Unplug From Your Distractions: The Effect of Digital Detoxing on Procrastination and Distractibility

Sjors Hexspoor

Snr 2041001

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School of Humanities and Digital Sciences

Tilburg University

Supervisor: M. Shin

Second reader: E. Abrahamse

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Abstract

The increase in smartphone usage is believed to have negative consequences for well-being of society. Reducing smartphone usage has therefore gained attention, this is also known as digital detoxing. Recent studies have aimed to explore what the effects of digital detoxing are, and what types of digital detoxing are successful in terms of reducing the negative effects of smartphones. Unfortunately, the current state of literature did not specify relevant aspects of digital detoxing, which includes the duration and the intensity of the digital detox. This has resulted in mixed findings of studies regarding the effects of digital detoxing on well-being. This study aimed to explore whether a more intense digital detoxing intervention (digital detoxing through a physical barrier) will give conclusive results regarding the effect of digital detoxing on procrastination and distractibility. During a 2-week intervention period, the effects of physical barrier-based detoxing on well-being (measured via procrastination and distractibility) were compared to a group without intervention. An experiment amongst 50 students was conducted to explore the effects of physical barrier-based detoxing on procrastination and distractibility. The results showed that physical barrier-based detoxing significantly influenced procrastination and distractibility in a negative way through strengthened self-regulation as a result of the digital detox intervention. This means that participants who used physical barrier-based detoxing reported less procrastinating behavior and less distractibility. These findings confirm that a more intense digital detox intervention consistently results in significantly lower procrastination and distractibility, and therefore higher reported well-being levels. The outcomes will provide a better understanding of digital detoxing. Further implications of the findings of this study were discussed.

Keywords: smartphone usage, digital detoxing, self-regulation, procrastination, distractibility.

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As more attention has been drawn recently to the negative consequences that smartphones have on people, reducing smartphone use is becoming a popular phenomenon (Mediawijsheid, n.d.). A well-known example of a media production about these negative consequences is the Netflix documentary The Social Dilemma. This documentary highlights how companies increase their revenue by making people dependent on their smartphones (Bekka, 2020; The Social Dilemma, n.d.). In addition, excessive smartphone usage has been shown to have negative effects on people. Studies have found that high smartphone use is related to poor academic performance (Amez & Baert, 2020), poor sleep (Thomée, 2018), and lower productivity at work (Duke & Montag, 2017). Altogether, smartphone use has been shown to negatively affect various types of performance.

It has become clear that the media (e.g., Netflix) and academia (e.g., the studies mentioned above) has seen the negative consequences of smartphone use. To counteract these effects, a reduction in smartphone use is needed. This reduction can be defined as digital detoxification, also referred to as time off from electronic devices (Brown & Kuss, 2020).

A systematic literature review by Radtke et al. (2021) analyzed the effectiveness of different types of digital detoxing, albeit on a limited scale. The study examined different forms of digital detoxification, ranging from limited use of certain applications to not using a smartphone at all. Various types of influences were also examined. These factors included: performance, self-control, health, and well-being. The results of the studies were inconclusive regarding the effects of digital detoxing on cognitive performance, sleep quality, and stress (Dunican et al., 2017; Liao, 2019; Vanman et al., 2018). Nonetheless, Radtke et al. (2021) showed that procrastination (i.e., the unnecessary postponing things a person intends to do;

Steel & Klingsieck, 2013) was consistently reduced in smartphone users through digital detoxing.

In addition, Hinsch and Sheldon (2013) found that a reduction in Facebook use, which could be a consequence of Digital Detoxing, could lead to a decrease in procrastination. This finding is consistent with other research linking the user's ability to resist procrastinating media use (Meier et al., 2016). There seems to be a clear theoretical link between smartphone use and procrastination. This means that mental well-being (especially procrastination) can be increased by digital detoxing.

Furthermore, a study by Levine et al. (2007) found a significant relationship between time spent using digital media and distractibility from academic tasks (i.e., difficulty ignoring task-irrelevant stimuli; Van der Linden, 2000). These findings support other studies in which the presence of a distractor worsened individuals' academic performance (Levine et al., 2007; Moisala et al., 2016). These previous findings consistently highlight that the use of media (i.e., a distractor) could negatively affect distractibility.

The mechanism underlying the effects of digital detoxing on procrastination and distractibility could potentially be explained by the extent to which digital detoxing modulates levels of self-regulation (i.e., the ability to control one's thoughts, feelings, and actions; Diehl et al., 2006). Digital detoxing has been shown to positively affect feelings of control (Billieux et al., 2015). Therefore, an increased sense of control could have a positive effect on self-regulation and thus on procrastination and distractibility. In the context of this study, this means that the ability to self-regulate behavior could allow a person to be less distracted and show less procrastinating behavior. While it seems clear that digital detoxing could have a positive effect on reducing procrastination and distractibility in smartphone users through the

mediating role of self-regulation, it remains unclear what type of digital detoxing determines the effectiveness of an intervention.

Intriguingly, recent research has suggested that imposing a physical boundary may aid the process of digital detoxification (e.g., Hoving, 2017). In a study from Hoving (2017), the imposition of physical barriers was found to have a positive effect on the digital detoxification process. However, this effect was only researched specifically for digital detoxing vacations. This concerned physically removing people from their smartphones (Hoving, 2017). In line with this proposal, it is worth noting that a physical intervention tool for digital detox has recently been developed, namely Unpluq (Smits et al., 2021). Unpluq provides a service that allows smartphone users to self-restrict app use by using a device (i.e., a USB stick) that they must plug into their smartphone to use the restricted applications. This device draws a physical boundary between users and smartphones in the form of a physical device.

Since physical boundary has been found to have positive effects on digital detoxification, it is likely that using the Unpluq device will also a have positive effect on digital detoxification and reduce users' procrastination and distractibility. Although the extent of physical boundary is weaker than imposing a digital detoxification vacation.

In summary, the current study aims to investigate whether digital detoxing in the form of a physical barrier helps reduce procrastinating behavior and distractibility through the mediating role of self-regulation. To this end, a 2-week micro-longitudinal field experiment was conducted using the screen time intervention tool developed by Unpluq (Smits et al., 2021). Specifically, this study aims to answer the following research questions:

RQ1. Will physical barrier-based digital detoxing affect procrastinating behavior and distractibility?

RQ2. Will self-regulation mediate the effects of physical barrier-based digital detoxing on procrastinating behavior and distractibility?

Theoretical framework

Digital detoxing

The phenomenon of digital detox started gaining attention in 2012, where several studies suggested that problematic use of digital media could have negative effects on users' well-being (Amez & Baert, 2020; Brown & Kuss, 2020; Duke & Montag, 2017; Felix & Dean, 2012). By definition, digital detoxing refers to "resistance to technological media such as phones, movies, television, and various other types of communication technologies" (Syvertsen & Enli, 2020, p. 1270). In the context of smartphone use, digital detoxing can be defined as a detachment from social or online media for a period of time (Syvertsen & Enli, 2020). Radtke et al. (2021) further specified this definition by considering three aspects related to digital media use: the type of device, the voluntary nature of the detox, and the completeness of the time away. When these definitions are combined, digital detoxing could be understood as a voluntary or involuntary time-out from specific devices or applications that varies in its completeness.

