Mediation of Boredom on the Relationship Between Electronic Media Use and Bedtime Procrastination

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PSB3E-BT15: Bachelor Thesis

Group 17

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July 9, 2023

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Abstract

Bedtime procrastination is an established phenomenon, but it is unclear in what contexts it is more likely to happen. This paper explores the correlates of bedtime procrastination and their relationships with each other. For this purpose, this study will follow a model in which boredom mediates the relationship between bedtime procrastination and electronic media use. Through this model, researchers generated three hypotheses that investigate whether these three factors are related to each other and if the mediation exists. The first hypothesis stated that electronic media use and bedtime procrastination would be related. The second hypothesis stated that there would be a correlation between boredom and electronic media use. Finally, the third hypothesis stated that electronic media use and boredom would be related. Participants (N = 191) were recruited via convenience sampling, and they responded to a preliminary questionnaire and 10 daily surveys across five days. Results found no significant mediation, but bedtime procrastination was significantly related to both electronic media use and boredom. With these findings, this study contributes to the body of literature about bedtime procrastination, and it might be helpful to future researchers.

Keywords: bedtime procrastination, boredom, electronic media use

Mediation of Boredom on the Relationship Between Electronic Media Use and Bedtime Procrastination

For some time, researchers have aimed at improving sleep, as it is a vital human function and it impacts health (Luyster et al., 2012). People need to sleep to survive and to enjoy a healthy life, but multiple factors could impair these outcomes. Consequently, interventions to ensure adequate sleep and the improvement of these interventions, are valuable endeavors (Luyster et al., 2012). One possible obstacle to healthy sleep is bedtime procrastination, which is the delay of bedtime despite the lack of an external reason (Kroese et al., 2014). This study examines the phenomenon of bedtime procrastination to contribute towards the improvement of sleep management.

Research on bedtime procrastination could bring developments in the field of sleep health, as evidence shows that it has a link with sleep quality, sleep duration, and daytime fatigue (Hill et al., 2022). Hill et al. (2022) found that bedtime procrastination is related to worse sleep outcomes and more inconsistent sleep schedules. These kinds of maladaptive sleeping habits have impacts on health and well-being (Luyster et al., 2012). An important caution to consider in this and future research is that the proper handling of sleep is a complex matter. It should be treated with nuance, as different people have different needs and there is no single correct sleep schedule (Ferrara & Gennaro, 2001). With these considerations in mind, more research into these matters could provide a basis to improve sleep management through bedtime procrastination.

An article by Luyster et al. (2012) analyzed the results of previous research on sleep and health outcomes and outlined some of the major impacts. They found that sleep deficiency has major health risks for the cardiovascular system, the management of metabolism, and increased risk of cancer. Additionally, results indicated that people who do not sleep enough are more

likely to be involved in accidents related to human error and that less sleep is generally related to higher mortality. These correlations indicate that a better understanding of bedtime procrastination could lead to advancements in managing sleep. Moreover, the findings were found across multiple sources of sleep deficiency, from sleep disorders to simpler failures to sleep. Hence, the value of research aimed at improving sleep deficiency through bedtime procrastination would affect a considerable population.

One way in which the scientific community can gain greater insight into sleep and bedtime procrastination is by establishing the process that causes bedtime procrastination. There are no firmly established causes yet because most research into the topic has been cross-sectional and there is a lack of studies with the appropriate methodology to determine a causal relationship (Hill et al., 2022). However, literature has found several correlates which point toward possible theories regarding the mechanisms underlying bedtime procrastination (Hill et al., 2022). The current study used the previous body of research to test a model aimed at investigating this system, using the correlates of boredom and electronic media use.

Hill et al. (2022) carried out a literature review of research about bedtime procrastination, which revealed some possible antecedents, among which are boredom and electronic media use. There were moderately strong links between bedtime procrastination and both boredom, and electronic media use (Hill et al., 2022) and research has shown a relation between them (Sümer & Büttner, 2022). However, the literature review also made it apparent that they have not been studied together in the context of bedtime procrastination. Therefore, it could be valuable to study them in a model that outlines a process that could regulate it. The aim of this study is to explore such a model, in which boredom mediates the relationship between electronic media use

and bedtime procrastination. Thus, the core research question is how much of an influence does boredom have on the relation between electronic media use and bedtime procrastination.

Bedtime Procrastination

The core concept of interest of this article is bedtime procrastination, which has some complex facets to consider. Kroese et al. (2014) define it as a failure of going to bed at the expected time, while no external causes prevent one from doing so. When people engage in this kind of procrastination they often go to sleep at an ill-suited time and that can mean that they are not getting enough sleep (Hill et al., 2022). It can be an intentional delay, an unintentional delay, or a strategic delay (Nauts et al., 2018) but overall, failure to get adequate sleep remains an unfavorable outcome (Luyster et al., 2012). An important fact to keep in mind is that bedtime procrastination is not the only phenomenon that might factor into insufficient sleep. People may experience issues with work schedules, mental health, sleep hygiene, lifestyle, or pre-sleep behavior but bedtime procrastination is prevalent and worth examining (Hill et al., 2022).

