



# IMPACT OF SMART-PHONE ON ACADEMIC PERFORMANCE: A LITERATURE REVIEW

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**ABSTRACT:** The first systematic review of the scientific literature on smart phone use and academic success were presented. The theoretical mechanisms, empirical approaches, and empirical findings described in the multidisciplinary literature up to date were synthesized. A smart phone use may interfere with study-related activities. The proximity of the mobile device can be a tempting distraction, leading to multitasking or task-switching. Our analysis of the literature reveals a predominance of empirical results supporting a negative association between student's frequency of smart phone use and their academic success. However, the strength of this association is heterogeneous by (a) the method of data gathering, (b) the measures of academic performance used in the analysis, and (c) the measures of smart phone use

adopted. The main limitation identified in the literature is that the reported associations cannot be give a causal interpretation, thus based on the reviewed findings and limitations, directions for further research are discussed.

**(Keyword:** Smartphone, Addiction, Proximity, Academic performance, Causality)

## INTRODUCTION

Impact of smartphone on people's private life, smartphone use is also expected to interfere with individual's educational and professional life. It has been related to tertiary student's academic performance. Smartphone ownership is highest among people aged 18-29 years (Pew Research Center, 2018), an age group in which students are highly represented. Moreover, there are many theoretical reasons based on which a direct effect of overuse of smartphone on academic performance is expected. To the best of our knowledge, 23 studies confront the theoretical expectations with the empirical reality. The present review is the first one to compile the existing literature on the impact of general smartphone use (and addiction) on performance in tertiary education.

We believe that a synthesis of this literature is valuable to both academics and policy makers. Firstly, as we focus on divergences in the empirical findings ergo, aspects in which there is no consensus in the literature and (methodological) limitations of existing studies, we explicitly provide scholars with directions for fruitful future research. Secondly, while in several countries' interventions have been developed to discourage heavy smartphone use in class because it is believed to obstruct knowledge acquisition (e.g., in France, a smartphone ban was introduced into schools in 2017; Samuel, 2017), it is unclear whether these popular perceptions correspond with a consensus in the related scientific literature.

The academic achievement subscale is a part of the author's problematic use of mobile phones scale. This subscale relates to the item that assesses whether the respondent believes her/his smartphone usage adversely affects his/her academic achievement, rated on a 5-point Likert scale.

1. The G-MNPS score is the student's weighted average score calculated by the business school, based on the student's rank for every course included in the curriculum.

2. The college adjustment scale comprises three items that assess self-related academic motivation, academic performance, and social adjustment to college, rated on a 5-point Likert scale.

3. The academic performance scale comprises three items that assess self-related academic participation, academic performance, and time management, rated on a 5-point Likert scale.

4. The final course grade is the final grade obtained for the specific course in which the survey was held, as provided by the lecturer of this course.

5. The student course engagement scale comprises 23 items that assess four factors found to relate to student's course engagement (skills engagement, emotional engagement, participation and interaction engagement, and performance engagement), rated on a 5-point Likert scale.

## **AIM OF THE STUDY**

To study the impact of smart phone usage on academic performance of students and also the impact on educational outcome because of smart phone use.

## **REVIEW OF LITERATURE**

This literature review is structured as follows. In the next section, we discuss the different theoretical mechanisms reported in the literature that could lead to improved or deteriorated educational outcomes due to (heavy) smartphone use. In next, we discuss a systematic overview of the empirical findings, with a focus on how the empirical research results converge concerning the overall negative association between smartphone use and academic performance but diverge according to the method of data gathering, the measures of academic performance used in these studies, and the measures of smartphone use adopted in the research. A final section concludes with directions for future research based on the discussed findings and the limitations of the current literature.

The literature's empirical findings on the association between general smartphone use and tertiary educational outcomes. This review is the result of a systematic search. In the first step, all 190 article abstracts indexed in Web of Science including a combination of 'smartphone use' with 'educational outcome' or 'academic performance' were screened for relevance, which provided an initial list of studies for our review. In the second step, we explored the articles included in the studies' references and the articles citing these studies in Web of Science. This second step was re-iterated whenever an additional relevant article was found.

A predominance of studies reporting a significantly negative association between smartphone use and academic performance in tertiary education. More specifically, 18 of the 23 included studies (i.e., 78.3 percent), relying on diverging empirical approaches elaborated upon below, conclude such a negative association. The remaining five articles find not statistically significant association between overall smartphone use and performance at university. However, no single study to date reports

a positive overall association. This first look at the literature provides an indication<sup>3</sup> that the negative mechanisms, as discussed in the previous section, contribute more to the association between smartphone use and academic outcomes than the positive mechanisms.