With the growing movement to explore digital detoxing (e.g., Amez & Baret, 2020), interest in the effects of digital detoxing on human well-being has increased. Since digital detoxing aims to reduce the negative effects of digital media use (Schmuck, 2020), many studies examine the effects of digital detoxing on well-being (e.g., Radtke et al., 2021). Schmuck (2020) examined the role of digital detoxing on young adults' well-being. Results showed that young adults who did not participate in digital detoxing reported more problematic smartphone use and lower well-being. Furthermore, Twenge and Campbell

(2018) found that extensive smartphone use led to lower psychological well-being. In their study, well-being included emotional stability, friendships, distractibility, and self-control. In addition, other studies found well-being to be related to procrastination (Beutel et al., 2016).

Well-being

Research has shown that people use digital detoxing with the aim of improving their well-being (Twenge et al., 2018). The concept of well-being is defined as mental health which has been determined by many different factors (Crisp, 2008). According to a study by Carriere et al. (2018) on the effects of attention and memory impairments on well-being, individual well-being can be determined by the level of distractibility. The aforementioned study showed that individuals who have attention deficits (i.e., individuals with high distractibility) reported negative long-term effects on well-being. Similar results were also obtained by Quoidbach et al. (2010), who suggested that distractibility is a negative predictor of well-being. Procrastination is also an influential factor in well-being. In a large representative community study in Germany, Beutel et al. (2016) found that procrastination correlated with overall life satisfaction (i.e., well-being; Przybylski & Weinstein, 2019). The results of previous studies on well-being, procrastination, and distractibility suggest that well-being is predicted by procrastination and distractibility. Thus, it can be concluded that procrastination and distractibility are conceptually related to well-being.

Physical barrier based detoxing

Research suggests that increasing the level of restriction through physical support (i.e., a physical barrier such as a USB stick that must be inserted into a smartphone to activate restricted applications) could be effective in reducing procrastination and distractibility by improving the level of self-regulation (Hoving, 2017; Radtke et al., 2021). The reasoning for

this conclusion is that physical barrier-based detoxification (compared to other forms of detoxification) is at the higher end of the spectrum in terms of intensity and completeness of time off, as defined by Radtke et al. (2021).

Physical barrier-based detoxing and self-regulation

Interventions aimed at reducing smartphone use should include components that promote self-regulation (Chun, 2018). According to Diehl et al. (2006), attentional control is an important component of self-regulation. This concept is defined as "a person's ability to focus attention on a specific task, control and regulate external and internal distractions, and work toward a desired goal or outcome" (Diehl et al., 2006 p. 306). Interruption of attentional focus (e.g., using a smartphone while working on a task) can be viewed as a failure to self-regulate behavior. This was examined by Mark et al. (2017), who found that distractions negatively affected productivity to a significant degree. Ignoring distractions indicates high self-regulation (Chun, 2018). In the context of the current study, self-regulation refers to the tendency for people to regulate their behavior so that smartphones are not overly intrusive in their lives (Syvertsen et al., 2020). The definition of self-regulation in this study has been studied by Mousavi and Moghtader (2015) who found that self-regulation skills can influence happiness.

Since self-regulation can positively influence people (Mousavi et al., 2015), it is the desire of many people to achieve this. Baumeister and Heartherton (1996) suggested that the ability to self-regulate can be compared to a muscle, meaning that it has a certain strength that can increase or decrease. This suggests that the ability to self-regulate can be trained. Various tactics can be used to strengthen the level of self-regulation. Examples of such tactics include motivation, planning, and goal setting (Berkman, 2016; Dignath, 2008). Self-regulation

training can lead to a high level of self-regulation because the level of strength increases (Baumeister & Heartherton, 1996). However, it is becoming progressively difficult for smartphone users to maintain high levels of self-regulation. As smartphone use increases (Amez & Baert, 2020), the level of self-regulation may decrease.

One example of a stimulus that weakens self-regulation is smartphone notifications. Notifications on smartphones are often used by companies to increase engagement with their applications. On average, smartphone users receive 60 notifications per day (Pielot & Rello, 2015). These notifications are mostly sent by messaging applications (Pielot & Rello, 2015). This tactic has proven to be effective, as notifications are usually viewed within a few minutes (Pielot et al., 2014). However, in the context of self-regulation, these stimuli make it difficult to self-regulate behavior and maintain regulatory focus (Diehl et al., 2007; Mark et al., 2017). To counteract the trend toward distracting impulses, individuals employ additional measures.

In addition to training tactics such as motivation, planning, and goal setting, individuals resort to measures that reduce the number of stimuli they need to process (Berkman, 2016; Dignath, 2008). This can be achieved by blocking or filtering unwanted stimuli (Mark et al., 2017). An example of an impulse reduction intervention is digital detoxing. Liao et al. (2019) found that digital detoxing significantly improves self-regulation. This can be explained by Baumeister and Heartherton's (1996) explanation of self-regulation because detoxing reduces the impulses that reduce self-regulation.

The effect of digital detoxing on well-being was examined by Radtke et al. (2021) in a literature review of 21 studies. The results of this study showed mixed findings regarding the effects of digital detoxing on well-being. While some studies showed a positive effect of digital detoxing on well-being (e.g., Hinsch & Sheldon, 2013), other studies found no effect

or even a negative effect of digital detoxing on well-being (e.g., Dunican et al., 2017). A possible explanation for this could lie in the different but unclear operationalization of digital detoxing. As explained by Radtke et al. (2021), digital detoxing may differ in terms of comprehensiveness, voluntary basis, and specific applications. Digital detox manipulations that included mild versions (e.g., a 24-hour detox or a 1 application detox) often showed no or negative impact on well-being. This can be explained by the fact that these manipulations lack the intensity, duration, and readiness to produce a strong effect between digital detoxing and well-being. Therefore, further research using a more intensive type of detoxification with a longer duration could confirm the effectiveness of digital detoxification.

One example of such an intervention is physical barrier-based detoxification. This is a relatively new form of digital detoxification in which a barrier, also known as a physical barrier, prevents smartphone use (Miksch & Schulz, 2018). For the purposes of this study, a physical barrier is defined as a restriction on visual or physical access to a smartphone (Miksch & Schulz, 2018). The reasons for using physical barriers were explored by Wang et al. (2019), who found that motives for taking a digital detox vacation included mindfulness, technostress, relaxation, and self-expression. A study by Miksch and Schulz (2018) found that detoxification through physical barriers was successfully used to reduce smartphone use.

In practice, reducing smartphone use can be achieved in a variety of ways. Participants reported reduced smartphone use after using physical barriers by leaving their smartphone in another room or turning on flight mode (Miksch & Schulz, 2018). Another example comes from Krischowsky and Fuchsberger (2021), who examined a concept called un-use. Un-use is defined as the way the use of a device is discontinued. This refers to the way a person treis to discontinue smartphone use. Examples of un-use include digital detox boxes, a hairband around a smartphone, and enabling grayscale (fewer colors) on a smartphone screen. Current

literature suggests that physical barriers may improve self-regulation by increasing strength. However, there is no research on the direct effects of a physical barrier on self-regulation. Therefore, this study attempts to show that:

> **H1.** Physical barrier-based digital detoxing intervention will improve the level of self-regulation as compared to having no digital detoxing intervention.

