



Effect of Mindfulness-Based Intervention on Problematic Smartphone Usage and Mind Wandering Among College Students in Chennai

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Abstract

Since COVID-19, the time spent on the smartphone has increased [1]. Increased use of smartphones might lead to problematic usage which can have negative effects on physical and mental health [2]. Studies have concluded that problematic smartphone usage is positively associated with mind wandering [3]. Thus, an increase in problematic smartphone usage will result in increased mind wandering. Both problematic smartphone usage and mind wandering resulted in poor academic performance, road accidents, academic procrastination, sleep problems, loneliness, anxiety, and depression [4]. Studies have shown that young adults engage in problematic smartphone usage and they report more mind wandering. Also, people use their smartphones [5] and mind wandering [6][7] as a coping strategy to deal with negative thoughts and emotions, which is maladaptive. These factors make the intervening of these variables the need of the hour. The present study aimed to find the effectiveness of mindfulness-based intervention that addresses difficult thoughts and emotions on problematic smartphone usage and mind wandering among college students in Chennai. The sample consisted of 70 female college students between the ages 18-22 years. The 70 students were randomly assigned to intervention (n=35) and control group (n=35). Results revealed that at post-intervention a significant difference in the problematic smartphone usage ($t(30) = 6.611, p < 0.001$) and mind wandering ($t(30) = 6.165, p < 0.001$) scores were observed in the intervention group whereas no difference was observed in the control group. The effect size of the intervention was also found to be large for problematic smartphone usage ($d = 1.6$) and mind wandering ($d = 1.5$). In conclusion, mindfulness-based intervention that addresses difficult thoughts and emotions can reduce problematic smartphone usage and mind wandering among college students in Chennai.

Key words: Problematic smartphone usage, Mind wandering, Mindfulness, Smartphone addiction

I. INTRODUCTION

Usage of smartphones have become an integral part of human life [8]. Due to the outbreak of COVID-19, smartphones have become even more essential to foster and strengthen social connections and overall well-being [9]. Since then, the time spent on the smartphone has increased [1]. A report by Redseer Strategy Consultant [10] stated that the average time spent by Indians on their smartphones is more than the average screen time of Americans and Chinese which is approximately 7.3 hours per day. Increased use of smartphones paves a way for problematic usage which can have negative effects on physical and mental health [11].

Problematic smartphone usage can be defined as “one’s inability to regulate the use of his/her mobile phone, which eventually involves negative consequences in daily life” [12]. Issues stemming from increased usage of smartphones are neck pain, back pain, eye strain, weight gain, weariness, lack of sleep, and headaches which can have direct negative effects on physical health [13]. Negative effects due to increased usage of smartphones on mental health are depression, loneliness, impulsivity, impaired cognitive function, addiction to social networks, shyness, low self-esteem, and poor cognitive control [11]. There’s a possibility that excessive smartphone use can lead to smartphone addiction [14]. Smartphone addiction is a severe, widespread, underdiagnosed addiction [15] which is not yet considered for clinical diagnosis [14]. Two factors which cause shifts in human attention and are considered to be great distractions are smartphones and mind wandering [16].

Mind wandering was observed several millennia ago by Buddha but only in recent decades mind wandering has become a topic of interest [17]. Mind wandering can be defined as “a universal human experience in which the focus of attention temporarily shifts from what we are doing” [18]. It is estimated that the one’s mind wanders 50% of the time i.e., half the time of the waking hours [19]. One of the well-known theories of mind wandering is the decoupling hypothesis [20] which states “during mind wandering, there is decrease in performance in the task at hand because the attention has decoupled from the task at hand and is instead coupled to task-unrelated thoughts. Thus, when an individual has task-unrelated thoughts i.e., when an individual’s thoughts shift away from the task at hand then the individual’s mind is said to be wandering”.

Mind wandering has two sides, positive and negative. Positives include creative problem solving [21], future focused and oriented toward personal goal resolution [22]. The negatives are that it is associated with reduced mood, disruption of performance, impaired general intellectual functioning, disruption in everyday life experience [17] and is also associated with poorer mental health [4]. If “the state in which task-unrelated thoughts occur” [23] is called mind wandering, then “the state in which one’s thoughts are centered in the present moment” is called mindfulness [24].