We report significant Pearson correlation coefficients with respect to the studies measures of these outcomes they could be gathered for 18 of the 23 studies . These correlation coefficients do not take into account any confounding variables and therefore are not the analysis end point in most reviewed articles. However, they allow us to compare a raw indicator of the magnitude of the association between smartphone use and academic performance across studies. The reported coefficients range from a correlation coefficient of 0.380 between total phone use in class and self-reported grade point average (GPA) in Kim et al. (2019) to a correlation coefficient of 0.047 between the problematic mobile phone use scale of Sert, Kumsar and Aygin (2019) and self-reported GPA. When considering only correlation coefficients of studies that concluded a statistically significantly negative association, not surprisingly the interval is less wide. Then it moves from a very small correlation of 0.079 (Lin & Chiang, 2017) to a (rather) small correlation of 0.380 (Kim et al., 2019) In sum, the reviewed literature seems to suggest a negative association between overall smartphone use and academic performance that is small in magnitude (at most). However, this general picture may conceal interesting (further) convergences and divergences in the literature that can be observed only after investigating the studies more carefully, which is addressed in the next two subsections.

Firstly, all studies based on survey data: Seven rely on an online survey and another 12 rely on a paper and pencil survey. Wins et al. (2019) rely partly on an online survey for the Korean subsample and partly on a paper and pencil survey for their Australian subsample. In addition, Felisoni and Godoi (2018), Rosen et al. (2018) and Kim et al. (2019) combined a paper and pencil survey with objective logged data, which is a strong point for these studies as Boase and Ling (2013) reported a limited correlation between self-reported smartphone use and actual logged data we return to this point below. Four of the five studies reporting no significant association between smartphone use and academic performance are relying on data gathered by a paper and pencil questionnaire. A possible explanation might be that those questionnaires are filled in during a course and therefore participants are surrounded by peers which might increase the tendency to socially desirable answers (Krumpal, 2013). In 2018, approximately 77 percent of America's inhabitants owned a smartphone (Pew Research Centre, 2018), defined here as a mobile phone that performs many of the functions of a computer (Alosaimi, & Shaik, 2016). In addition, a survey conducted in 2015 showed that 46 percent of Americans reported that they could not live without their smartphone (Smith, 2015). Similar numbers can be observed in other parts of the

(Western) world (OECD, 2017). Therefore, it should come as no surprise that in recent years discussions about the (potential) consequences of (heavy) smartphone use have earned an important place in societal debates (Eliahu, 2014). Simultaneously, the possible effects of smartphone use received increasing interest from scientists in different disciplines. As such, scholars have investigated associations between smartphone use and smartphone addiction and, for example, (a) driving performance (Choudhary & Velaga, 2019); (b) Sleep quality and quantity (Akpinar, 2015); (c) Anxiety, loneliness, and depression (Boumosleh & Jaalouk, 2017); (d) Satisfaction with life (Samaha & Hawi, 2016); (e) Social relationships (Chen & Peng, 2008); (f) Substance addictions (Ho et al., 2014); and (g) Attention deficit and hyperactivity disorder (Ho et al., 2014).

Multiple literature argues for an association positive or negative between smartphone use and academic performance. In this section, we review the main theoretical mechanisms. On the one hand, (particular functions of) smartphones could: when used properly: lead to better educational performance. Smartphone's mobility allows students to access the same (internet-based) services as a computer almost anywhere, almost every time (Lepp, Barkley, & Karpinski, 2014). Easy accessibility to these functionalities offers students the chance to search continuously for study-related information. Thus, smartphones provide a multi-media platform to facilitate learning which cannot be replaced by reading a textbook (Zhang, Ho, & Ho, 2014). Furthermore, social networking sites and communication applications may contribute to the quick sharing of relevant information. Faster communication between students and between students and faculty staff may contribute to more efficient studying and collaboration (Chen & Ji, 2015).

A growing body of literature (Junco, 2012) has shown this behavior negative implications with respect to educational performance. We discuss four potential causes for this multitasking or task switching behavior. Firstly, visual, and auditory notifications on the smartphone may draw student's attention during class and/or during study time (Junco & Cotten, 2012). Secondly, the desire not to miss out on what is happening online and to continuously interact with the rest of the world may lead to a lack of focus necessary to achieve good study performance (Firat, 2013). Thirdly, but related, smartphone use during study-related activities may be the result of addiction behavior and cyberslacking, which can be defined as the interference of personal (online) life during working or study activities (LaRose, 2011). Finally, due to the lack of academic motivation, students can experience a sense of boredom for which smartphone applications provide a fast and tempting escape (Hawi & Samaha, 2016).

The association between smartphone use and academic performance has been investigated on all continents. However, most studies were conducted in North America and Asia. No remarkable differences were noticed between the studies relying on data from these two continents. Among the North American studies, Bun Lee (2015) and Wentworth and Middleton (2014) found no significant association while a negative association was concluded in the five other articles. Similarly, two of the Asian based investigations (Rashid & Asghar, 2016; Sert et al., 2019) did not report a significant association while a negative association was reported by the nine other studies. Furthermore, Wins et al. (2019) found no significant association for their Korean subsample. For their Australian (Oceania) they reported a significantly negative association. Besides, Felisoni and Godoi (2018) and Jankovic, Nikolic, Vukonjanski and Terek (2016) reported a significantly negative association in South America and Serbia (Europe), respectively. Finally, among the studies relying on African data, Olufadi (2015) found no significant association in Nigeria while Asante and Hiadzi (2018) reported a negative association in Ghana.

