BRIEF REPORT

Smartphone use and social media addiction in undergraduate students [version 1; peer review: awaiting peer review]

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Abstract

Background: Children's use of social media has increased significantly over the past decade. As a result, they are susceptible to smartphone addiction. In particular, parents' and children's well-being and behaviors are negatively affected by smartphone addiction. Such addiction likely affects both physical performance and lifestyle. Adolescents utilize their smartphones while performing other tasks. The secondary task might divert attention away from the primary task. Reaction time is the combination of brain processing and muscular movement. Texting or communicating on a smartphone while performing another task may affect reaction time. Thus, the purpose of this study was to explore the influence of smartphone use on reaction time in undergraduate students who were addicted to smartphones.
Methods: The Smartphone Addiction Scale-Short Version (SAS-SV) was used to assign 64 undergraduate students to the smartphone addiction group (n = 32) and the control group (n = 32). The reaction time (RT) of an organism is used to determine how rapidly it responds to stimuli. All participants were examined on the RT test under three conditions: no smartphone use (control), texting, and chatting on a smartphone. Participants were questioned by smartphone through text message or chat with the support of a researcher during the texting and conversation conditions. While responding to the questions, the participant was administered an RT test.
Results: The results showed that smartphone addiction tends to have a reduced influence on reaction time when compared to the control group. Also, texting or conversing on a smartphone while doing other work had a substantial impact on reaction time in the undergraduates.
Conclusions: Combining smartphone use with other activities tends to reduce undergraduate students' reaction time.

Open Peer Review

Approval Status *AWAITING PEER REVIEW*

Any reports and responses or comments on the article can be found at the end of the article.

Keywords
Smart phone addiction, Social media addiction, Children, Smart phone used

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Introduction

The Internet is tremendously useful in a variety of applications, including productive electronic commerce, instant knowledge sharing, cultural exchange, and enjoyment.[1–3] Smartphones are devices that combine Internet and phone functionality. They provide qualitatively distinguishing features in addition to the benefits of the Internet. Children use smartphones to watch videos, express themselves, communicate with friends, and search for information. The portability and convenience of a smartphone allow it to be utilized anywhere and at any time. However, although smartphones provide several benefits in our lives, we must be aware of their negative implications, the most concerning of which is smartphone addiction, which relates to the unrestrained use of smartphones. Individuals with smartphone addiction endure emotional, mental, and physical challenges.[2,3]

Even though smartphone addiction does not remain listed in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition[4] or the upcoming International Classification of Diseases, Eleventh Revision, evidence suggests that there is an increasing perception of the issue.[5] Smartphone addiction is a new type of addictive behavior that has developed from the rapid proliferation of smartphones across the internet, resulting in a severe behavioral addiction.[6] According to the National Information Society Agency in Korea, smartphone addiction surpasses internet addiction.[7] Lin *et al*.[8] identified four characteristics of smartphone addiction, including compulsion, functional impairment, tolerance, and withdrawal. Smartphone addiction has been found to correlate with a variety of negative effects on physical health, including brain tumors, cancer, a weakened immune system, neck and wrist pain, and sleep disorders.[9,10] Prolonged smartphone use at nighttime might cause insomnia, stress, and sadness.[11] Screen time and Internet use have been shown to have an impact on sleep,[12,13] and SNS addicts have been shown to have poorer sleep quality than non-SNS addicts.[14]

Adolescents, in particular, are at a significant risk of becoming addicted to smartphones. They are inextricably linked to their smartphones, which they consider to be a second personality.[15] In addition, the adolescents spent the most time of their daily routine with smartphone applications, such as, mobile messengers, web browsing, gaming, and social media.[16] Several smartphone owners insist that they could not really operate without their devices.[17] Adolescents go through a variety of physical and psychological changes during their growth. Despite the fact that teenagers depend on their parents for survival and identity, they are also working to separate themselves from them in order to grow as individuals and carve out a place for themselves. Adolescents become more dependent on smartphones during these transitional periods. Compared to adults, they are significantly more sensitive to and embrace new technologies. Adolescents express themselves online as “digital natives,” aiming to stay current with fashion trends, using a variety of apps, and seeking emotional connections and support.[18] They specialize in multitasking and require fast feedback and input.[18]