Self-regulation and procrastination

Upon the improvement in self-regulation through physical barrier-based detoxing, procrastination may be significantly reduced. The term procrastination is defined as a delay in completing a task (Steel, 2007). Factors such as social and entertainment needs can often cause this delay. Duckworth et al. (2016) describe procrastination as a deviation from an original task to obtain a short-term reward. In reference to Duckworth et al.'s (2016) research, an example of such deviation is a student who prefers to socialize with other students rather than study for an exam, resulting in an inadequate grade. For instance, Senecal et al. (1995) found that students with an intrinsic reason to pursue academic tasks procrastinated less (i.e., self-regulated their behavior to complete a task). Similar results were observed by Darling-Hammond et al. (2019), who found that students with high self-regulation reported less procrastination. In short, procrastination is considered a determinant of self-regulation (Ariely & Wertenbroch, 2002).

In addition to academic studies regarding procrastination in general, other research has aimed to examine procrastinating behavior in relation to smartphone usage. A cross-sectional study by Cui et al. (2021) found that failure to self-regulate smartphone behavior also influences other types of procrastination, particularly procrastination at bedtime. Similar results on different types of procrastination have been found in other studies (Liu et al., 2010;

Yang et al., 2020). In examining these results, the above studies suggest that self-regulation may lead to less procrastinating behaviour. However, the relationship between self-regulation and procrastination has not been explored under the influence of physical barrier-based detoxification. Considering the relationship between smartphone use and procrastination (Cui et al., 2021), reducing smartphone use could potentially influence self-regulation, resulting in less procrastination. To investigate this possible relationship, the following hypothesis was proposed:

> **H2a.** The level of self-regulation, influenced by using physical barrier-based intervention, will negatively affect procrastination.

Self-regulation and distractibility

Distractibility might also significantly decrease as the level of self-regulation improves as a result of having a physical barrier-based detoxingThe second construct measured as part of well-being is distractibility. Other studies define distractibility as the loss of attention from its intended focus (e.g. Lavie, 2010). This concept has been extensively researched in the context of smartphone use. Studies have found that a smartphone is a distraction in several domains, including distractibility while studying and during driving (David et al., 2015; Strayer & Drews, 2007). For example, the relationship between self-regulation and distractibility was explored by Hoekstra-Atwood et al. (2014). They conducted an experiment in which participants had to perform a driving simulation while being distracted by smartphone and smartwatch gaze patterns. The results showed that inhibitory control was related to the number of distractions during driving. In addition, Wandtner et al. (2016) investigated secondary task engagement during automated driving. They found that

individuals with high levels of self-regulation were less prone to distractions than individuals with low levels of self-regulation.

Distractibility has also been researched in the scope of smartphone sage. The popularity of smartphones has resulted in increased distractibility in individuals (Oraison et al., 2020). However, smartphone distractibility could also affect other aspects. Wilmer and Chein (2016) examined the role of heavy smartphone use in task distractibility and impulsive behavior. They indicated that individuals who use smartphones intensively are more prone to impulsive behaviors. In addition, Levine et al. (2007) found that instant messaging use on smartphones increased distractibility during academic tasks, even when there were no smartphone distractions during the task. These results suggest that smartphone distractions may also cause higher overall distractibility.

This concept can be explained by the fact that patterns in one domain (e.g., checking the smartphone as a distraction) can cause similar behaviors in other domains (Liu et al., 2010). This suggests that being easily distracted can result in habitual behavior. However, there is no research aimed at determining whether digital detoxing could reduce these effects. Since previous research on distractibility and self-regulation implies that high levels of self-regulation can negatively affect distractibility, the following is hypothesized:

> **H2b.** The degree of self-regulation influenced by the use of physical barrier-based detoxing will negatively affect distractibility.

Physical barrier-based detoxing effect on procrastination through self-regulation

The relationship between digital detoxing and procrastination was explored by Hinsch and Sheldon (2010). They found that abstaining from using Facebook for two days resulted in lower procrastination, showing a link between digital detoxing and procrastination. Further

research on smartphone use and procrastination found that procrastination before bedtime was predicted by screen time per day (Ciroth, 2020). In addition, Van Eerde (2000) found that procrastination is caused by avoidance behaviors and impulsivity, suggesting that individuals with higher susceptibility to impulsive thoughts are more prone to procrastinating behaviors. This interpretation, which suggests that individuals with higher susceptibility are more prone to procrastinate, is confirmed by a study from Zhao et al. (2019).

However, these studies merely found that participants reported associations with procrastination. Since these studies did not entail an experimental study, a causal relationship was not established. Based on the literature previously discussed, and the hypotheses constructed, these findings could be clarified by the mediating role of self-regulation. After investigating the relationship between physical barrier detoxification and self-regulation, and self-regulation and procrastination, this paper aims to confirm that physical barrier detoxification reduces procrastination through self-regulation (Cui et al., 2021). Based on these considerations, it is hypothesized that the effects of physical barrier-based detoxification on procrastination will be mediated by self-regulation:

> **H3a.** Self-regulation will mediate the relationship between digital detoxing and procrastination.

Physical barrier-based detoxing effect on distractibility through self-regulation

The effects of smartphones on distractibility were explored by Mahsud et al. (2020), who found that smartphone addiction leads to increased distraction in the classroom. Moreover, David et al. (2015) discovered that multitasking while studying was positively related to interference with the originally planned task. When multitasking, individuals show increased levels of distractibility (Levine et al., 2007; Moisala et al., 2006). This is confirmed

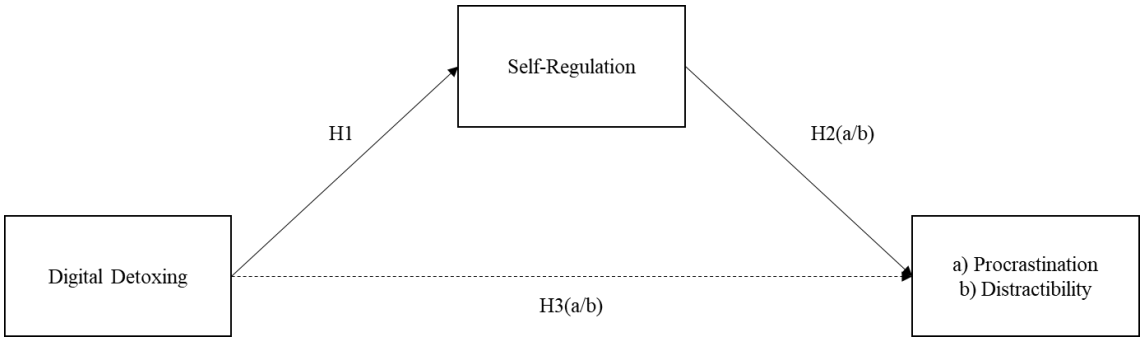
by Moisala et al. (2016), who also found a relationship between media multitasking and distractibility.

