Mobile phone addiction has been identified as a new kind of psychological disorder (Bianchi and Phillips 2005). Not surprisingly, based on a survey in India, Nayak (2018) found that smartphone addiction has negative impacts on the academic performance of both male and female students (albeit the effect is more serious for the male students).

In another stream of research, scholars have focused on the links between the use of specific smartphone apps and academic performance. For instance, several studies have found that video games can weaken academic performance of middle school students (Jackson et al. 2011), or college students (Anand 2007). Also, Facebook users have been reported to spend less time studying and to have worse study performance and lower GPAs (Kirschner and Karpinski 2010) than nonusers. In addition, Junco (2012) concluded that frequency of multitasking particularly with certain communication services (e.g. Facebook and text messaging) was negatively predictive of overall semester GPA.

### ***Mobile Learning and Academic Performance***

Mobile learning is assumed to benefit the learners by, for example, supporting individualized learning and realizing situated learning (Cheon et al. 2012). Nonetheless, the benefits of mobile learning seem to be mostly stem from location-based learning in environments such as museums, or from scenario-based laboratory learning with predefined teaching materials (see e.g. Hall and Bannon, 2006). Regarding more conventional learning objectives, the effect of mobile learning has been questioned. For instance, according to Tossell et al. (2015), even though the experiment participants perceived the use of smartphones for university education as favorable prior to use, they later considered it a detriment to their academic goals. Yet, there is very little earlier research on the overall impact of mobile learning app use on students' academic performance, especially in the context of tertiary education. Hence, one of the focus areas in our study consists of mobile learning apps and their affects the academic performance of university students.

Noteworthy, smartphone usage in educational situations has been claimed to trigger some serious side effects including psychological disorders, including addiction and attention-deficit-disorder (Spitzer 2015). There is no evidence that mobile learning apps would be immune from this effect. For instance, Gezin and Çakır (2016) advised that teachers need to pay attention to the risk of nomophobia while applying mobile learning tools in their lessons. Therefore, we can infer that mobile learning apps, just like other smartphone apps, can cultivates the formation of nomophobia. This can, in turn, result in an overall negative impact on students' academic performance, in spite of some momentary benefit on a particular learning subject. This concern motivates the current study.

### ***Nomophobia and Problematic Mobile Habits***

Nomophobia is a new psychologic term that refers to problematic usage of mobile technologies. Recent popularity of smartphone usage has been found to increase the prevalence of nomophobia among teenagers (Gezin et al. 2018). Nomophobia, which is conceptually similar to smartphone addiction, is

viewed as a consequence of usage of a smartphone and its apps (Csibi et al. 2018; Lin et al. 2018). Accordingly, the use of different apps is expected to induce nomophobia albeit to various degrees.

Nomophobia has been reported to change users' daily habits (Gezgin and Çakır 2016). With a high level of nomophobia symptoms, a person may become overanxious of being inaccessible by phone or Internet. This may result in the person never turning off his or her smartphone or frequently checking it, further leading to changes in other life habits. Gupta et al. (2016) explained how excessive smartphone use can negatively impact our psychological wellbeing and sleeping patterns. Gezgin et al. (2017) claimed that nomophobia negatively affects individuals' daily lives both physically and psychologically. For students, in addition to alter the daily habits such as sleeping, nomophobia may impede their focus in class and lead to problems in their academic activities and ultimately, academic achievements.

## **Theoretical Background**

### ***Theory of Psychological Traits***

Psychological studies define traits as person's habitual patterns of behavior and thoughts, which are products of the combination of genetic predispositions and personal experiences (Allport 1937). Therefore, smartphone usage, as a personal experience, may also contribute to shaping users' psychological traits, and even lead to a phone addiction or nomophobia. In fact, number of studies have associated addiction with specific personality traits or personality disorders (Ko et al. 2006). Personal experiences of excessive usage and habitual checking on missed calls or messages, for example, may lead to compulsive behavioral patterns or addiction for smartphone users. Lee et al. (2014) found that compulsive usage of smartphone and technostress are both positively related to psychological traits such as locus of control and social interaction anxiety. In other words, smartphone usage may increase the risk of different anxiety disorders like nomophobia, which further affects how people behave in different situations.