Furthermore, social comparison, concern for one's reputation, and identity formation are all long-standing characteristics of adolescence,[19] as is the need for social approval and acceptance, which is impacted by the judgment of one's peers.[20,21] However, current smartphones enhance the negative potential of addictive behavior, especially through the amplification of anxiety as adolescents navigate the power dynamics that support their online connectivity.[22] In another aspect, power dynamics influence who youth seek acceptance from online, how they use smartphones, and how they understand online content. Furthermore, internet comparisons between oneself and others may become more common and increase relative deprivation, reducing self-esteem and negatively damaging mental health. When these characteristics, such as novelty seeking in teenagers, are combined with their immature control abilities, they are predisposed to developing smartphone and social media addiction.[23] In this study, we examined the features of smartphone addiction in adolescents aged 18 to 22 years. In addition, we sought to examine if there would be a difference in reaction times between those who didn't use smartphones and those who did in a smartphone-addicted undergraduate student. Furthermore, we compared the smartphone use patterns of a risk group for smartphone addiction and a normal user group, as well as the risk variables for smartphone addiction.

Methods

Study design and setting

This is a cross-sectional study (blind assessor and statistician) that included 64 graduate students who used a smartphone for social media every day for at least a year before participation. The data was collected in a laboratory room at the Department of Physical Therapy, School of Allied Health Science, University of Phayao, between February and August 2019.

Participants

The participants were recruited via poster advertising in the local area. The primary outcome of the study was sample size that was calculated as follow (eq (1))

$$n = \frac{2s^2\left(Z_{\propto} + Z_{\beta}\right)^2}{d^2} \quad (1)$$

when n is number of sample sizes, s is standard deviation, Z_α is z-score at 95% confidence level, Z_β is 99% confidence level, d is mean difference of virtual reaction time. In this study, we used "d = 0.45" and "s = 0.58" as follow,[24] while Z_β and Z_α were 0.842 and 1.96, respectively.

An initial sample size was 29 in each group which allowing for a dropout rate of 10% (n=3). Finally, at least 64 participants (32 per group) were recruited in this study. The participant recruited for this study was undergraduate students aged between 18 and 22 years, and had used smartphones for social media every day for at least a year before participation. Also, the question survey was developed in this study to exclude participants who had myopia, poor vision, impaired vision, or color blindness, as well as auditory or any perception deficiencies, upper body muscle weakness, sensory loss associated with any type of neurological illness, major surgery, or limb injuries.

Ethical considerations

The purposes and processes of the study was explained to the participants before the experiment began, and all participants were promised that their data would be kept anonymous and confidential. Informed consent was signed from all subjects before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the Human Ethic Committee of the University of Phayao approved the project (No.2/095/61, effective from 5 November 2018 to 5 November 2019).

Measurement

The reaction time (RT) of an organism is an assessment of how rapidly it responds to a stimulus. The RT is the amount of time that passes between when the stimulus is sent and when the subject shows the relevant voluntary reaction. Three forms of RT were characterized by DukeElder S.[25]; Luce[26]; Welford.[27] (1) Simple RT: In this scenario, there is only one stimulus and one reaction. (2) Recognition RT: Any stimulus should be responded to, whereas others should not. (3) Choice RT: There are several stimuli and reactions in this situation. The nervous system recognizes the stimulus in human RT. The message is subsequently relayed to the brain by the neurons. The message is sent from the brain to the spinal cord, and eventually to the hands and fingers. Average RTs have been reported to be approximately about 190 and 160 m/s for light and sound stimuli, respectively.[27] Fast RTs can be beneficial in some activities, such as athletics and sports, but slow RTs might have catastrophic consequences when driving.