Electronic Media Use

Electronic media use is a term that refers to the time spent using electronics for information or leisure. It could be a useful tool to examine bedtime procrastination, because research has found these two variables to be related (Hill et al., 2022) and because electronic media use is related to the inhibition of sleep, through a variety of mechanisms (Exelmans & Bulck, 2019; Exelmans, 2019). Bedtime procrastinators may spend the time they might have spent sleeping, engaging in a variety of activities instead (Hill et al., 2022). These activities can include electronic media use in multiple forms, such as video games and social media. When procrastinating before bedtime online and electronic activities disrupt sleep habits in three ways, blue light, sleep displacement, and arousal (Exelmans & Bulck, 2019). Disruption from blue

light and arousal show how electronic media use can interfere with internal processes. While sleep displacement is an overtaking of the schedule itself, where there is no time left to sleep. Consequently, electronic media use is a valuable correlate that can be examined to develop a more accurate model of bedtime procrastination. It might explain how people end up delaying sleep, and lead to developments that could use electronic media to manage one's sleep schedule more effectively. Nevertheless, there is not enough information on the subject to draw conclusions. Still, these precedents form a useful basis for the first hypothesis of the present article.

Hypothesis 1: there is a positive correlation between electronic media use and bedtime procrastination.

Boredom

To expand on previous work, this article aims to look into the connection between electronic media use and bedtime procrastination in greater depth and to understand how they relate to an additional variable: boredom. Among the established correlates of bedtime procrastination is boredom, which is a "state of low interest, low arousal, high dissatisfaction, high distractibility, and task disengagement" (Teoh et al., 2021, p. 2). Boredom proneness is related to the overall trait of procrastination in general (Vodanovich & Rupp, 1999) but this correlation applies to the more specific field of bedtime procrastination. A study by Teoh et al. (2021) concluded that boredom is a predictor of bedtime procrastination. The paper's results supported this connection both when boredom is measured as a trait, through boredom proneness, and when it is indicated by behavior, through fidgeting and mind wandering. They explore this connection through the variable of inattention, with mixed results, but their findings

suggest that reducing boredom could prove to be an effective strategy to manage bedtime procrastination.

Additionally, Teoh et al. (2021) establish a possible mechanism through which boredom is related to bedtime procrastination and sleep quality. Their findings support the possibility that boredom around bedtime leads to searching for stimulation in activities other than sleep, thus moving sleep to a later moment and impacting sleep quality. Zhou and Kam (2017) found a connection between boredom and procrastination through a behavioral component, coping strategies. In their article, they outline four boredom coping strategies, defined by the intersections of the avoidance-approach and cognitive-behavioral dimensions. Of the four strategies, only the behavioral avoidance strategy had a significant connection. This suggests that bored people procrastinate as a result of their coping strategy, which motivates them to avoid a disliked activity by engaging in another behavior. Zhou and Kam (2017) looked into general procrastination, not bedtime procrastination, but the constructs are similar and their results might generalize. Boredom is a promising mediator because of this precedent, which could provide support for possible explanations if the data shows a link. This leads to our second hypothesis:

Hypothesis 2: there is a positive correlation between boredom and bedtime procrastination.

The Mediation Model

The model used in this study was to examine what might happen in the process of bedtime procrastination and it is based on existing evidence, including the previously mentioned research. There is evidence to suggest that there might be a link between electronic media use, boredom, and bedtime procrastination. Sümer and Büttner (2022) found that boredom proneness predicts online procrastination. The term online procrastination refers to putting off an

uninteresting or unpleasant activity by spending time on the internet. Sümer and Büttner (2022)'s research was based on the previously documented correlation between boredom and online activity, but they applied it to the context of procrastination. There is no such research about bedtime procrastination yet, as the field is relatively new, but their findings could be indicative of relationships that apply in its case as well. Results showed that those who get bored more easily are also more likely to use social media, instant messaging, and online shopping to procrastinate. Thus, they will use electronic media to procrastinate engaging in a non-stimulating task. This correlation could apply to bedtime procrastination because going to sleep is generally less stimulating than using electronic media, and bedtime procrastinators may have the same behavioral patterns if the same underlying mechanisms exist. That would mean that Sümer and Büttner (2022) provided a link between the three variables that are relevant to this article. Their results show that increased boredom is associated with both online activity and procrastination. Taking this into account, there is a possibility that electronic media use, boredom, and bedtime procrastination interact in a significant manner that reveals the process that brings about bedtime procrastination. This background provides the basis for the third hypothesis:

Hypothesis 3: there is a positive correlation between electronic media use and boredom.