### ***Activity Theory: Principles of Internalization and Externalization***

Activity theory focuses on "object-oriented, collective, and culturally mediated human activity" (Engeström et al. 1999, p. 9). It distinguishes between internal and external activities, and emphasizes the processes of mutual transformations between internalization and externalization. Therefore, activity theory is in line with literature on psychological traits stating that experiences of human activities shape personality, which in turns influences future human activities.

#### ***Internalization***

Internalization is defined as the "transformation of external activities into internal ones" (Kaptelinin et al. 1995, p. 192). Broadly speaking, the processes of all forms of "taking in" external stimuli can be described with the term of internalization (Sandler and Perlow 1988). Internalization is a transition in which external material objects are transformed into processes that take place on the mental plane. And during these processes, the external undergoes exceeding the boundaries of the possibilities of external activity (Kaptelinin et al. 1995). Accordingly, internalization provides a possibility for human beings to structure psychological traits with personal activities by performing actual manipulations on certain objects in reality. Likewise, external requests to use smartphone apps for certain purposes will be internalized to make an impact. Anshari et al. (2016) provide evidence for how bad smartphone habits and behaviors like using a smartphone daily over extended periods of time can lead to negative consequences, including smartphone dependence and nomophobia. In this way, smartphone app usage likely contributes to a kind of personal experience that, through internalization, is transformed from external activities to internal anxiety disorder of nomophobia.

#### ***Externalization***

Externalization can be defined as a "transformation of internal activities into external ones" (Kaptelinin et al. 1995, p. 192). By and large, the term covers all forms of transforming some aspect of one's internal world or psychic structure to the outside (Bedny and Karwowski 2004). Evidently, anxiety triggered by nomophobia will externalize to initiate or alter particular human activities, such as constantly checking

phone for new messages. Smartphone could be a bridge from the externalization of the mind to its extensions, making the ontological leap from the utensil status to that of "part of the mind". Oulasvirta et al. (2012) suggested that nomophobia leads to a more intensive smartphone usage. In other words, when nomophobia is established, it is likely projected into an external manifestation of problematic smartphone usage, like excessive smartphone usage or smartphone usage in-class.

## **Hypotheses and Research Framework**

In this study, we focused on five types of smartphone apps, which are among the most popular apps used by college students (iiMedia-Research 2018): mobile learning, mobile games, social media, entertainment, and Internet surfing.

### ***Process of Internalization***

The formation of nomophobia from smartphone usage can be viewed as an internalization process considering the "taking in" procedure of smartphone app usage into an internalized psychological symptoms of nomophobia. Smartphones enable the use of Internet and various apps, which themselves can be addictive (Lin et al. 2018). Many studies have shown that the usage of smartphone apps cultivates nomophobia. Past studies have demonstrated the direct impacts of the use of different smartphone apps on nomophobia, irrespective of the differences in apps. For instance, Csibi et al. (2018) established that the use of three types of apps (i.e. traditional mobile communication, social media, and information apps) is positively linked to nomophobia. Similarly, Jeong et al. (2016) found that using SNS and playing games on smartphones is positively associated with smartphone addiction.

By definition, the use of smartphone is a prerequisite for nomophobia to take place. Once a user starts to interact with a smartphone, a risk of nomophobia emerges, which should be independent of the types of the apps used. Hence, it is conceivable that nomophobia develops along with an increased usage of different smartphone apps. Thus, we postulate:

**H1a-e:** The usage of apps for mobile learning (a), mobile games (b), social media (c), entertainment (d), Internet surfing (e) with smartphone increases the likelihood of the person developing nomophobia.