Although several studies have shown that smartphone use can increase levels of distractibility, it is unclear how these effects occur. These findings could potentially be explained by the mediating role of self-regulation. As discussed earlier, physical barrier-based detoxification is expected to leads to a higher levels of self-regulation and the improvement in the level of self-regulation reduces distractibility. Given the direct relationship posited between the variables, the current study predicts that:

H3b. Self-regulation will mediate the relationship between digital detoxing and distractibility.

Figure 1

Theoretical Model



Note. Dashed line indicates the mediation path.

Method

Participants and experimental design

To examine whether digital detoxing reduces procrastination and distractibility by improving self-regulation, a 2-week micro-longitudinal field experiment was conducted with

a 2 x 2 factorial mixed ANOVA design. The choice for the micro-longitudinal design was made because previous research showed mixed findings for digital detox interventions with limited duration (Radtke et al., 2021). In addition, the experimental design allows for a detailed comparison of the intervention group and the control group. Meaning that the data from the intervention group can be compared to the control group without the influence of other confounding variables.

The factorial design consisted of a between-subjects factor (digital detoxing: no treatment vs. physical barrier-based intervention) and a within-subjects factor (time of measurement: Pre-intervention vs. Post-intervention). A total of 50 students from Tilburg University were recruited for the experiment (N = 50), using TSHD's SONA pooling system. On average, participants were 22 years of age (*SD* = 3.20). Of the participants, 62% were female and 38% were male.

Participants were randomly assigned to a condition (no treatment vs. physical barrier-based intervention). To participate in the experiment, participants had to meet the following requirements: Participants should: 1) be over 18 years old, 2) own a smartphone with an Android software system and a USB-C input, 3) have never restricted their smartphone use before the start of the experiment, and 4) be willing to comply with a smartphone restriction for two weeks. They needed a smartphone with an Android software system, as the intervention would only work for that specific operating system. USB-C input was required to install the physical barrier. For more information about the physical barrier-based intervention tool (i.e. Unpluq), see the next section.

Stimuli and experiment

Two different intervention types were used for the experiment: 1) no intervention and 2) intervention with physical barriers. In the experiment, participants assigned to no intervention were instructed to use their phones as they normally would. On the other hand, participants assigned to the intervention with physical barriers were instructed to select and restrict three applications that they find particularly distracting via Unpluq. The conditions were that the applications must be among their 10 most used applications and that they were free to choose three applications to restrict for two weeks. Unpluq offers a service through which smartphone users can restrict the use of certain applications. Unpluq required users to insert a USB stick into their smartphone to activate the self-restricted applications. When "normal mode" was activated by inserting the USB device, users could freely use their applications without any restrictions. On the other hand, if the "focus mode" was activated after unplugging the USB stick, users could not access the restricted applications. During the time that focus mode was enabled, users would also not receive notifications from the self-restricted applications. The visual representation of the Unpluq device can be found in Appendix A.

Procedures

Before participation in the experiment, all participants received an email to verify eligibility requirements. All participants who met the eligibility requirements were invited to an intake interview. During this meeting, participants were asked to sign an informed consent form (Appendix B and C). Depending on the assigned condition, participants were informed how to participate in the experiment and how to set up the Unpluq physical barrier. In addition, demographic information, existing levels of self-regulation, procrastination, and distractibility were requested in a pre-survey questionnaire (i.e., baseline data).

After the briefing, participants either used Unpluq or did not use Unpluq (control group) for a period of two weeks. Before and after this period, participants were asked to complete an online questionnaire. In this questionnaire, participants were asked to indicate their experience with digital detoxification, and report the measures regarding self-regulation, procrastination and distractibility. Upon completion of the experiment and questionnaires, participants received three course credits as compensation for their participation.

Measures

Self-regulation, the mediator, was measured using a 3-point Likert Scale. It was measured before and after the intervention. The scale is called The Amsterdam Executive Function Inventory and ranged from 'Not true' to 'True' (Appendix D; Diehl et al., 2006). The scale consisted of ten measures and participants reported on the participants' level of self-regulation (e.g., I can concentrate for a long time when I need to). The self-regulation scale was rated with an average of 2.92 (*SD* = 0.32). With an overall good reliability α = .79 (pre-intervention: α = .64 ; post-intervention: α = .79; overall: α = .77).

Procrastination was measured twice using a 5-point Likert scale ranging from 'Disagree' to 'Agree' called the Academic Procrastination Scale (Appendix D). This scale was developed by Yockey (2016). The measure consisted of five questions and participants reported how they experienced distractibility during the experiment (e.g., I get distracted by other, more fun things when I should be working on schoolwork). The procrastination scale was scored with an average of 2.96 (*SD* = 0.95). With a good overall reliability of α = .91 (pre-intervention: α = .91; post-intervention: α = .93; Overall: α = .91).

Distractibility was measured twice using a 5-point Likert scale ranging from 'Never' to 'Very Often', via the Attention-Related Cognitive Error Scale (Appendix D). This scale was

developed by Cheyne et al. (2006). The measure consisted of thirteen questions and participants indicated how often they engaged in distractible behavior (e.g., I lost track of a conversation because I was absent when someone else was talking). The distractibility scale had an average of 2.99 (*SD* = 0.94). With a good overall reliability of α = .92 (pre-intervention: α = .90; post-intervention: α = .95; Overall: α = .92).

Data analysis

A structural equation model, known as WarpPLS 7.0, was used to validate the relationship between the digital detox intervention, self-regulation, procrastination and distractibility(H1-H2a/b). This structural equation model was used because it allows for an unaffected test of a model without being affected by the normality assumption, sample size, and complex structure of a model (Chan et al., 2015). Different values were used to test the relationship between self-regulation, procrastination, and distractibility (H3a/b) (i.e., post-intervention minus pre-intervention).

Results

Measurement validity

PLS-SEM was conducted to investigate the validity of the measurement model. The validity of a measurement model can be tested using the item loadings of the reflective indicators. The significance of the item loadings below the .001 level ensures the validity of the measurement model (Kock, 2020). The results of the PLS-SEM analysis showed that four items did not meet the criteria. Therefore, items 2 ("I can make quick decisions (e.g., in class)"), 8 ("It is easy for me to find another solution when I get stuck solving a problem."), 9 ("I am full of new ideas."), and 13 ("I am curious, I want to know how things work.") were

deleted based on the results. Table 1 shows an overview of the item loadings tested in this model.

Table 1

Item Loadings for Reflective Indicators

PR	IL	DI	IL	SR	IL
PR_1	0.78***	DI_1	0.70***	SR_1	0.66***
PR_2	0.84***	DI_2	0.63***	SR_3	0.82***
PR_3	0.74***	DI_3	0.81***	SR_4	0.70***
PR_4	0.85***	DI_4	0.74***	SR_5	0.65***
PR_5	0.87***	DI_5	0.83***	SR_6	0.70***
		DI_6	0.82***	SR_7	0.70***
		DI_7	0.81***	SR_10	0.63***
		DI_8	0.85***	SR_11	0.65***
		DI_9	0.82***	SR_12	0.71***
		DI_10	0.78***		
		DI_11	0.76***		
		DI_12	0.75***		

Note. PR, Procrastination; IL, Items Loading; DI, Distractibility; SR, Self-regulation.