This study will endeavor to test a model for bedtime procrastination, which involves boredom and electronic media use. Specifically, it will look into electronic media use as a predictor and boredom will be analyzed through the lens of a mediator for the relationship between electronic media use and bedtime procrastination. With these considerations in mind, this study will look into the three hypotheses explained beforehand. By researching the hypotheses, this article aims to address the gap of knowledge on the relationships between these three variables. Although previous research has investigated their effect on bedtime

procrastination separately, the literature review did not result in any other papers that included all three variables. Thus, looking into these relationships could provide valuable insight. If the model accurately predicts the affects and behaviors that precede bedtime procrastination researchers could use that knowledge to develop strategies to manage them, and consequently to improve sleep habits. For instance, psychologists might teach people who have difficulty regulating their electronic media use that they might be more successful if they do something fun or stimulating before bedtime, as that would mitigate the effects of their behavior on bedtime procrastination.

Method

Participants

We collected 191 participants. However, during the analysis 29 people were excluded for not completing the questionnaires and four outliers were excluded, resulting in a sample size of 158. The remaining sample went through a descriptive analysis to assess meaningful demographics. In terms of gender, 37% of respondents were male, 45% of respondents were female, and 1.6% of respondents chose another option. Furthermore, the mean age was 37.8 (*SD* = 13.3).

Responses also included the country of residence, the majority of which were from the Netherlands (39.2%). The second most common answer was Germany at 12.2% and the third most common answer was Greece at 11.6%. The rest of the countries were mostly part of the European Union, with the exceptions of Thailand and the United Kingdom.

Additionally, participants reported work hours per week and day, as it was relevant to the research. The mean of work hours per week was 35.5 (*SD* = 9.71) and the mean of work hours per day was 8.28 (*SD* = 2.98).

Procedure

This diary study required a sample from a population of working adults above 18 years old, who would be working in the period between the 17th and the 21st of April 2023. In addition, it was preferable for them to work during the day and to work for a minimum of 20 hours a week, as to reduce unknown confounding variables that might arise from such different schedules. Participants were found through a convenience sampling method. This study is a collaboration with a group of bachelor and master thesis students, each looking into some facet of bedtime procrastination antecedents. The group found participants by reaching out to people who were likely to fit the required criteria. These contacts received emails asking for their participation, explaining what would be required, and asking them to reach out to others who could take part in the study.

At the beginning of the study, participants received instructions in written form from the people who recruited them, either by text or email. This initial information included a request to self-select as an appropriate participant based on the study's requirement and to prepare to receive the preliminary questionnaire and the 10 daily surveys for five days. It also explained that all participants would be anonymous, and that research would only proceed with consent. Still, the beginning of the surveys contained a full consent form. All participants provided informed consent before beginning the study and the Ethics Committee of the Faculty of Behavioural and Social Sciences at the University of Groningen approved the study beforehand. Moreover, there was no reward for the completion of the study.

Afterwards the questionnaires were sent out through the submitted emails. To ensure anonymity all data was encoded by associating the participant's results with a random number and no other identifying information was stored. Furthermore, a week and a half before the 5

days reserved for the diary study, on the 5th of April, participants received the survey about demographics. Subsequently, on the working days from the 17th and the 21st of April, they received two questionnaires a day, in the morning and the afternoon. In case of technical difficulties, participants had the option to contact researchers throughout the whole procedure.

The study's design delved into three variables, bedtime procrastination, electronic media use, and boredom, to explore the viability of the proposed model. In this model electronic media use is the independent variable, boredom is a mediator, and bedtime procrastination is the dependent variable. Because the study is correlational there was no manipulation. Results will be based on observational data and cannot be used to establish causal relationships. This is a longitudinal diary study, but all three variables were recorded initially as traits, using scales. Boredom and electronic media use had an additional measure in the diary study section. Both had items that were repeated across the five days because this repeated measures approach might have revealed a different relationship.

Using this design is an effective method to obtain an initial assessment of the model because it considers the three variables and the possibility that an additional point of view could bring different results while accounting for material and time restraints.

Statistical Analyses

Data analysis was carried out with the program SPSS 29.0 with the addition of Process Macro. First, we constructed the necessary scales while running reliability analyses to ensure they were practical. Second, we ran descriptive and correlation analyses, which provided an overview of the variables and their relationships. Last, we did a mediation ANOVA analysis to test the model. This process included obtaining the descriptive statistics, the assumption checking, Cronbach's alphas, and the Pearson correlations used in the evaluation of the

relationships between the variables involved in the model. Lastly, Process Macro allowed for an ANOVA analysis, using its model 4 with electronic media use as the independent variable, bedtime procrastination as the dependent variable, and boredom as a mediating variable.