The Multichoice Reaction Timer (Grand Sport brand, 383059/No.BHX 0012), produced in Bangkok (Thailand), was used to measure the reaction time to visual stimuli as well as the response time (Figure 1). It consists of a simple interface for the researcher with controls for generating stimuli, a monitor displaying the light of communicated stimuli in three

Figure 1. Flowchart of the Study.

Table 1. Questionnaire for interview.

No. of Question	Texting	Conversation
1	Your name	What are your hobbies?
2	Faculty, school name	What is your favorite sport?
3	Year in school	Have you seen a movie lately? What was the story about?
4	Gender	What book have you read recently? What was the book about?
5	Date of birth	What is your part-time job?
6	Age	What subject are you good at?
7	Favorite foods	What is your weak subject?
8	Favorite colors	What are you career plans?

colors (red, blue, and yellow), a set of three hand-operated buttons, and a screen of the obtained score with a second's precision. The two stations of the apparatus were placed along a line 2 meters apart, such that the controller could perceive the optical pulses but the controller's interface was out of the subject's range of vision. A hand-operated toggle and a visual stimulus were used to measure response time to a single stimulus. Each subject was told to sit in front of the light box with their hands on the table. The participants were instructed to press the button as soon as they saw a light on the box (red, blue, or yellow), which measured the response time in seconds while three light stimuli were used randomly in the ten trials and repeated three times for each condition recorded in the exam. The average response time from the test were used for the analysis of the risk for smartphone addiction. s.

Procedure

After signing the informed consent form, the participants were screened by the researcher based on the inclusion and exclusion criteria. Then, all participants were separated into two groups based on their scores on the Smartphone Addiction Scale Thai Short Version (SAS-SV-TH).[28] The participants were scheduled for general data collection (age, weight, height, and duration and frequency of smartphone use) and an RT test with the researcher. The study was carried out on the same day at the University of Phayao’s Department of Physical Therapy, School of Allied Health Science. To prevent the effects of exhaustion produced by everyday responsibilities, the trials were conducted in the morning in a well-lit, silent room with only the investigators present. It is a self-report evaluation of 10 items with Likert's type ratings of 1–6 (1 = strongly disagree and 6 = strongly agree) meant to identify a prospective high-risk category for smartphone addiction. The scale's dependability was demonstrated by a Cronbach's alpha of 0.911.[29] Subjects with an SAS-SV-TH score of more than 31 points (in male) or 33 points (in female) were allocated to the smartphone addiction group.[29]

The RT test was administered to all participants in three conditions: no smartphone use (control), texting, and chatting on a smartphone. During the control condition, participants did not have access to their devices and had no interaction with other people or devices in a distraction-free area with only study professionals present for supervision. During the texting and conversation conditions, participants were questioned via smartphone (through text message or chat) with the assistance of a researcher. The subject was given an RT test while answering the questions as listed in Table 1.

Statistical analysis

STATA version 17 was used for all statistical analyses. The data is presented as the mean standard deviation (SD) (eq (1)).

$$SD = \sqrt{\frac{\sum (x_i - \mu)^2}{n}} \tag{1}$$

x_i is each value of population

μ is the population mean

n is the size of population

The one-sample Kolmogorov–Smirnov test (eq (2)) was performed to check the normality of the distribution of each continuous variable.

$$D = Maximum|F_0(X) - F_r(X)| \quad (2)$$

$F_0(X)$ = Observed cumulative frequency distribution of a random sample of n observations.

$F_r(X)$ = The theoretical frequency distribution.

Because of the general distribution of data used, sample t-tests were employed to compare the RT between the addiction group and the control group in three conditions. In a within-group analysis, the mean values of RT between the control, texting, and talking conditions were compared by the pair sample t-test. Statistical significance was determined using p-values < 0.05.