Finally, the research results are rather homogeneous according to the level of control for confounding factors in the main empirical approach. Importantly, none of the empirical results can be given a causal interpretation; that is, to date there is only evidence for heavy smartphone users performing worse at higher education institutions, with no support for heavy smartphone use causing this worse performance. None of the approaches can fully control for the endogeneity of smartphone use and academic achievement because they all rely on observational, cross-sectional data. Thus, they can only control for a limited set of confounders. However, factors such as motivation, intellectual capabilities and perceived academic pressure are typically not included in their collected survey data but might influence both smart-phone use and academic performance. Thereby, it is unclear whether the worse performance of heavy smartphone users reported by many of these studies is really the result of smartphone use or reflects variation in unobserved personal characteristics.

## **SUMMARY AND CONCLUSION**

The statistical and economic magnitude of the association between smartphone use and academic performance seems to be rather homogeneous by the public versus private nature of tertiary education institutions, the method of data analysis as well as by the region and sample size of the realized data. Firstly, one could expect that the students in samples from private universities are positively selective with respect to non-Chen and Peng (2008) report a positive association in the situation when personal electronic devices are (mainly) used for educational purposes.

The reported associations cannot be given a causal interpretation, though. We return to this point below. The Pearson correlation coefficient was reported in 15 of the articles. For the other articles, we attempted to obtain this coefficient from the authors via email, or, when our email was not answered, via telephone (using both personal and institution numbers). By contrast, the association between smartphone use and academic performance seems to be heterogeneous by (a) the method of data gathering, (b) the measures of academic performance used in the analysis, and (c) the measures of smartphone use adopted in the research. Secondly, across the reviewed studies, three measures of academic performance are used. Six studies use data on students' actual grades received from the lecturer or from the faculty or university administration. All of these studies conclude a significantly negative association between smartphone use and these outcomes. In addition, 11 studies rely on self-reported grades. Remarkably, all five articles not reporting a negative association fall within these 11 studies. Finally, the six studies using self-reported academic performance scales all found a negative association. This contrast may indicate that errors of measurement occurred in the self-reported grade variables. Indeed, these variables may be biased due to recall issues or socially desirable answering (Krumpal, 2013). Thirdly, we distinguish a similar difference in research results depending on how smartphone use is measured. In 12 articles, the researchers investigate the association between academic performance and total smartphone use. Except for Felisoni and Godoi (2018), Rosen et al. (2018), who used objectively tracked information, these frequencies are self-reported. Of these twelve studies, only Wentworth and Middleton (2014) did not report a significant association while Wins et al. (2019) find a significant negative association for their Australian subsample and no significant association for the Korean subsample. In contrast, of the other 11 studies, using a scale instrument to measure smartphone attitude and addiction, only seven find a significantly negative association.

The main limitation identified in the literature is that the existing studies all conduct correlational analyses and/or linear or logistic regression analyses on cross-sectional data so that their results cannot be given a causal interpretation. We suggest two different forms of analysis to counter this endogeneity problem that could be explored in further research. Firstly, longitudinal data could be collected in view of regression analyses controlling for individual fixed effects. By integrating fixed effects into the analysis, it is possible to control for time invariant unobserved characteristics of university students that may affect both smartphone use and academic performance. Secondly, instrumental variables correlated with smartphone use but not (directly) affecting educational attainment (such as perceived quality of the Wi-Fi in the classrooms) may be surveyed. These can be

used to capture an exogenous prediction of smartphone use. Thereafter, the causal impact on academic performance of this exogenous prediction can be estimated.

A second limitation of the literature is related to the analyzed data. As pointed out in the empirical findings, 20 out of 23 reviewed articles used self-reported measures of smartphone use in their analysis. Felisoni and Godoi (2018), made a first attempt to introduce actual tracked use in their analysis but they had a rather small sample (N = 43 and 84 respectively). However, Boase and Ling (2013) provided evidence for only a limited correlation between actual smartphone use and that measured by self-reported instruments. So, it is recommended for future research to further investigate whether the results based on self-reported measures can be confirmed when analyzing actual data.

A third shortcoming in the scientific literature so far is the lack of research investigating the empirical validity of the reviewed theoretical mechanisms for a potential impact of smartphone use on academic performance. However, uncovering the mechanisms at work is of great importance for policy making. To implement adequate policy measures on smartphone, use in academic settings, we need to know what precisely causes their (potential) relationship. Tracking university student's smartphone use, as advocated above, may also help in this respect. Actual tracked data would provide more insight into the timing of student's smartphone use. This could reveal indications for the multi-tasking mechanism and/or the time trade-off argument behind the association between smartphone use and academic performance.

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