Measures

Bedtime Procrastination

Bedtime procrastination was measured with a 9-item scale (Cronbach's α= 0.90) developed by Kroese et al. (2014). Answers were in a 5-point scale format, going from 1 (never) to 5 (always). An example of an item from this scale is "Often I am still doing other things when it is time to go to bed". Its basis on previous research and analysis showed that it is likely a reliable and valid measure.

Electronic Media Use

Electronic media use was assessed through a 5-item scale about smartphone addiction (Cronbach's α = 0.81), first used by Chen et al. (2017), and through the morning diary study section, by asking "How many minutes did you use cyber devices (e.g., smartphones, laptops, tablets, etc.) for leisure last night?". Thus, results will be presented in minutes. All items from Chen et al. (2017)'s scale were answered on a Likert scale, with 1 as Strongly disagree to 5 as Strongly agree. The focus of the analysis will be the results from the diary section study, as the 5-item scale is less relevant to the variable of electronic media use, and it will be examined through an aggregate variable made from this data.

Boredom

Boredom was measured with a 6-item scale (Cronbach's α = 0.88) called the Dutch Boredom Scale (Reijseger et al., 2013) and through the morning diary study section, by the question "How bored did you feel last night?". The question was worded to evaluate boredom

state and it is based on research by Chao et al. (2020). All items in the Dutch Boredom Scale were answered from 1 (never) to 5 (always) and the items in the morning questionnaires offered seven options, from 1 (not at all) to 7 (very much). The data analysis will focus on the trait measures.

Demographics

A preliminary survey assessed demographic characteristics before the diary study proper. It included items about age, gender, nationality, and the highest level of education (including primary education, high school or equivalent level, Bachelor's or equivalent level, Master's or equivalent level, and Doctoral or equivalent level).

As work life was relevant to the study the demographics also included several items about it. Participants reported their work hours per week and day, type of work contract, job title, leadership position, field, time with an employer, time in current position, and amount of remote work. Moreover, they were asked to classify their job as blue collar, lower-level white collar, upper-level white collar, and high management. Finally, there were also questions about start and finish times during the workday.

Results

Descriptive Analysis

Table 1 contains both the descriptive statistics and the correlations between the three variables included in the model. The results about bedtime procrastination (M = 2.87, SD = 0.8) show that participants experienced it on a relatively regular basis. In addition, they indicate that it was positively correlated with electronic media use (r = .31, p < .01) and boredom (r = .32, p < .01). Descriptive statistics express that participants used electronic media for 42.88 minutes (SD = 43.54) on average, but the high variance shows there were multiple kinds of habits in the

sample. Furthermore, electronic media use was positively correlated with bedtime procrastination ($r = .31$, $p < .01$) but it had no significant correlation to boredom ($r = .12$, $p = .23$). Finally, boredom ($M = 1.81$, $SD = .58$) was positively correlated with bedtime procrastination ($r = .32$, $p < .01$) but it showed no significant correlation with electronic media use ($r = .12$, $p = .23$).

Table 1

Correlations of variables, using trait measures for electronic media use and boredom

	n	*M*	*SD*	1	2	3
1. Bedtime Procrastination	152	2.87	.86	1		
2. Electronic Media Use	147	42.88	43.54	.31*	1	
3. Boredom	103	1.81	.58	.32**	.12	1

Note. *p < .01, **p< .001.

Hypothesis Testing

This statistical analysis aims to test the viability of the model proposed by this article. In this model electronic media use is the independent variable, boredom is the mediator, and bedtime procrastination is the dependent variable. Analysis of the results, reported in Table 2, showed that there is not a significant mediation of boredom unto the relationship between bedtime procrastination and electronic media use. Bedtime procrastination was positively associated with both electronic media use ($\beta = .00$, $p < .01$) and boredom ($\beta = .57$, $p < .01$). These results indicated that there was a significant but weak direct effect of electronic media use on bedtime procrastination ($\beta = .0053$, $p < .01$), However, there was no association between

electronic media use and boredom (β = .00, p = .29). This insignificant relationship indicates that there is no mediation where the model predicts.

In addition, the indirect effect of electronic media use on bedtime procrastination is not significant 95% CI [-.0006; .0025]. This also indicates that there is no mediation. The total effect is not significant, because of the indirect effect, but it would be β = .0061. Figure 1 visualizes the results in a graph of the model.