*** $p < .001$

Hypotheses testing

H1 posited that physical barrier-based detoxing will improve the level of self-regulation as compared to having no digital detoxing intervention. The PLS-SEM results showed that participants who used physical barrier-based detoxing significantly improved

self-regulation (β = .33, p < .001, R^2 = .11). Specifically, participants who used the Unpluq USB key (M = 0.37, SD = 0.63) reported a significantly larger increase in self-regulation compared to the participants who did not use the Unpluq USB key (M = .04, SD = .31). Therefore, H1 is supported.

H2a stated that the level of self-regulation, influenced by the use of physical barrier-based detoxing, will negatively affect procrastination. The PLS-SEM results indicated that self-regulation significantly influenced procrastination (β = -.50, p < .001, R^2 = .25). Similarly, H2b posited that the level of self-regulation, influenced by the use of physical barrier-based detoxing, will negatively affect distractibility. The PLS-SEM results indicated that self-regulation significantly influenced distractibility (β = -.48, p < .01, R^2 = .23). Therefore, H2a and H2b are supported.

The last hypotheses regarded the mediating effects of self-regulation. H3a presumed that self-regulation will mediate the relationship between digital detoxing and procrastination. The mediating effects of self-regulation on digital detoxing and procrastination were also tested via PLS-SEM. In support of H3a, the results showed that self-regulation significantly mediated the relationship between digital detoxing and procrastination (β = .17, SE = .09, p < .05, R^2 = .04). In addition, H3b posited that self-regulation will mediate the relationship between digital detoxing and distractibility. Again, the results indicated that self-regulation significantly mediated the relationship between digital detoxing and distractibility (β = .16, SE = .09, p < .05, R^2 = .06). Therefore, H3a and H3b are supported.

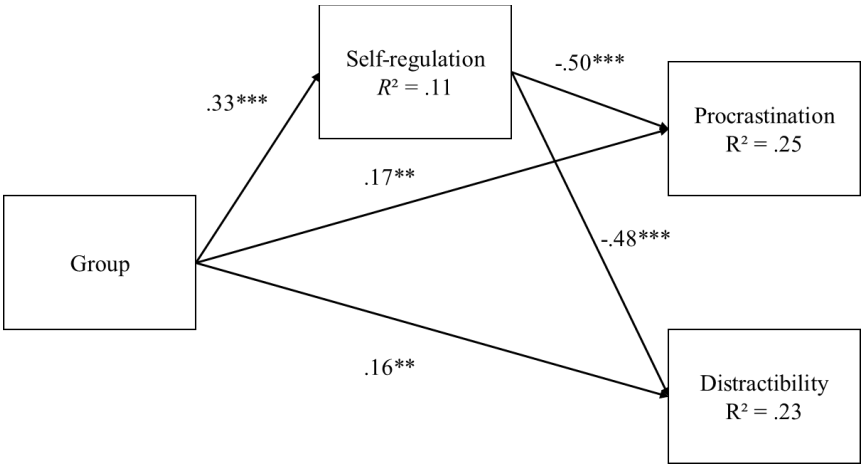
Model fit

To test if the research model has a good fit, the average path coefficient (APC), average R-squared (ARS), and average full collinearity variance inflation factor (AFVIF)

were computed using WarpPLS 7.0. The AFVIF below 3.3 and the statistical significance of APC and ARS ensure the validity of a structural model (Kock, 2020). Overall, the results of the model fit showed a good model fit: APC = .44, $p < .01$; ARS = .19, $p = .03$; and AFVIF = 1.39.

Figure 2

PLS-SEM Results



Note. *** $p < .001$

** $p < .05$

Discussion

Discussion of findings

Overall, the current study attempted to examine whether physical barrier-based detoxing (a form of detoxing that is perceived to be more intense) significantly reduces users' procrastination and distractibility in relation to their digital well-being. This research advanced on a literature review by Radtke et al. (2021), which examined several studies on digital detoxing and the effects on well-being. Radtke et al. (2021) study showed that more intensive forms of digital detoxification had a positive impact on well-being, which is supported by the results of this study. In this study, it was found that physical barrier-based detoxification can significantly reduce procrastination and distractibility in smartphone users.

Specifically, the current study used the first hypothesis to test whether physical barrier-based detoxification can significantly improve users' level of self-regulation. Consistent with the prediction of the current study, the results showed that physical barrier-based detoxification can significantly and positively affect users' level of self-regulation compared with detoxification without digital barriers. This finding is consistent with previous literature in which self-regulation improved as a result of digital detoxification (Miksch & Schulz, 2018). Heartherton and Baumeister's (1996) study provides some useful explanations for why physical barrier-based detoxing can improve user self-regulation. This theory states that self-regulation training leads to stronger self-regulation skills. For this study, participants were asked to regulate their smartphone use through a physical barrier-based detoxification method. By using this measure, participants might have strengthened their self-regulation. Therefore, the level of self-regulation might have been increased by a stronger intervention.

The second hypothesis tested the effects of self-regulation on procrastination and distractibility. Again, consistent with the prediction of this study, the results showed that increased levels of self-regulation could significantly reduce users' procrastination and distractibility. This result suggests that high levels of self-regulation may lead to lower procrastination and distractibility. In the academic scope, these results provide empirical evidence that physical barrier-based detoxing does not only affect academic procrastination, but procrastination in general as well (Senecal, 1995). Furthermore, these results confirm that reducing distractions in one area (e.g., smartphone distractions) may lead individuals to be less prone to distractions in general (Lui et al., 2010; Oraison et al., 2020).

Finally, the last two hypotheses tested the mediating effects of self-regulation on the relationship between physical barrier, procrastination, and distractibility. The results of this study combined two lines of literature. The first line of literature consisted of findings that

confirmed the relationship between physical barrier relief and self-regulation (Berkman, 2016; Dignath, 2008; Heartherton & Baumeister, 1996). The second line of literature addressed the relationship between self-regulation and well-being (procrastination and distractibility). Current literature speculates that procrastination may be influenced by non-self-regulated smartphone use (Ciroth, 2020; Van Eerde, 2020). The results of this study confirmed that individuals who used physical barrier-based detoxification reported less procrastinating behavior, as the increased level of self-regulation mediated the effects. Correspondingly, a significant relationship was found between physical barrier-based detoxification and distractibility, which is influenced by self-regulation. This finding is consistent with other research that has found a significant relationship between digital detoxing and distractibility (Levine et al., 2007; Moisala et al., 2006).

In summary, this study examined the relationship between physical detoxification and well-being. The results of this study showed a significant relationship between physical detoxification through physical barriers and self-regulation, self-regulation and distractibility, and self-regulation and procrastination. In addition, a significant relationship was found between detoxification through physical barriers and distractibility through self-regulation, and between detoxification through physical barriers and procrastination through self-regulation.