Mindfulness is “awareness that emerges by way of paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment” [25]. Mindfulness-based interventions are used in treatments of behavioral addiction [26], workaholism [27], sex addiction [28], and smartphone addiction [29]. The reasons why mindfulness is used in treating behavioural addiction is because one can learn to increase the perceptual distance from mental urges through mindfulness techniques [30] and also the reasons are meditation can reduce relapse and withdrawal [27], mindfulness can regulate an addiction-related distressed emotional state, techniques help in recognizing the intrinsic value of life instead of the superficial reward of addictive activities, salience can be reduced, and patience can be improved. Mindfulness-based intervention will be effective in addressing problematic smartphone use, this is supported by the findings of a study that the problematic smartphone use reduces as mindfulness increases [31]. It was found that mindfulness training reduces mind wandering and the negative effects associated with it [4] and people who are low on trait mindfulness reported high levels of mind wandering [32]. The explanation underlying these findings is that “mind wandering is the occurrence of task unrelated thoughts” [20] whereas mindfulness is being present in the moment and here the thoughts are centered on the “here and now” [24].

Studies have suggested that adolescents and emerging adults' mental health over the last decade is suffering a decline [33]. There are numerous factors contributing to this decline but one important factor to consider is the change in technology. A study found that new digital technologies are negatively affecting young people’s mental health [34]. Though there was high dependency on smartphones and technology during COVID-19, the same dependency is seen even after COVID-19. A study concluded that emerging adults were found to spend more time on the smartphone compared to adults during and after COVID-19 [1]. Excessive smartphone usage is linked with numerous negative effects such as smartphone addiction and since emerging adulthood is the stage where personality develops emerging adults are the at-risk population. In terms of mind wandering, Schaie’s theory of development states that young adults are in the achieving stage, where they are expected to shift their focus to here and now and apply the knowledge they have acquired so far in life and make choices regarding career, marriage and other areas of life which will have long term implications [35] but previous studies have revealed that when compared to older adults, younger adults are more prone to report mind wandering [36][37] Few studies have also found that through intervention levels of mind-wandering can be influenced among adults [38].

Studies have proven that problematic smartphone usage and mind wandering go hand in hand, i.e., there is significant positive correlation between them [3]. Both smartphones, and mind wandering are considered as a great distraction as they cause shifts in human attention [39][40] and have numerous negative effects on both physical and mental health. Smartphones are used to cope with unpleasant thoughts, negative emotions, and almost 40% of young adults in an Indian study agreed that they use their phones to cope with negative emotions [5]. In the same way deliberate mind wandering was also found to be used as a coping strategy to deal with negative affect [6]. This form of coping is maladaptive. Thus, the intervention used to reduce these issues should address the thoughts and emotions because people use smartphones and mind wandering to cope with it. Mindfulness can help people escape the vicious cycle of negative thinking, reactive impulses, and emotions [41]. Several western studies have also proven that mindfulness-based intervention can reduce problematic smartphone usage and mind wandering. This study aims to study the impact of mindfulness-based intervention that addresses thoughts and emotions on problematic smartphone usage and mind wandering among college students in India.

II. METHODOLOGY

Research Design

Pretest-posttest control group design was used.

Sample

Purposive sampling design was used. A sample of 70 (intervention group- 35, control group- 35) female students from a college in Chennai were selected based on the inclusion criteria. The participants were between the ages 18-22 years. There were 4 drop outs during the intervention. Thus, post-test data was collected from 31 participants in the intervention group.

Tools used

Smartphone Use Scale (SUS)- Smartphone Use Scale [42] is 30 items, 5- point Likert scale and it measures the problematic smartphone usage. The responses are scored on a Likert scale, 1=Never, 2= Rarely, 3= Sometimes, 4= Frequently, and 5=Always. Total score is calculated by adding the scores in each of the items. The total score range is 30-150, high scores indicate high levels of problematic usage. Cronbach's Alpha was found to be 0.712 indicating a reasonably good reliability. Correlation between the Smartphone Addiction Scale and the Smartphone Use Scale was found to be 0.763, which indicated reasonably good validity of the SUS.