Table 2

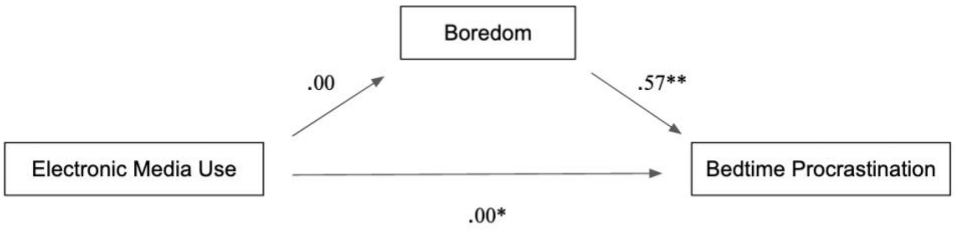
Test of the mediation effect of boredom on the relationship between electronic media use and bedtime procrastination

Predictor	**B**					**BP**				
	β	*SE*	*t*	*p*	*95% CI*	*β*	*SE*	*t*	*p*	*95% CI*
(Constant)	1.79	.08	22.01	.0000	[1.63, 1.95]	1.61	.25	6.33	.0000	[1.10, 2.10]
EMU	.0014	.0013	1.06	.29	[-.0012, .0041]	.0053	.0017	3.09	.0026	[.0019, .0088]
B						.57	.13	4.45	.0000	[.32, .83]
R^2	.01					.25				
F	1.13					16.29				
(df1, df2)	(1, 100)					(2, 99)				
Indirect effect of X on Y						.0008	.0008			[-.0006, .0025]

Note: Analysis conducted using PROCESS model 4, N = 102, Bootstrap sample size = 5000. BP = bedtime procrastination, EMU = electronic media use, B = boredom.

Figure 1

Mediation path of the model



*Note. *p < .01, **p < .001.*

Exploratory analysis

Other than the Dutch Boredom Scale this research included another measure for boredom. Boredom was measured in the diary study as well and translated into an aggregated variable. Consequently, an exploratory analysis was possible with both electronic media use and boredom as data was gathered across five days. The variables involved remain the same three, but the analysis of boredom will use different data from this secondary measure. This was carried out to address the likelihood that measures had affected results and that the model might change with a different approach. For this purpose, a correlation and a regression analysis were carried out. The outcomes are reported in Table 3 and Table 4.

Results suggested that there was no mediation in this case as well. Bedtime procrastination was positively correlated with electronic media use ($r = .31$, $p < .01$) but there was no significant correlation with boredom ($r = .18$, $p = .06$). There was also no correlation between electronic media use and boredom ($r = .07$, $p = .49$). The lack of correlations suggests that there is no relationship between electronic media use and bedtime procrastination, and

electronic media use and boredom, thus it is unlikely that there is a mediating relationship in accordance with the model.

The regression analysis confirmed the lack of significance. There was a significant effect of electronic media use (β = .00, p < .01) but there was not from boredom (β = .25, p = .06). Thus, these results show no mediation.

Table 3

Correlations of variables, using state measures for boredom

	n	*M*	*SD*	1	2	3
1. Bedtime Procrastination	152	2.87	.86	1		
2. Electronic Media Use	106	42.88	43.54	.31*	1	
3. Boredom	109	1.59	.64	.18	.07	1

Note. *p < .01.

Table 4

Regression of the relationships between electronic media use, boredom, and bedtime procrastination

	β	*SE*	t	p
Intercept	2.25	.23	9.87	< .001
Electronic Media Use	.006	.002	3.19	.002
Boredom	.25	.13	1.88	.063

Note: N = 103.

Discussion

The present research set out to explore the relationships between possible antecedents of bedtime procrastination and how that might affect the phenomenon. For this purpose, design and analysis focused on a mediation model which supposed that boredom could mediate the relationship between electronic media use and bedtime procrastination. Unfortunately, all three hypotheses involved in this model were not significant according to the results. Firstly, there was no support for the first hypothesis, which states that there is a correlation between electronic media use and bedtime procrastination. Secondly, results showed no correlation between boredom and bedtime procrastination. Lastly, there was no correlation between electronic media use and boredom. This lack of support was corroborated by the analysis through Process Macro, which found no significant mediation effect.

Considering the results overall presents a cohesive picture. There is a considerable possibility that all three variables are linked, as previous research has pointed to the existence of separate relationships between electronic media use and bedtime procrastination (Exelmans & Bulck, 2019), and boredom and bedtime procrastination (Teoh et al., 2021). There is also evidence of a link between electronic media use and boredom (Whelan et al., 2020), thus all three are likely to interact in some manner. Despite these precedents, this research did not find evidence for a model where boredom mediates for the other two and that means that it is not their underlying mechanic. These conclusions do not necessarily say that there is no model in which the three interact but that is unlikely to be found through our hypotheses.

According to Hill et al. (2022), there is a correlation between electronic media use and bedtime procrastination. Exelmans and Bulck (2019) suggest that the delay in bedtime might originate from the competition between electronic media use and sleep. As both must take place

in the same time frame, and people have to choose which one to engage with. They call this sleep displacement, and they also consider that electronic media use increased arousal, which would make sleep more difficult. These findings are consistent with the present article's results, and they propose several mechanisms that could explain them.