Theoretical and practical implications

On the theoretical level, this research contributes to clarify the mixed results in the area of problematic smartphone use. The existing literature on digital detoxing did not show consistent effects of digital detoxing on well-being. These mixed results were discovered for different detoxification types, with varying duration and intensity of the detoxification

intervention. Furthermore, most studies did not specifically define digital detoxification according to Radtke et al.'s (2021) definition. The results of this study extend the existing literature by suggesting that more intensive operationalization of a well-defined digital detoxification intervention leads to fewer negative effects of smartphone use on well-being. This study suggests that future studies may find consistent results if a digital detoxification intervention is clearly defined and strongly operationalized.

Complementing the theoretical implications, the results of this study also have practical implications for organizations whose goal is to reduce smartphone screen time and smartphone addiction. Previous research has not shown consistent positive outcomes for well-being following digital detoxification. In addition to previous findings on digital detoxification, this study confirms consistent positive effects of physical barrier-based detoxification on well-being.

The results of this study suggest that companies that focus on selling digital detoxification solutions or focus on well-being could gain some insights into how to improve the well-being of intervention users. Therefore, the first recommendation for digital detox developers would be to include a physical barrier in the design of the digital detox product. According to the results of this study, adding such a physical barrier could lead to an increase in well-being through self-regulation. In other words, a physical barrier facilitates self-regulation of behavior and has a positive effect on well-being.

There are also additional implications for corporate marketers developing digital detoxification interventions. In contrast to previous mixed results, the findings of this study confirm that digital detoxification improves well-being. Marketers can therefore communicate to their customers that digital detoxification has a positive impact on well-being. This is a

potential incentive for consumers to purchase the product and can help generate revenue for companies.

Limitations and future research

There are some limitations of this study that should be noted by other researchers. First, smartphone use was not measured during the intervention. This means that it was not possible to verify that participants actually reduced screen time on their smartphones. Also, it was not possible to verify whether participants started to use more applications that were not restricted. Therefore, it is not possible to conclude that a physical barrier-based detoxification intervention reduces screen time on smartphones. Future studies could measure how often the restricted applications are used and compare this to the reported increase or decrease in procrastination and distractibility. In this way, researchers could determine whether participants who use the restricted applications more often report lower well-being than users who use the restricted applications less.

Second, in the present study, participants were required to restrict only three applications, which they could select themselves. The number of applications was not chosen based on scientific research. Therefore, it cannot be said whether this number is ideal to achieve the best results. Future studies may find a theoretical explanation for the number of applications that need to be restricted. These findings can be used to obtain more valid results.

The third limitation was the reliability of the self-regulation scale. Through the use of the scale in this study, four of thirteen items were unreliable and were therefore removed. Since these four items were reverse coded, this could mean that participants were not able to correctly answer the reverse coded questions. Therefore, the suitability of the current self-

regulation scale is questionable. Future studies could use a different scale to measure self-regulation to increase reliability.

The final limitation was the sample of this study. The first aspect of the sample that was discovered as a limitation during the study relates to the fact that the physical barrier software was only suitable for Android software. This means that participants who used other operating system software (e.g., Apple software) could not participate in this study. Because this software system is different, the results for these users could differ from those of Android users. In a study by Taylor and Levin (2014), Android users were found to exhibit different behavior than users of Apple software. Future research should therefore examine both Android and Apple software users. This would allow researchers to determine if the results of this study are applicable to a broader and larger sample. In addition to the possible differences in behavior, the participant pool that was used did not provide enough Android users to meet the proposed sample size. This was also influenced by the Covid 19 pandemic. Since participants were not allowed to come to college for lectures, it was more difficult to be physically present when the experiment was introduced. This made it more difficult to recruit participants. As a result, the sample size was smaller than originally expected. The sample size had to be corrected from 150 to 75 participants.

In conclusion, the present study found significant results for the effect of detoxification through physical barriers and well-being. The results suggest that the use of physical barrier-based detoxification will lead to higher levels of well-being through self-regulation. Future studies could further explore the effects of physical barrier-based detoxification on well-being by measuring the difference in smartphone use, adjusting the number of restricted uses, choosing a different scale for self-regulation, and increasing the sample size.

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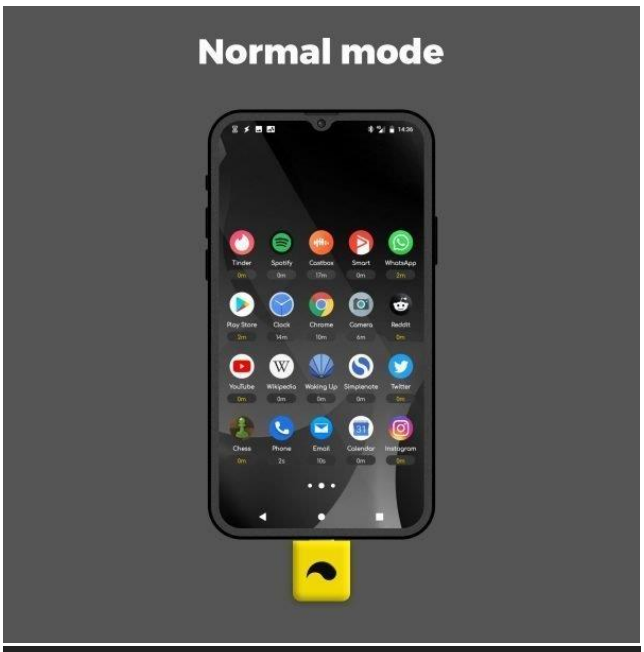
Appendix A

Unpluq device



Appendix B

Information letter

Information letter for participants

Dear participant,

You are invited to participate in the study "Unplug Your Distraction" that is being carried out by Tilburg University. This information letter describes the purpose and procedure of this study, along with explanation of your rights as a participant. Participation in the study is completely **voluntary,** so you are not obliged to participate. If you have any questions after reading this letter, please contact the researcher (contact details are at the bottom of this letter).

What is the purpose of the study?
Smartphones can be an important source of distraction in daily life. Frequent smartphone notifications may affect your study performance, cause stress or lead to problematic smartphone use. However, students may differ in how smartphones affect them. The purpose of this study is to investigate the usability and effectiveness of different tools that might be helpful to reduce smartphone distraction.

Who can participate?
You can participate if you:

- are a student of 18 years or older.
- have an Android phone. The Unpluq device is not compatible with iOS devices.
- are able to run the built-in Android feature named 'Digital Wellbeing'
- do not already actively restrict your smartphone use with this feature or another screen time app.
- are willing to restrict your smartphone use for a duration of two weeks.

What does participation in the study entail?
As soon as you sign up for this study you will be asked to activate the Digital Wellbeing ('Digitaal Welzijn') feature built into the Android operating system, which you can find under Settings. You will be invited for an intake session on campus, where you will digitally sign the informed consent form and receive further instructions. However, please note that the intake session might be organized online due to the Covid-19 measures.

At the start of the study, all participants will be asked to fill out an online questionnaire that includes questions that address personal traits, behavior regarding smartphone usage, and your well-being. In addition, you will be asked to report the logged data in the "Digital Well-Being" application, such as the number of screen unlocks, number of notifications and the average usage time of applications. You may withdraw from the experiment if you are not willing to disclose such information. You can do so without providing any explanation, and without any negative consequences. We ensure that the information will be only used for academic research.