### ***Process of Externalization***

Nomophobia as a personal status will externalize to alter users' behavior patterns, which may directly or indirectly affect students' learning behavior or learning effectiveness. For instance, nomophobia may compel users to excessively use smartphone at the cost of their study time, or tempt him or her to use a smartphone for an extended period of time before sleep, resulting in poor sleep quality and poor learning effectiveness in the coming day. On the other hand, nomophobia triggers individual stress and fatigue, thereby decreasing relative self-control. For instance, the lack of information about the duration of a meeting where the use of smartphones is not allowed has been experienced stressful by nomophobic individuals (Tams et al. 2018, p. 3). Past studies have also highlighted self-control as a limited resource, and that depletion of self-control brings about more inappropriate behaviors, including excessive use of smartphone before sleep or improper smartphone usage in certain situations like in class at school (Muraven et al. 1998).

Several studies offer support for the above assumptions. For instance, Gokçearsan et al. (2016) showed that smartphone addiction is positively related to the duration of smartphone usage. College students usually regularly attend to their smartphones even while studying. Young people, who are more prone to develop Internet addiction, are more inclined to go to sleep later during nighttime (Ekinçi et al. 2014). In other words, it is likely that students with nomophobia will develop problematic smartphone using habits. Thus, we postulate:

**H2a-c:** Nomophobia has increases individual's overall smartphone usage (a), smartphone usage in-class (b), and smartphone usage before going to sleep (c).

### Smartphone Usage Habits and Academic Performance

Bad smartphone usage habits adversely impact students' learning behavior and learning effectiveness. Earlier research has shown that smartphone can be a distraction deterring students from achieving their academic goals (Tossell et al. 2015). Li et al. (2015) reported that individuals addicted to cell phone use are more likely to use phone during class or while studying, resulting in poor academic performance. Furthermore, smartphone habits (such as excessive checking) dominate the behaviors driving smartphone use and can make overall smartphone usage even more intensive and time consuming. As a result, students are likely to get distracted even during the lectures and turn their focus on smartphone apps, leading to a poor academic performance. Earlier research has found that students who reported to use mobile devices often for multitasking in study-related situations will perform poorly in their studies (Jacobsen and Forste 2011). Thus, we postulate that:

**H3a-c:** Overall smartphone usage (a), smartphone usage in-class (b), and smartphone usage before sleep (c) has negative influence on academic performance.

### Direct Impacts of Apps Usage on Academic Performance

Mobile learning refers to studying with the help of general mobile learning apps available at the app market. Since mobile learning apps were developed to assist learning activities, their usage is expected to facilitate better academic performance of students. There is evidence showing that the use of mobile learning tools can, indeed, lead to positive academic outcomes. For instance, earlier studies have found that both college students' academic achievements (Jsun et al. 2012) and faculty's perceptions on performance of university students (D'Ambra et al. 2013) can be improved significantly with the assistance of mobile learning tools, such as e-textbooks. Moreover, students, utilizing digital video tools as technical assistance, have been reported to be able to improve their oral presentation skills (Raven et al. 2010). Accordingly, we propose the following hypothesis:

**H4a:** The usage of mobile learning tools via smartphone has a positive influence on academic performance.

Previous studies examined the adverse impacts of various non-academy-related apps on academic performance of students. For instance, Jackson et al. (2011) found that video games playing negatively linked to students' GPAs. In addition, students' excessive participation or obsession with social media has a negative impact on academic performance (Kirschner and Karpinski 2010). Social media and non-academic Internet use were found to have negative impacts on college students' class performance. Individuals tend to use their social media no matter when class is in session or not, and even spend day and night online for chatting. As a result, we argue that students, who spend a lot of time on using different smartphone apps, will have a poor academic performance, thereby postulating the following hypotheses.

**H4b-e:** The usage of mobile games (b), social media (c), entertainment (d), Internet surfing (e) via smartphone has negative influence on academic performance.

The research model is presented in Figure 1.