Analysis showed a significant correlation between electronic media use and bedtime procrastination, and the association found in the mediation analysis was significant, but both were weak. The correlation was $r = .31$, which is comparable to the ones found by Hill et al. (2022) in their literature review. It should be noted that electronic media use was measured differently across different articles, so results might not relate directly. Some studies focused on cyber leisure, while others focused on smartphone addiction, with variance within those categories as well. However, this article's results fall within the range of Hill et al. (2022), which was $r = .12$ to $r = .44$, lending support to their accuracy. Still, results regarding the mediation were not promising, as there was a weak association which suggests that electronic media use does not have a strong effect on bedtime procrastination in the context of the model.

An explanation regarding the weak correlation could be that in this case the mechanisms listed by Exelmans and Bulck (2019) could still be engaged, as shown by the correlation. However, these systems might not be involved in the relationships between all three variables of the model. For example, someone might experience sleep displacement through electronic media use, but their level of boredom might have no strong influence on how much they experience it. If that were the case, people could be choosing electronic media over sleep for another reason that this article has failed to consider. There is also the possibility that the measure of electronic media use did not consider all its aspects, such as procrastination through work instead of leisure, or that people prefer to procrastinate with another activity that does not involve electronics.

Ultimately, it remains unclear what happens around bedtime procrastination and there might be several factors that compete for attention against sleep. If electronic media use is only one of these factors it could just be one of many, which might result in the significant but weak correlation found by our analysis. Another possibility is that the two are coincidentally related because they share some mechanism that includes both as separate parts. There are multiple possible explanations for the relationship between bedtime procrastination and electronic media use that was found in this study, but more information is needed to approach a coherent explanation.

The second hypothesis was supported by previous research. Teoh et al. (2021) found a correlation between boredom and bedtime procrastination. They proposed that this correlation could come from the need for arousal that could relieve boredom, and this pushes people to avoid bedtime in favor of more stimulating activities. They measured boredom through three variables, proneness, fidgeting, and mind wandering, which do not match perfectly with the measures of this study but they both intend to measure the same construct. Thus, it is fair to say that the correlation found in the present results is comparable to Teoh et al. (2021)'s results. The three correlations they found were weak as well, in the range between $r = .18$ and $r = .28$, which supports the veracity of this new data.

This article's outcomes about boredom and bedtime procrastination could also be a partial explanation for the results of the mediation analysis. In the model proposed at the beginning of this article, boredom and bedtime procrastination have a significant association, which shows that they could have a moderately strong relationship. However, the model is not significant overall, so it is unlikely to be the explanation for these results. A more probable explanation would involve the direct relationship between bedtime procrastination and boredom,

as found in this article. Explanations might also include the indirect influences that boredom may have on bedtime procrastination, in related contexts. There is a precedent of boredom as a significant mediator in research by Zhou and Kam (2017). In this article, the authors explore the possibility that boredom coping strategies could mediate the relationship between motivation and procrastination. The strategy of behavioral avoidance was significantly related, and this could provide a possible explanation for our results. It could be the system through which the two variables interact. The significant association might not be because of a mediation that follows the model but it could be related to unaccounted variables that do have such a mediation, like the ones found by Zhou and Kam (2017).

Data from the surveys did not support the third hypothesis, which stated that there would be a correlation between electronic media use and boredom. This outcome was unexpected, as a substantial amount of electronic media is made to be stimulating. As Poels et al. (2022) state, boredom is an important factor in the functioning of media, and there is a limited amount of research on their interaction. Research by Whelan et al. (2020) has also found that boredom proneness is linked to some negative side effects of electronic media use, such as social media fatigue, and information and communication overload. In addition, their model included social media use intensity as an additional layer of complexity regarding the relationships between information overload and communication overload, and social media fatigue. Our results did not align with previous research as there was no significant correlation between electronic media use and boredom, and they were not related in the mediation model either. The theoretical explanation of this outcome is not clear, but several explanations are available. It could be that the relationship between electronic media use and bedtime procrastination is strictly direct, or that it functions through some other pathway that is not represented in the model. There is also

the possibility that there is no relation at all or that this is the product of random error. Moreover, the variable of electronic media use could be too broad, as Whelan et al. (2020) found correlations with specific aspects of interactions with media which could be closer to representations of reality. Additionally, the design could have caused certain gaps that might have produced insignificance. Firstly, the sample size might have been too small, or the convenience sampling could have changed outcomes. Secondly, there might have been flaws in the procedure. Finally, although directionality was not in the scope of this paper, it may nonetheless impact the relationships investigated, therefore rendering the model inaccurate.

The model of boredom's mediation on the relationship between electronic media use and bedtime procrastination was not significant. This could have been because of flaws in the design, flaws in the model itself, or both. The field of bedtime procrastination is relatively recent, and it will take time to increase the amount of information that is available. Consequently, this model was a new approach with narrow research to support it. As a novel idea, it could have unforeseen gaps that would be evident in more established models. In addition, the variables involved could have been too broad, and their measurements could have been examining the incorrect construct. For example, the findings about electronic media use might have been different if the model focused on specific aspects, like in the article by Whelan et al. (2020). Another example could be the use of the practical ways people interact with a variable, such as the boredom coping strategies from Zhou and Kam (2017). There is also the possibility that there are no real relationships between the three variables, and the whole model is incorrect.