Mind Wandering Questionnaire (MWQ)- Mind Wandering Questionnaire [38] is a five-item scale that measures the frequency of mind-wandering, irrespective of whether mind-wandering is deliberate or spontaneous. The scale is scored using a six-point Likert scale where 1 = almost never and 6= almost always. The total score may extend from 5 to 30. Using college undergraduates for the sample, a reliability analysis revealed a Cronbach's alpha of 0.850 and the scale demonstrated high internal consistency ($\alpha = 0.82$). MWQ had good inter-item correlations (Mean=0.540, Min:0.439, Max:0.684). Convergent validity was demonstrated with existing measures of mind-wandering and related constructs.

Statistical test

- Independent sample t-test was used to establish the pre-equivalence between the intervention and control group.
- Paired sample t-test was used to find the difference in the pre-test and post-test scores of the intervention group and control group.
- Cohen's d was used to calculate the effect size of the intervention.

Mindfulness-based intervention module

A group, in-person intervention was held over a period of 4 weeks with one session each week, for a duration of 2 hours. To develop the intervention module, the Palouse MBSR course [43] which is based on the program founded by Jon Kabat-Zin at the University of Massachusetts Medical School was used with the permission. The module (Table 1) focused on dealing with difficult thoughts and emotions by using mindfulness techniques rather than using smartphones and mind wandering. Mindfulness techniques such as meditation, breathing exercises, mindful journaling, mindful eating were taught during the intervention.

Table 1 Framework of the mindfulness-based intervention used in this study

Sessions	Activities/Lecture/Mindfulness techniques	Objectives
Session 1: Introduction to Mindfulness	1.1 Introducing each other to the group- Activity	1.1.1 To bring students to the present by being attentive to what others are saying. 1.1.2 To get the participants get comfortable with the group.
	1.2 Lecture- What is Mindfulness?	1.2.1 To help the participants understand mindfulness.
	1.3 Meditate- Activity	1.3.1 To demonstrate what mindful meditation is and what to expect when meditating.
	1.4 Sitting meditation - MBSR	1.4.1 To enable participants to practice mindfulness meditation.
	1.5 Box Breathing	1.5.1 To equip the participants with a brief mindfulness technique to practice on a busy day.
Session 2: Emotions and Mindfulness	2.1 Name the emotions- Activity	2.1.1 To introduce the participants to the session on emotions.
	2.2 Lecture- Emotions	2.2.1 To teach the participants about emotions and its types.
	2.3 Ways in which I manage my emotions- Activity	2.3.1 To build awareness into participant's coping strategies.
	2.4 Soften, Soothe, Allow-MBSR	2.4.1 To deal with difficult emotions through meditation.
	2.5 Mindful Journaling	2.5.1 To teach the participants to journal with and without prompts.
Session 3: Thoughts and Mindfulness	3.1 Monkey see and monkey do-Activity	3.1.1 To bring the participants to the present moment before starting the session
	3.2 Bubble Blowing- Activity	3.2.1 To introduce the participants to the session's topic- Thoughts and Mindfulness
	3.3 Lecture- Labelling the thoughts	3.3.1 To teach the participants to label their thoughts.
	3.4 Silent meditation (MBSR)	3.4.1 To deal with thoughts in life and during meditation by labelling them.
	3.5 Journaling your thoughts	3.5.1 To enable the participants to be aware of their thought pattern and shift the focus from negative thoughts by substituting it with positive thoughts.
Session 4: Phone usage and Mindfulness	4.1 When and Where have you used your smartphone? -Activity	4.1.1 To build awareness about the participant's problematic phone usage.
	4.2 Raisin meditation (MBSR)	4.2.1 To help participants engage in mindful eating.
	4.3 Lecture- Commute mindfully	4.3.1 To enable participants to commute mindfully.
	4.4 The 4-7-8 breathing technique [44]	4.4.1 To equip participants with a mindful technique when they can't sleep.

III. RESULTS AND DISCUSSION

Independent sample t-test was used to test whether the intervention group and the control group were significantly different from each other on problematic smartphone usage and mind wandering.

Table 2 independent sample t-test results of pre-test scores of the intervention and the control group.