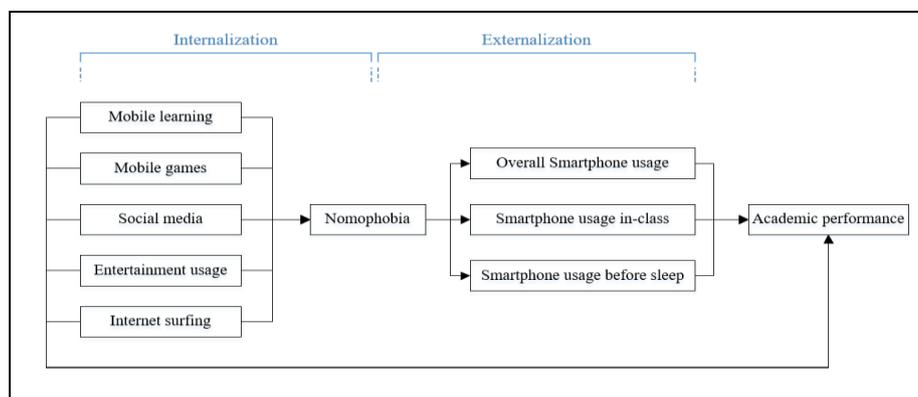


Figure 1. Research Model

## Research Methodology

### Measurement

The measurement for nomophobia was adapted from existing literature (Yildirim and Correia 2015), in which a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) was used to measure each item. Meanwhile, academic performance was measured using academic ranking, which is the overall reflection of students' academic grade. Additionally, we measured average time of using certain type of apps. For the three dimensions of mobile habits (i.e. overall smartphone usage, smartphone usage in-class or before sleep), we asked for the daily average time that they spend on smartphone in corresponding occasions. Noticeably, smartphone usage in class is not recommended at the university where the study was conducted, because the study program does not have an e-learning platform or offer an online access to course materials.

We will apply structural equation modeling technique to analyze the research model and test our hypotheses with SmartPLS 3.0 that can simultaneously test both the structural model and the measurement model.

### Sampling and Data Collection

The survey was distributed online on a university website between 12th November 2017 and 18th January 2018 to undergraduates of a well-regarded university in China. We received a total of 10352 responses. After discarding incomplete and unmindful responses (e.g. where the same answers were chosen for most questions), we had 9256 responses that will be used to test our hypotheses. The demographic breakdown of our sample is shown in Table 1 below.

**Table 1. Demographic characteristics of respondents (N = 9,256)**

Variable	Categories	Frequency (%)	Variable	Categories	Frequency (%)
Gender	Male	5385 (58.18%)	Stay up late (frequency)	1-2 times per month	587 (6.34%)
	Female	3871 (41.82%)		1-2 times per week	2260 (24.42%)
Age	Below 18	19 (0.1%)		3-5 times per week	2231 (24.10%)
	18-22	8383 (90.57%)		6-7 times per week	4178 (45.14%)
	23-28	852 (9.20%)	Daily smartphone use (hours)	Less than 0.5 hour	219 (2.37%)
	Above 28	2 (0.02%)		0.5-1 hour	553 (5.76%)
Internet experience	Less than 0.5 year	195 (2.10%)		1-2 hours	1699 (18.36%)
	0.5-1 year	476 (5.14%)		2-4 hours	2870 (31.01%)
	2-3 years	1618 (17.48%)		4-6 hours	2348 (25.37%)
	4-5 years	1633 (17.64%)	7-8 hours	679 (7.34%)	
	More than 5 years	5335 (57.64%)	More than 8 hours	888 (9.59%)	

### Expected Contribution

This study seeks to add to the literature on smartphone usage and its adverse impacts on students' academic performance. Moreover, this study is among the first to apply the theoretical principles of internalization and externalization to understand the mechanisms of how different types of smartphone apps affect academic performance through nomophobia and individual habits. The practical contribution of this study will be in the form of guidelines for students and educational institutions to better manage the use of different smartphone apps.

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