The exploratory analysis did not result in a significant model either. In fact, it had less significant relationships than the initial mediation analysis, as boredom was not related to either electronic media use or bedtime procrastination. Without these links it is unlikely that a

mediation exists, as boredom seems to have nothing to do with the other variables or the relationship between them. The purpose of this exploratory analysis was to assess how much the measure of boredom affected results, by using the items from the diary study instead of the Dutch Boredom Scale. There was a difference, in the fact that boredom was not related to bedtime procrastination with this new measure, meaning that the measures did affect results. Still, the new outcome fits the model less, suggesting that the diary study measure is less suited to it. This might be because the questions from the diary study account for less complexity in the concept of boredom and some part of those facets might be relevant to the relationship between boredom and bedtime procrastination.

Importance and Implications

Our findings are important because they contribute to the body of knowledge in the field of bedtime procrastination. The model proposed in this article has not been investigated before and its insignificance could have implications for future research. A researcher developing a new model could benefit from knowing the likelihood of the existence of a mediation of boredom on the relationship between electronic media use and bedtime procrastination. Likewise, the significant results provided further support to the previously established correlations between electronic media use and bedtime procrastination, and boredom and bedtime procrastination. Overall, this research shows a possible limit for eventual further theories to keep in mind. Furthermore, while it may not have straightforward practical applications, it could be helpful for developing theories that could contribute to the development of interventions. These interventions would likely be about limiting bedtime procrastination, because of its negative effect on well-being (Hill et al., 2022; Luyster et al., 2012).

The model might not have been significant but certain results are relevant for practical applications. This study found that bedtime procrastination is significantly related to electronic media use and to boredom. These outcomes are in line with previous research (Exelmans & Bulck, 2019; Hill et al., 2022; Teoh et al., 2021; Zhou and Kam, 2017) and the existence of these relationships can provide a basis for interventions. Firstly, since evidence shows that electronic media use is associated with bedtime procrastination, researchers could explore how exactly they interact with each other and learn how to lessen or manipulate the relationship. By controlling that link, the effects might translate into a healthier sleep schedule. Depending on directionality, this might be possible by decreasing bedtime procrastination through the management of electronic media use, or by disrupting the negative effects of electronic media use on sleep (Exelmans & Bulck, 2019) through the management of bedtime procrastination. Progress might go even further if future research includes experiments that establish this directionality, and the causal relationship, if any is involved.

Outcomes regarding the third hypothesis, which stated that electronic media use and boredom would be related, were not significant and suggested that this relationship would not result in effective interventions. However, there is evidence to the contrary (Sümer and Büttner, 2022) and this indicates that there is more to research on the subject. Electronic media, such as social media and mobile games, is a common strategy to manage boredom, and that made it a promising candidate for the mediation model used in this study (Sümer and Büttner, 2022). Our findings could be the result of limitations but there might be a theoretical reason for the difference of outcome, which could show the mechanics of how boredom and electronic media use interact. If this difference is meaningful, and it explains the relevant underlying system, researchers could use it to understand how to make the interactions more efficient.

Limitations

There are some limitations to this study that could have affected the results and they should be acknowledged. Firstly, the sampling method and generalizability could be improved. Gathering participants involved a convenience sampling method, meaning there was no random selection. This limits the diversity of participants, and it could have introduced bias. A particular type of bias that is likely to be involved is the fact that most participants belonged to a WEIRD, or western, educated, industrialized, rich, and democratic population. Because invitations to take part in the survey were spread through word of mouth, they stayed within certain communities that fall into the WEIRD category. Furthermore, the requirements for a person to participate also limited diversity. For example, part of the research related to work, and how it interacts with bedtime procrastination, which made it necessary to refuse unemployed participants. The model could have a different outcome if non-working people were included. For these reasons, the results of this article are not generalizable.

Another limitation was the design of the questionnaire. Feedback from participants showed that some items were difficult to decipher or oddly phrased and that translations were not accurate. If participants misunderstood what they were asked, that could have impacted results. The surveys were also self-report measures, which could cause self-report biases, like responding in a way that increases social desirability. Therefore, our results might not reflect reality. The choice of measurements could have also influenced the results, and another approach could find significant relationships. Furthermore, the diary study section was also relatively short and could have been more efficient. There would be practicality concerns, it could have been influential if it spanned further than a week to avoid skewness from life events and the like. Additionally, most of the analysis focused on measures from the preliminary survey, which were not

longitudinal, and greater use of the diary surveys could have been beneficial. A final limitation is that this is a correlational study. The design cannot establish temporality and it cannot account for confounding variables; thus any results are not indicative of a causal relationship.