Variables	Intervention group		Control group		t (34)	p
	M	SD	M	SD		
Problematic Smartphone Usage	103.06	16.715	100.89	14.81	-0.655	.515
Mind Wandering	22.61	3.556	22.11	3.44	-0.721	.474

The table 2 shows the pre-equivalence between the intervention and control group that was established using an independent sample t-test. It was found that there was no significant difference between the intervention and control groups in problematic smartphone usage and mind wandering. Therefore, the intervention group and control group were equal at pre-intervention.

Table 3 t-test results of pre-test and post-test scores of the intervention group on problematic smartphone usage and mind wandering

Variables	Pre-test		Post-test		t (30)
	M	SD	M	SD	
Problematic Smartphone Usage	103.06	16.715	76.65	16.051	6.611***
Mind Wandering	22.61	3.556	16.55	4.449	6.165***

***p < 0.001

A paired-samples t-test was conducted to compare the pre and post test scores of the intervention group (n=31) on problematic smartphone usage and mind wandering (Table 3). There were 4 dropouts during the mindfulness-based intervention in the intervention group. The results suggest that there is a significant statistical difference in the scores of problematic smartphone usage before (M= 103.06, SD= 16.715) and after the mindfulness-based intervention (M= 76.65, SD= 16.051) and t (30) =6.611, p< 0.001. This is in line with a finding that group mindfulness-based cognitive-behavioral intervention (GMCI) resulted in lower scores on smartphone addiction at post-intervention [30]. Adding on to this, a study revealed that the scores on mobile phone addiction of the experimental group was significantly lower than that of the control group (significant at p<0.001) and it improved their mental health and cognitive abilities after mindfulness-based mental health education therapy [45]. The results also suggest that there is a significant decrease in mind wandering from the pre-test scores (M = 22.61, SD = 3.556) to post-test (M = 16.55, SD = 4.449) with t (30) =6.165, p< 0.001. This finding is supported by a study that found that 2-week mindfulness-training course reduced mind wandering and improved GRE reading-comprehension scores and working memory capacity [38]. Another research endeavor [46] used the similar mindfulness-technique used in this study i.e., MBSR and found that mindfulness can reduce mind wandering.

Based on the above findings, mindfulness-based intervention has a significant effect on problematic smartphone usage and mind wandering. The significant effect can be attributed to the mindfulness-based intervention module in this study which specifically focused on reducing problematic smartphone usage and mind wandering by addressing difficult thoughts and emotions. Previous findings suggested that the intervention for reducing problematic phone usage and mind wandering needed to address the thoughts and emotions as people tend to use their smartphones and mind wandering to cope with unpleasant thoughts and negative emotions. This was concluded from an Indian study which revealed that 70% of the participants agreed that mobile phones aid them in overcoming guilt, anxiety, depression, helplessness, feelings of inferiority, etc. More than 40% of the participants agreed that they use mobile phones to escape from their problems [5].

With respect to mind wandering, studies have shown that mind wandering is also used as a tool to deal with difficult thoughts and emotions. This was concluded from a study which found that the sadness was a precursor of mind wandering, as instances of mind wandering were associated with higher levels of prior sadness. In terms of time orientation, sadness before mind wandering led to thoughts about the past, and anxiety before mind wandering led to thoughts related to the future [7]. Thus, it can be implied that a negative mood leads to mind wandering and the time orientation of the content of the mind wandering is past and future. A study revealed that deliberate mind-wandering was used by the participants who scored high in problem gambling as a maladaptive means of coping to deal with the negative affect due to the highly repetitive and boring task [6].

A comprehensive overview of the literature suggested that the previous studies done on reducing problematic smartphone usage and mind wandering using mindfulness-based intervention did not focus on addressing the underlying difficulty to deal with unpleasant thoughts and emotions. Thus, the intervention of this study specifically provided the participants with mindfulness techniques to replace their smartphone and mind wandering as a tool for dealing with difficult thoughts and emotions which might have reduced the smartphone usage in the participants of the intervention group. Therefore, a significant decrease in the post-test scores of the intervention group in problematic smartphone usage and mind wandering was seen when compared to the control group.