Results

Figure 1 depicts a flow diagram of the recruitment process. The eligibility of 102 subjects was determined. Overall, 38 participants were excluded because they did not match the inclusion criteria (n = 18) or declined to participate (n = 20). The demographic information of all participants is listed in Table 2. A total of 64 undergraduate students (13 males, mean age 20.61±1.16 years) were selected from the University of Phayao, Phayao Province in Thailand.[30] They were separated into two groups according to the SAS-SV score. There weren't any statistically significant distinctions in gender, age, weight, or height between the two groups. The SAS-SV-TH score difference was only statistically significant at a p-value of 0.000.

In an among-group analysis (Table 3), the addiction group tended to have a slightly higher RT than the control group. Still, there was no difference in the average changes in RT between the addiction group and the control group. While comparing among the three conditions of smartphone use (Figure 2), a within-group analysis, the RT of the conversation and texting conditions in both groups was significantly improved compared with their control condition. In the smartphone group, the RT in the texting condition (1.742 ± 0.599 s) was significantly greater (p-value < 0.001) than in the talking condition (1.309 ± 0.322 s.) and also in the control condition (1.044 ± 0.221 s.). Similarly, in the control group, there was a significant (p-value < 0.001) difference in RT between talking (1.225 ± 0.272 s) and in the control condition (0.995 ± 0.284 s.). Moreover, there was the greatest increase in RT between the control condition and the texting condition (p-value < 0.001).

Discussion

In any of the three conditions, there wasn't any substantial difference in visual reaction time (VRT) here between the smartphone addict group and the control group. The results were not inconsistent with our hypothesis that smartphone-addicted people may show a lower VRT. However, there are possible mechanisms that provide for the different hypotheses. Perhaps the most likely mechanism is the idea that those individuals who are smartphone addicts have a

Table 2. Demographic Information.

Characteristics	Addiction group (n=32)	Control group (n=32)	*p*-value
Gender (M/F, n)	7/25	6/26	-
Age (years)	20.67±1.203	20.53±1.135	0.502
Weight (kg)	53.15±9.93	54.57±10.60	0.614
Height (cm.)	160.47±7.7	163.08±6.90	0.160
SAS-SV-Score	37.06±4.43	25.69±3.51	0.000*

Note. *A significant baseline difference.

Table 3. Average Reaction Times of both groups across all condition of smartphone use.

Reaction Times (s) in three conditions of Smartphone use	Smartphone addiction group (n=32)	Control group (n=32)	*p*-value
Control condition (no use)	1.044 ± 0.221	0.995 ± 0.284	0.439
Talking condition	1.309 ± 0.322	1.225 ± 0.272	0.267
Texting condition	1.742 ± 0.599	1.735 ± 0.599	0.964