Future research

This article found multiple approaches that could be useful in future research. First, it could be beneficial to replicate the research while accounting for the limitations of the sampling and the design. Doing so could provide stronger support for the significant results and examine the model to further depth. In addition, a wider and more diverse sample could increase generalizability. Future research could also modify the model to get closer to an accurate representation of the relationships between bedtime procrastination, electronic media use, and boredom. A promising direction could be narrowing down the specificity of the constructs involved or exploring another kind of mediation or relationship. In regard to the separate significant relationships of bedtime procrastination with boredom and with electronic media use, future research can use those results as support for models that might involve those relationships.

This article focused in part on some activities that people engage in around bedtime procrastination, through electronic media use, but it might be useful to deepen the knowledge about these activities. During preliminary research, there was no article that found specifically which activities people engaged in and for how much time. Such a list of activities, online or otherwise, could allow researchers to understand what kinds of motivations cause bedtime procrastination. It might also explain the weakness of the relationship between electronic media use and bedtime procrastination, as it could paint a clearer picture of what role electronics play in the delay of bedtime. As such, it is a possible avenue for future research. This relationship could

also benefit from an investigation of why our findings do not reflect previous research (Sümer & Büttner, 2022), as there could be a relevant factor involved in the difference.

An additional recommendation is to revise the concepts from this present article once the field, in general, has progressed. Bedtime procrastination is not well understood yet, neither the concept itself nor its mechanisms. For example, it was recently classified into three separate categories by a paper by Nauts et al. (2019): deliberate procrastination, mindless procrastination, and strategic delay. Thus, it is fair to assume that there will be further discoveries in the field, which could be incorporated into a possible replication to increase its effectiveness.

Conclusion

In conclusion, there is still a lot to learn about bedtime procrastination. This study aimed to enrich that knowledge by looking into the antecedents of bedtime procrastinations and their relationships to each other. For this purpose, we used a model that involved the variables of electronic media use and boredom, as a mediator. The results showed no mediation, but there were some significant direct effects, between bedtime procrastination and the two other variables separately. The current body of research is not in a position to locate possible causes or mechanisms yet, but this study has found an approach that is less likely to work. Still, the findings of this study add to the literature about bedtime procrastination, and they point to some promising developments.

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Appendix

Appendix A: Preliminary Questionnaire

Section 1: Demographics

1. How old are you (in years)?
2. How many hours do you work per week (on average)?
3. How many hours do you work on a usual work day?
4. What is your gender?
5. In which country do you currently live?
6. Do you live by yourself or with someone else?
7. What is your highest completed level of education?
8. What kind of work contract do you have?
9. What is your current job title
10. Do you have a leadership position?
11. In which field are you working?
12. How would you classify your current job
13. How long have you been working for your current employer?
14. How long have you been working in your current job?
15. When does your workday usually starts (e.g., 9 am)
16. When does your workday usually ends (e.g., 1700)
17. To what extent are you currently working remotely?

Section 2: Bedtime Procrastination

Instructions: For each of the following statements, please decide whether it applies to you using a scale from 1 (almost) never to 5 (almost) always.

1. I go to bed later than I had intended
2. I go to bed early if I have to get up early in the morning (R)
3. If it is time to turn off the lights at night I do it immediately (R)
4. Often I am still doing other things when it is time to go to bed
5. I easily get distracted by things when I actually would like to go to bed
6. I do not go to bed on time
7. I have a regular bedtime which I keep to (R)
8. I want to go to bed on time but I just don't
9. I can easily stop with my activities when it is time to go to bed (R)
10. I wake up easily in the morning

Section 3: Dutch Boredom Scale

Instructions: For each of the following statements, please decide whether it applies to you using a scale from 1 (almost) never to 5 (almost) always.

1. At work, time goes by very slowly
2. I feel bored at my job
3. During work time I daydream
4. It seems as if my working day never ends
5. I tend to do other things during my work
6. At my work, there is not so much to do

Section 4: Smartphone Addiction

Instructions: For each of the following statements, please decide whether it applies to you using a scale from 1 strongly disagree to 5 strongly agree.

1. My social life has sometimes suffered because of using my smartphone.

2. Using my smartphone sometimes interfered with other activities (e.g., work or study).
3. When I am not using my smartphone, I often feel agitated.
4. I have made unsuccessful attempts to reduce the time using my smartphone.
5. I find it difficult to control my smartphone use.

Appendix B: Diary study

Section 1: Cyber Leisure

1. How many minutes did you use cyber devices (e.g., smartphones, laptops, tablets, etc.) for leisure last night?

Section 2: Boredom

Instructions: For each of the following statements, please decide whether it applies to you using a scale from 1 not at all to 5 very much.

1. How bored did you feel last night?