If you participate, you will be randomly assigned to the ‘Unpluq group’, ‘Screen time limit group’ or ‘Control group’.

Unpluq group
If you’re in the Unpluq group, you will be using the smartphone control aid device ‘Unpluq’ for two weeks. After two weeks, you will be asked to report the logged data again and fill out a similar online questionnaire, which additionally includes questions that address your experiences with using the Unpluq device. After the experiment, you have to return the device to the researcher.

The smartphone usage control aid device ‘Unpluq’ is a combination of hardware (the Unpluq USB key) and software (the Unpluq launcher). By plugging the Unpluq key in or out of your phone, the Unpluq launcher will switch between the ‘Focus mode’ and the ‘Normal mode’. In the Focus mode (=key plugged out), only applications of your choice will be available and notifications of all other applications will be blocked. In the Normal mode (=key plugged in), you will have access to your entire phone’s functionality and you will receive all missed notifications. You can decide whether you want to be free of distraction, by plugging the Unpluq key in or out.

Unpluq may be most effective if you restrict the use of the most distracting applications in the Focus mode. Therefore, you are encouraged to select at least 3 out of your top 10 applications you spent most time on. We recommend to use Focus mode on a daily basis during activities that require your full attention, such as studying, driving or cycling, and social conversations.

Screen time limit group
If you’re in the Screen time limit group, you will be using the Digital Wellbeing feature for two weeks to set time limits to the use of applications. After two weeks, you will be asked to report the logged data again and fill out a similar online questionnaire, which additionally includes questions that address your experiences with using the time limits.

Setting time limits may be most effective if you restrict the use of the most distracting applications. Therefore, we encourage you to select at least 3 out of your top 10 applications you spent most time on. We recommend to use time limits on a daily basis. You are free to choose your own time limits.

Control group
If you are in the control group, you are expected to use your phone as usual. After two weeks, you will be asked to report the logged data again and fill out a similar online questionnaire.

What are the benefits and risks of participating in this study?
There is minimal risk in participating in this study. However, there could be situations where you may find the experimental conditions to be discomforting.

First of all, the fact that some smartphone applications are temporarily disabled (in the Focus mode or if time limits are exceeded) may cause some discomfort. However, you are allowed to choose for yourself which applications will be temporarily disabled and you may withdraw from the experiment at any time. Secondly, there is the risk of losing the Unpluq key. There is a built-in feature to access all functionality of your phone again if this happens, but it will

involve a delay of several minutes. Additionally, it is not possible to plug in the key in and charge your phone at the same time, so charging might require some planning.

Please let the researchers know if you experience any discomfort or lose the Unpluq key during the experiment via the email addresses listed below. You may always withdraw at any time.

There is no direct benefit to you for participating in this study. However, by taking part, you will contribute to the knowledge in the field of social sciences. Participants in the Unpluq and Screen time limit group may experience a distraction-free environment as pleasant. Participants in this study are entitled to earn 3 credits upon completion of the experiment.

What will happen to your data?
We are committed to protecting your privacy as much as possible. We ensure that we will keep the confidentiality of the collected research data. All research data obtained will be processed anonymously. These data will be anonymously coded by providing all participants in this study with a three-digit random code number. We link this number to your answers. So we don't know who gave which answers. All research data obtained will be processed in a manner that your personal data cannot be traced back. Only the main researchers have access to to the key file. The coded data can be shared with other researchers, but your personal data (such as your name and email address, which will be registered by SONA, the participant pool system to reward you course credits) will never be disclosed to anyone outside of the group of researchers. The file that contains data from this study will be encrypted with a password which will be shared only among the researchers of this study. You have the right to request access to or rectification, erasure or restriction of your personal data for as long as the data collection is ongoing. All the personally identifiable data will be deleted once the study has ended. Your anonymous research data will be kept for at least 10 years. The research data is intended for scientific research. The results obtained are published in scientific journals. This concerns general results for the entire group, whereby the results can never be traced back to individual persons.

What information will be collected by the Unpluq app?
The Unpluq app collects personally-identifiable, yet minimal, information. During the installation of Unpluq, you are required to create an account. The following data is collected: email address, password, activation code. When you install the app, you will be asked if you want to help improve Unpluq. You can decide whether to allow this or not. If you choose to allow this, the following data is collected and stored in the database of Unpluq:

1. Unpluq usage: time when Unpluq is launched, which applications are installed on your phone, which applications you select as “Focus applications”
2. Other app usage: the daily usage statistics for each app, amount of time you use each app daily, app status (Focus app or Normal app)

Importantly, Unpluq will not have access to the research data collected by Tilburg University. Additionally, Tilburg University will not have access to the user information that is being collected by Unpluq.

Please follow the link to see the full privacy policy of Unpluq:
https://drive.google.com/file/d/1W5JNaPsmv7e2F4JlxXSTppZTFTcAc_zH/view?usp=sharing

Do you have questions?

If you have any questions about the research please contact:
Dr. Mincheol Shin (m.shin@tilburguniversity.edu), Assistant Professor at Tilburg University
Dr. Anouk Vermeij (A.Vermeij_1@tilburguniversity.edu), Postdoctoral Researcher at Tilburg University

Do you have a complaint?

This study has been approved by the Ethical Review Board of Tilburg School of Humanities and Digital Sciences. If you have any remarks or complaints regarding this research, you may also contact the "Research Ethics and Data Management Committee" of Tilburg School of Humanities and Digital Sciences via tshd.redc@tilburguniversity.edu.

Appendix C

Informed consent

By checking “Yes”, I acknowledge the following statements:

I am at least 18 years old

I have read the information letter about the study. I have been able to ask questions about the study and I have been able to think long enough about whether I want to participate in the study.

I know that participation in the study is voluntary. I can withdraw from the study at any time, without it having negative consequences and without having to tell why I want to stop.

I know that my research data is processed confidentially. The research data is coded as explained in the information letter. Only the researchers have access to the key file containing my personal data (e.g., my name and e-mail address). This key file is stored in a secure place, with a password. The key file will be deleted once the investigation has ended, after which only a fully anonymous data set will remain.

I know that I have the right to request access, rectification, erasure or restriction of my personal data, up until the moment the key file is deleted.

I know that the anonymous research data can be used for scientific research now and in the future. The anonymous data is examined for all participants at the same time, and not separately for me.

I know that only the anonymous research data can be shared with other researchers. My personal data (for example my name, date of birth and my e-mail address) will never be shared with other researchers.

I know that the coded (anonymous) research data will be kept for at least ten years.

Yes ☐ No ☐

Name participant:	Name researcher:
Date:	Date:
Signature:	Signature:

Upon your request, the researchers of this study will send you a copy of the informed consent. Please allow us up to 72 hours of processing time after you request a copy.

Appendix D

Measures

Procrastination scale pre-test.

Yockey, R.D. (2016). Validation of the Short Form of the Academic Procrastination Scale. *Psychological Reports, 118(1),* 171-179.

The following questions assess your habits and routines as a student. Please answer the following as they apply to yourself.