Table 4 t-test results of pre and post test scores of the control group on problematic smartphone usage and mind wandering

Variables	Pre-test		Post-test		t (34)	p
	M	SD	M	SD		
Problematic Smartphone Usage	100.89	14.81	100.60	13.639	0.97	0.923
Mind Wandering	22.11	3.44	23	3.162	-1.367	0.181

To evaluate whether there is a difference between the pre and post test scores of the control group (n=35) on problematic smartphone usage, a paired sample t-test was performed (Table 4). The results indicated that there is no significant difference between the pretest scores (M= 100.89, SD= 14.81) and the post test scores (M = 100.60, SD = 13.639) with $t(34) = 0.97$, $p = 0.923$. Also, there is no significant difference on mind wandering between the pretest scores (M= 22.11, SD= 3.44) and the post test scores (M = 23, SD = 3.162) and $t(34) = -1.367$, $p = 0.181$.

Table 5 Effect size of the mindfulness-based intervention

Variables	Cohen's d
Problematic Smartphone Usage	1.6
Mind Wandering	1.5

Cohen's d indicated that the effect of the mindfulness-based intervention was large on problematic smartphone usage ($d=1.6$) as well as mind wandering ($d=1.5$) of the intervention group (Table 5)

The large effect of mindfulness-based intervention on problematic smartphone usage ($d=1.6$) and mind wandering ($d=1.5$) might be attributed to the length of the intervention i.e., 4 weeks which is as effective as 8-week mindfulness-based intervention. This was supported by a study compared the effectiveness of 4-week and 8-week mindfulness-based intervention in non-clinical populations and concluded that both the interventions have similar effect size [47]. Reviewing the literature suggested that brief mindfulness-based intervention was found to have a significant impact on problematic smartphone usage. A study concluded that a brief-single session mindfulness intervention can reduce levels of problematic smartphone use. [48]. Additional study in which a 5-hour session mindfulness-based module addressed the problematic phone usage of at-risk late adolescents (17-19 years) found a significant less scores in overuse and withdrawal factors of Mobile Phone Problematic Usage Questionnaire [49].

In terms of mind wandering, studies have found that brief-mindfulness intervention reduces mind wandering. A study aimed to investigate whether two short term online based interventions i.e., mindfulness meditation and brain training can reduce the behavioral markers of mind wandering [50]. The findings revealed that there was a significant increase in dispositional mindfulness in the mindfulness training group but not in the brain training group. It can be inferred that short online Mindfulness-based intervention is effective in reducing mind wandering. In addition to this, a brief mindfulness-based intervention practice taught in university may play a role in promoting mental wellness among students [51].

From the above discussed findings, it can be concluded that brief mindfulness-based intervention can reduce problematic smartphone usage, mind wandering and promote wellness. If mindfulness-based intervention in brief could have a significant impact, a 4-week intervention which is similar to 8-week intervention might have resulted in a significant effect in reducing the problematic smartphone usage and mind wandering.

According to the theory of planned behavior [52], a behavior change is dependent on one's intention to perform the behavior, subjective norms and also self-efficacy. The behavior this study aimed to reduce was problematic smartphone usage which in itself will also reduce mind wandering. An individual's intention is based on the attitude about the outcome of the behavior, the participant's attitude about smartphone usage was altered by building awareness into one's problematic smartphone usage, excessive mind wandering and its effects with empirical evidence and activities. The awareness built in the participants in the intervention group helped them to understand how unhealthy their usage is and motivated them to change their problematic smartphone usage. Parents and elders in general want their children to focus more on life, career and education rather than using smartphones which acted as a subjective norm to reduce one's smartphone usage. Providing the research findings of how practicing mindfulness can reduce one's smartphone usage helped in improving the self-efficacy of the group to reduce their problematic usage. The above discussed factors might have also contributed to the decrease in problematic smartphone usage and mind wandering at post-test.

Conclusions

At post-intervention, mindfulness-based intervention was effective in decreasing problematic smartphone usage and mind wandering, with a large effect size in the intervention group when compared to the control group.

Limitations of the study

1. The findings of this study cannot be generalized to a wider population since the study was conducted only on students from one college.
2. The study did not provide the gender difference in the dependent variables as it did not include male participants.
3. This study captured only the short-term effect of the mindfulness-based intervention and the long-term effect remains unclear as follow-up was not done.

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