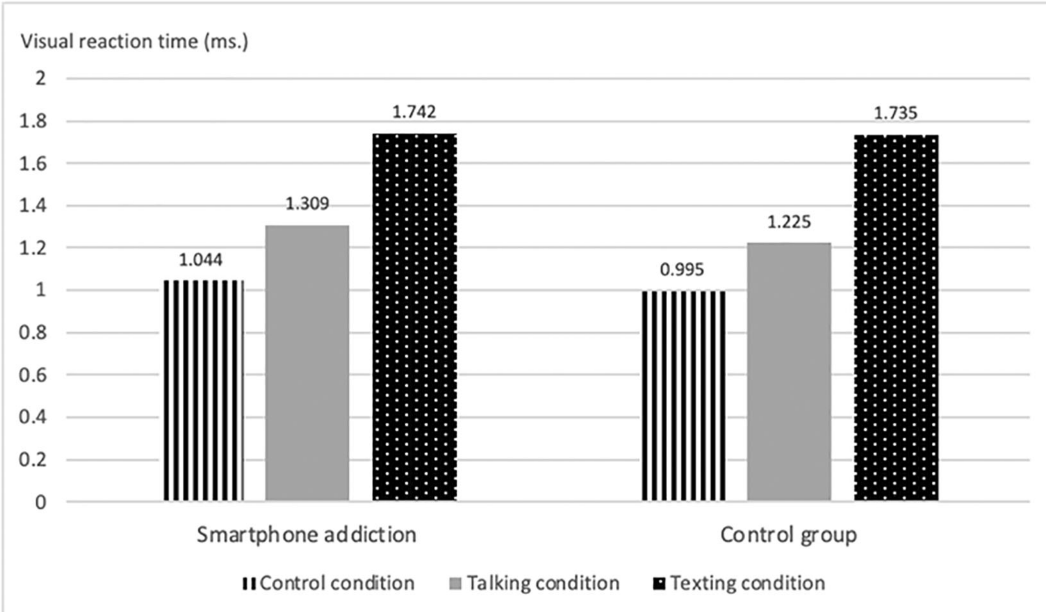

Figure 2. Reaction time in the difference conditions of the smartphone use.

higher rate of smartphone use. Social networking was the most popular smartphone application among the smartphone addicts. The average usage time of texting or talking was almost 30 minutes per session, with several sessions per day. On the other hand, individuals in the control group took only 5–15 minutes per time for entertainment applications. In the test conditions, the smartphone addicts group had similar smartphone usage. Eye-hand coordination when texting in social networking apps and when performing repetitive tasks such as performance practice and brain training has been found.[31] As a result, the participants were unable to use the extra time to extend their reach duration. Rather, they finished the assignment in the same amount of time, allowing them more opportunity to switch focus and optimize dual-task attention. This impacts the brain and results in improved cognitive functioning.[32]

Furthermore, the participants in both groups demonstrated the same results for VRT in 3 conditions of smartphone use. When texting and talking on their smartphones, all participants exhibit slower VRT. Dual-task interference, according to capacity theory, results from the concurrent allocation of a restricted group of general-purpose resources, or efficient clustering.[33,34] When mixed tasks exceed (consolidated or specific) resource availability, one or both activities perform poorly. Bottleneck accounts, on the other hand, stress the serial structure of the dual-task process as a result of single-channel screening or information timetabling during the stimuli decoding, identification, and judgment phases.[35] Since such instances of disturbance exist, it is argued that the nervous system temporarily delays operations solely on a single task in favor of processes on the prioritized task, resulting in poor efficiency on the non-priority activity. Participants may have coordinated task prioritizing by altering the timing or scheduling of tasks to improve the processing of information and prevent a processing bottleneck.[35–38] This result was consistent with the study by Yu and Huang[39] which reported that dual tasking significantly increases the RT. Increased reaction times due to cognitive distraction have been reported earlier.[40] This shows that the stimuli can be seen or heard while doing another task but are not processed normally as the brain is overloaded. Our study shows that the RT during the talking condition of smartphone use is faster than the texting condition. The expenditure on decision making, and planning was much higher in the texting condition. Texting caused participants to physically move their focus between the smartphone and light stimulation, in addition to turning cognitive resources in a similar direction that conversation does.[41] There are limitations to this study that must be considered. Our study only investigated the reaction time for light stimuli. Future research should attempt to evaluate auditory reaction time, as well as studies in a different age group.

Conclusions

This study was conducted on 64 teenagers to investigate the effect of smartphone use for social media on Visual Reaction Time (VRT). There was no significant difference statistically in the reaction time between adolescents with and without smartphone addiction in all test conditions (no smartphone use, texting, and talking using a smartphone). However, the adolescents show prolonged reaction times when they must perform the dual-tasking. Therefore, the adolescent should avoid other activities when using a smartphone.

Data availability

Underlying data

Figshare: The Study of Smartphone Use and Social Media Addiction in Children, https://doi.org/10.6084/m9.figshare.21688259.v1.[30]

This project contains the following underlying data.

- Reaction-time_data_For-share.xlsx
- Survey_use.pdf

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