How much do you, yourself agree to the following statements? (Scored on a 1 to 5 Likert-type scale, with 1= Disagree and 5= Agree)

a. I put off projects until the last minute.	1	2	3	4	5
b. I know I should work on schoolwork, but I just don't do it.	1	2	3	4	5
c. I get distracted by other, more fun, things when I am supposed to work on schoolwork	1	2	3	4	5
d. When given an assignment, I usually put it away and forget about it until it is almost due.	1	2	3	4	5
e. I frequently find myself putting important deadlines off.					

Procrastination scale post-test.

Yockey, R.D. (2016). Validation of the Short Form of the Academic Procrastination Scale. *Psychological Reports, 118(1),* 171-179.

The following questions assess your habits and routines as a student. Please answer the following as they applied to yourself <u>during the past two weeks</u>.

How much do you, yourself agree to the following statements? (Scored on a 1 to 5 Likert-type scale, with 1= Disagree and 5= Agree)

a. I have put off projects until the last minute during the last during the past two weeks.	1	2	3	4	5

b. I know I should have worked on schoolwork, but I just didn't do it.	1	2	3	4	5
c. I got distracted by other, more fun, things when I was supposed to work on schoolwork	1	2	3	4	5
d. When given an assignment, I usually have put it away and forget about it until it is almost due.	1	2	3	4	5
e. I frequently found myself putting important deadlines off during the past two weeks.					

Distractibility scale pre-test.

Cheyne, J. A., Carriere, J. S., & Smilek, D. (2006). Absent-mindedness: Lapses of conscious awareness and everyday cognitive failures. *Consciousness and cognition*, *15*(3), 578-592

Please CHOOSE the most appropriate answer that best describes your experience (A 5-point Likert Scale: 1= never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often)

1. I have gone to the fridge to get one thing (e.g., milk) and taken something else (e.g., juice)	1	2	3	4	5
2. I go into a room to do one thing (e.g., brush my teeth) and end up doing something else (e.g., brush my hair)	1	2	3	4	5
3. I have lost track of a conversation because I zoned out when someone else was talking.	1	2	3	4	5
4. I have absent-mindedly placed things in unintended locations (e.g., putting milk in the pantry or sugar in the fridge).	1	2	3	4	5
5. I have gone into a room to get something, got distracted, and wondered what I went there for.	1	2	3	4	5
6. I begin one task and get distracted into doing something else.	1	2	3	4	5
7. When reading I find that I have read several paragraphs without being able to recall what I read.	1	2	3	4	5
8. I make mistakes because I am doing one thing and thinking about another.	1	2	3	4	5

9. I have absent-mindedly mixed up targets of my action (e.g., pouring or putting something into the wrong container).	1	2	3	4	5
10. I have to go back to check whether I have done something or not (e.g., turning out lights, locking doors).	1	2	3	4	5
11. I have absent-mindedly misplaced frequently used objects, such as keys, pens, glasses, etc.	1	2	3	4	5
12. I fail to see what I am looking for even though I am looking right at it.	1	2	3	4	5

Distractibility scale post-test.

Cheyne, J. A., Carriere, J. S., & Smilek, D. (2006). Absent-mindedness: Lapses of conscious awareness and everyday cognitive failures. *Consciousness and cognition*, *15*(3), 578-592

Please CHOOSE the most appropriate answer that best describes your experience <u>during the past two weeks</u> (A 5-point Likert Scale: 1= never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often)

1. I have gone to the fridge to get one thing (e.g., milk) and taken something else (e.g., juice)	1	2	3	4	5
2. I went into a room to do one thing (e.g., brush my teeth) and end up doing something else (e.g., brush my hair)	1	2	3	4	5
3. I have lost track of a conversation because I zoned out when someone else was talking.	1	2	3	4	5
4. I have absent-mindedly placed things in unintended locations (e.g., putting milk in the pantry or sugar in the fridge).	1	2	3	4	5
5. I have gone into a room to get something, got distracted, and wondered what I went there for.	1	2	3	4	5
6. I began one task and get distracted into doing something else.	1	2	3	4	5
7. When reading I found that I have read several paragraphs without being able to recall what I read.	1	2	3	4	5

8. I made mistakes because I am doing one thing and thinking about another.	1	2	3	4	5
9. I have absent-mindedly mixed up targets of my action (e.g., pouring or putting something into the wrong container).	1	2	3	4	5
10. I have to go back to check whether I have done something or not (e.g., turning out lights, locking doors).	1	2	3	4	5
11. I have absent-mindedly misplaced frequently used objects, such as keys, pens, glasses, etc.	1	2	3	4	5
12. I fail to see what I am looking for even though I am looking right at it.	1	2	3	4	5

Self-regulation scale pre-test.

Van der Elst et al (2012). The Amsterdam Executive Function Inventory (AEFI):

Psychometric properties and demographically corrected normative data for adolescents aged between 15 and 18 years. *Journal of clinical and experimental neuropsychology*, *34*, 160-171.

Please CHOOSE the most appropriate answer that best describes your experience (A 3-point Likert Scale: 1 = not true, 2 = partly true, 3 = true).

1. I am not able to focus on the same topic for a long period of time.*	1
2. I can make fast decisions (e.g., in lessons).	
3. I am well-organized. For example, I am good at planning what I need to do during a day.	1
4. I am easily distracted.*	
5. I often react too fast. I've done or said something before it is my turn.*	1

6.	My thoughts easily wander.*	1
7.	It is difficult for me to sit still.*	1
8.	It is easy for me to come up with a different solution if I get stuck when solving a problem.	1
9.	I am full of new ideas.	1
10.	It takes a lot of effort for me to remember things.*	1
11.	I often forget what I have done yesterday.*	1
12.	I often lose things.*	1
13.	I am curious, I want to know how things work.	1

*reverse coded

Self-regulation scale post-test.

Van der Elst et al (2012). The Amsterdam Executive Function Inventory (AEFI):

Psychometric properties and demographically corrected normative data for adolescents aged between 15 and 18 years. *Journal of clinical and experimental neuropsychology*, *34*, 160-171.

Please CHOOSE the most appropriate answer that best describes your experience <u>during the past two weeks</u> (A 3-point Likert Scale: 1 = not true, 2 = partly true, 3 = true).

1.	I was not able to focus on the same topic for a long period of time during the past two weeks.*	1
2.	I could make fast decisions during the past two weeks (e.g., in lessons).	
3.	I was well-organized during the past two weeks. For example, I was good at planning what I need to do during a day.	1
4.	I was easily distracted during the past two weeks.*	
5.	I often reacted too fast during the past two weeks. I've done or said something before it was my turn.*	1
6.	My thoughts easily wandered during the past two weeks.*	1
7.	It was difficult for me to sit still during the past two weeks.*	1
8.	It was easy for me to come up with a different solution if I got stuck when solving a problem during the past two weeks.	1
9.	I was full of new ideas during the past two weeks.	1
10.	It took a lot of effort for me to remember things during the past two weeks.*	1
11.	I often forgot what I did the day before during the past two weeks.*	1
12.	I often lost things during the past two weeks.*	1
13.	I was curious, I wanted to know how things work during the past two weeks.	1

*reverse coded